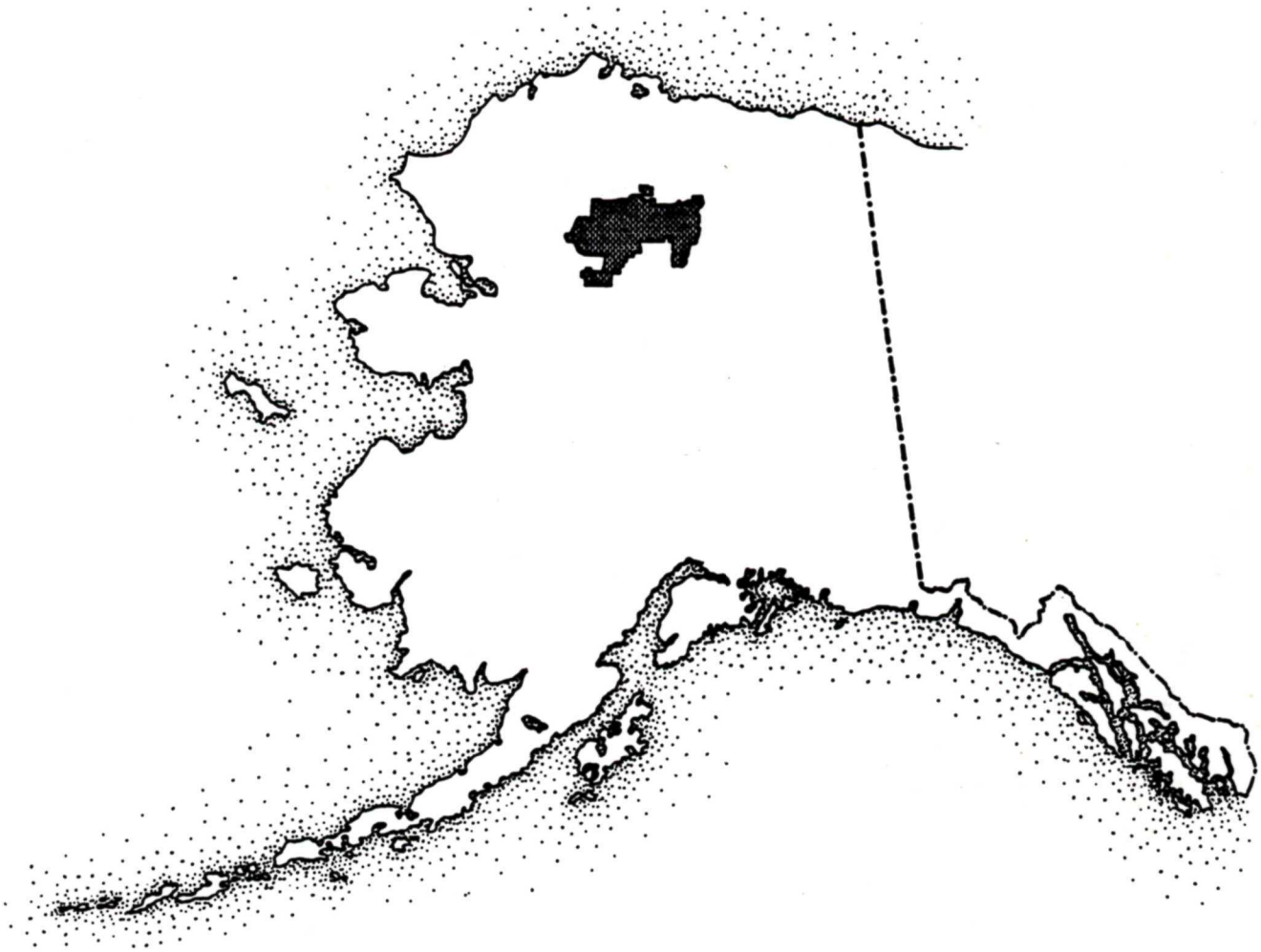
NATIONAL PARK SERVICE
RESEARCH / RESOURCES MANAGEMENT REPORT AR-18

CULTURAL RESOURCE SURVEY AND INVENTORY: GATES OF THE ARCTIC NATIONAL PARK AND PRESERVE, ALASKA



United States Department of the Interior

National Park Service
Alaska Region

ERRATA:

Cultural Resource Survey and Inventory: Gates of the Arctic National Park and Preserve, Alaska, compiled by Michael L. Kunz

Page 41, sentence at center page should read as follows (underlining indicates change):

> Locally, however, it should be noted that of the three radiocarbon dated Paleo-Arctic sites that lie directly adjacent to the park, only one has artifacts typical of a core and blade industry and that site lacks lanceolate points.

CULTURAL RESOURCE SURVEY AND INVENTORY: GATES OF THE ARCTIC NATIONAL PARK AND PRESERVE, ALASKA

Compiled By Michael L. Kunz

With Contributions by Patricia Anderson, John M. Campbell, Matthew L. Ganley, John N. Kilmarx, Michael L. Kunz, Peter G. Phippin, Richard E. Reanier, Grant Spearman, and Ann E. Halleen

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NATIONAL PARK SERVICE - Alaska Region

Research/Resources Management Report AR-18

United States Department of the Interior
National Park Service
Alaska Regional Office
2525 Gambell Street
Anchorage, Alaska 99503-2892

February 1991

ABSTRACT

This volume is a compilation of the results of an archaeological survey and inventory project in Gates of the Arctic National Park and Preserve between 1983 and 1985. It's purpose is to provide the reader with as much information as possible regarding the prehistory of the park as concisely as possible. This objective has been met by an extensive set of summary tables that provide a "Reader's Digest" version of the data gathered from the 626 sites that form the park and preserve's archaeological database.

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The time and resources of many individuals contributed to this report. Besides Michael L. Kunz, the project director, the field crews included Peter G. Phippen (all years), Richard E. Reanier (all years), Mark Standley (1983, 1984), Grant Spearman (1984, 1985), Matthew L. Ganley (1985), and John N. Kilmarx (1985). These people along with Patricia M. Anderson, William E. Brown, Russell H. Sackett, Susan M. Will, John M. Campbell and Edwin S. Hall contributed as authors. Deborah Madison provided editorial assistance and typed the 1983 draft with assistance from Patti Kunz. Ann Haleen typed the 1984 and 1985 drafts and also provided editorial assistance.

The success of the three field seasons, as well as the production of the drafts was also due to the efforts of many others.

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FOREWORD

In 1982, when I initiated the archeological survey and inventory program of the new national parks and preserves in Alaska, the number one priority was Gates of the Arctic National Park and Preserve. The area was, and is, rich in diverse cultural resources; additionally, there was an existing logistical base of operations in Bettles and the park staff was supportive and enthusiastic.

Funding was obtained in 1983 and Mike Kunz was hired as Project Archeologist. Based at the park staff level, he took charge of the project - especially the field operations. Technical oversight was through the regional office staff. Three successful field seasons followed, with the recording of over 600 new sites.

During this project, the park management team made the decision to maximize the field operations while funds were available. As a result, the analysis and report of the survey results has been somewhat delayed. This summary report is the end product of a concerted effort to make the data available. The original draft was compiled and written by Mike Kunz. It was then extensively edited by Diane Lehman Turck. This was done, however, without changing Mike's professional conclusions and opinions.

This, then, constitutes the summary report on the archeological survey of Gates of the Arctic National Park and Preserve that was begun in 1982. The site reports and field data, in Volume II, are available to interested professionals at the park headquarters and the Alaska regional office of the National Park Service.

The 600 archeological sites recorded during this survey are only a small proportion of the potential prehistoric sites in the park and preserve. Most of the area remains to be surveyed. This inventory does reveal the richness of the archeological record and should spark interest in doing more research there.

Ken Schoenberg
Supervisory Archeologist
Alaska Regional Office
2/13/91

PREFACE
By Michael Kunz

While most of the hard archaeological data presented in this volume are the result of the above noted survey and inventory, the database from which the synthesis of the park's culture history evolved was derived from a much broader informational spectrum. Broader in the sense that it reflects the 21 years during which I participated in fieldwork in the Brooks Range or on the North Slope; and broader from an input standpoint, in that this information relates to an array of people and places.

I believe that it is necessary for an archaeologist to know as intimately as possible the physical and environmental aspects of his or her research area. Researchers in Alaska are fortunate since the environment and the landscape have altered little over the last 10,000 years providing an excellent window on the past. I was fortunate, over the years, to have spent a number of winters in and north of the Brooks Range (as well as springs, summers and falls), providing me with a perspective of the country that is not commonly or personally experienced by many researchers.

I was extremely fortunate to be the beneficiary of the experiences and knowledge of some of the grand old men of Arctic archaeology during my first years in Alaska. Helge Larsen, Elmer Harp, Jack Campbell, and especially Bob McKennan, were my early field companions in the north. From our many conversations, as well as from listening to them talk among themselves, I developed an historic perspective of both the history of archaeological research in the region, as well as their views of the culture history of the area. Much of the thinking behind the information presented here is the result of the influence of these men.

The three summers that I spent in the Eskimo village of Anaktuvuk Pass and my association with Simon Paneak, one of the founders of that village, have also influenced my perspective of Nunamiut culture history, by providing insights that can only be obtained by knowing the people. Hopefully, I have melded all of these inputs into an accurate construct of regional culture history.

The crews and authors of the project also wish to thank the residents of Wiseman, Nolan, Coldfoot, Anaktuvuk Pass and the tributary streams of the Middle Fork Koyukuk River for their information and support.

The blood, sweat and tears of a lot of people are represented by this volume. I hope the results are worth the effort.

INTRODUCTION

Gates of the Arctic National Park and Preserve was created on December 2, 1980, with the enactment of the Alaska National Interest Lands Conservation Act (P.L. 96-487). The park and preserve contains 13,238 square miles (approximately 8.47 million acres), all of which lies north of the Arctic Circle. Most of the park and preserve lies in the Brooks Range with rivers flowing on both the north and south sides of the Continental Divide. Generally speaking, there are two basic environmental settings. South of 68° latitude is a mixed boreal forest containing spruce, birch, and poplar while north of 68° the country is treeless tundra.

Section 1301 of P.L. 96-487 which created Gates of the Arctic National Park and Preserve mandated the preparation of General Management Plans for the new Conservation Units. An integral part of the plans was an assessment of the cultural resources. Therefore, in order to obtain the baseline information needed, a project to inventory and evaluate such resources was initiated. This project also complied with the requirements of Executive Order 11593 and the National Historic Preservation Act. While the project addressed both the prehistory and the history of the area, only the prehistoric (archaeological) portion of the project is discussed here. Park Service historians and historical architects participated in the survey and wrote the

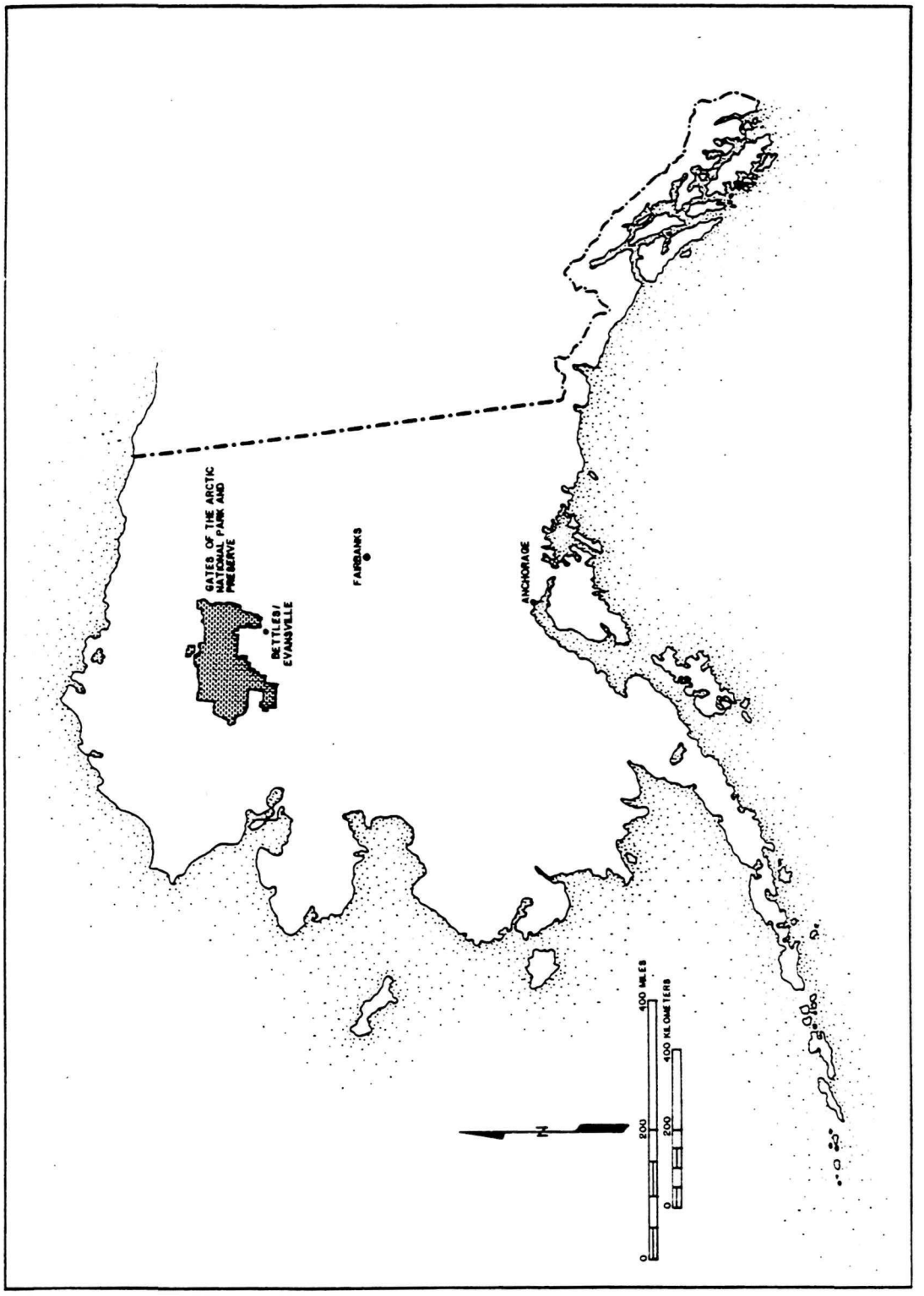

Figure 1. Map of Alaska Showing Location of Gates of the Arctic National Park and Preserve.

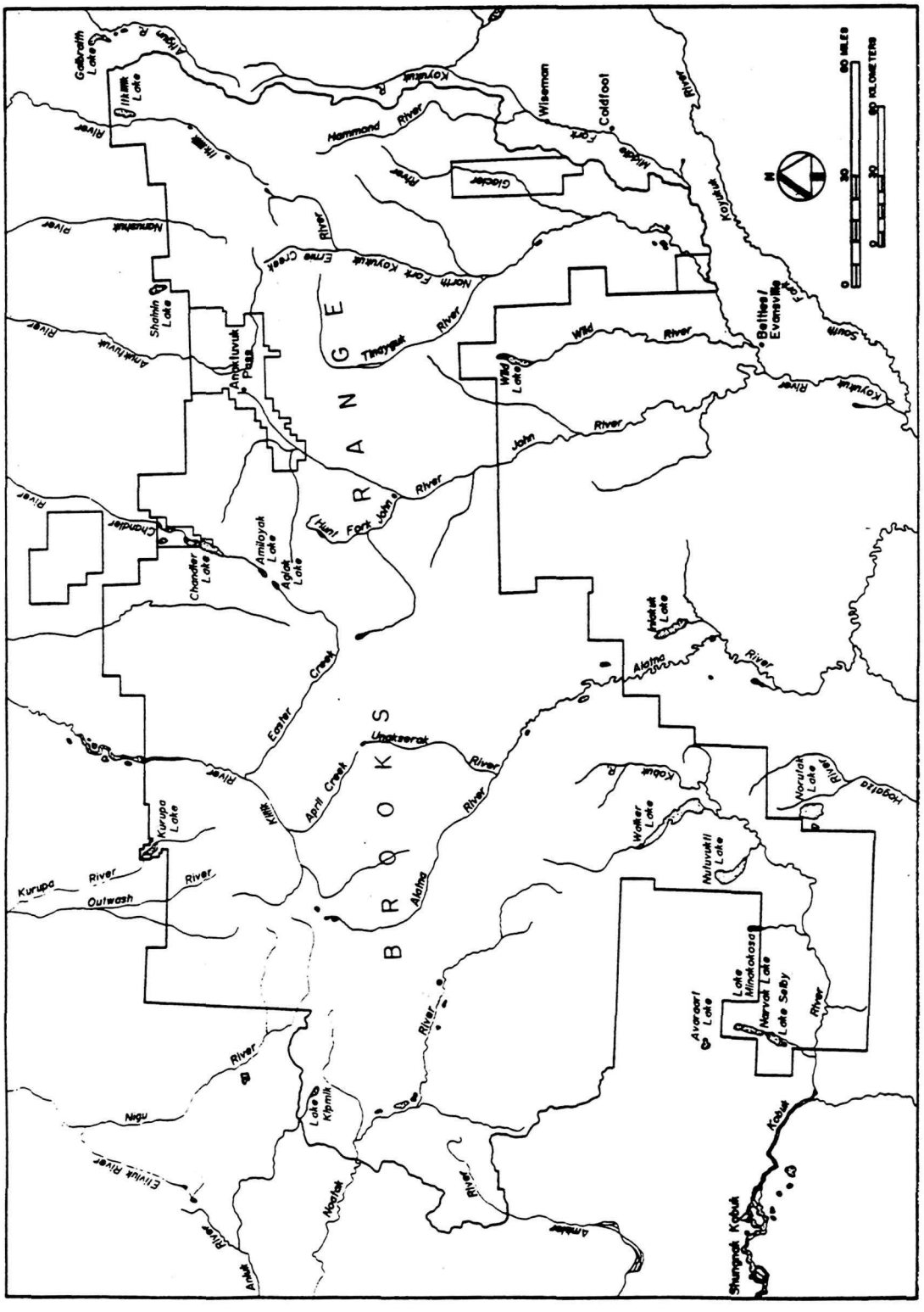

Figure 2. Gates of the Arctic National Park and Preserve.

report for historic cultural resources entitled Gaunt Beauty...Tenuous Life (Brown 1989). It should also be noted budgetary constraints have prevented the complete survey of the park and preserve.

The initial research design allowed five years to complete the prehistoric component of the cultural resources inventory. Division of the land surface into geographic regions fulfilled the task directives, and assisted in the orderly progression of the investigation in such a remote and roadless area. The selection and order of investigations in the research areas involved four concerns, the prominence of each varying by year. These included the logistics of travel and supply, finding a survey area close to locations of previous archaeological research in order to have comparative data available for the project, assessing more frequently used areas or those which will be impacted by human or erosional activity, and providing the best all-around coverage of park and preserve lands. It should be noted, and taken for granted, that transportation within the field presented different problems every field season, including weather, bears, river rapids, and sharing the same equipment with personnel from other projects.

Assessment of potential damage, the third concern expressed above, dictated the choice of the 1983 research area which included the Walker Lake terminal moraine, Kichaiakaka Creek, the

upper Kobuk River down to the Lower Canyon, the mid-portion of the Reed River, Nutuvukti Lake, Narvak Lake, and Lake Selby. This southern area had the highest priority for initial investigation because it was the general location of a proposed transportation corridor into the Ambler Mining District and would therefore suffer impact. Additionally, previous archaeological research had been conducted in the Walker Lake area in 1967, 1973 and 1974 (Hall 1975a, 1975b) and around Norutak Lake in 1964 and 1968 (Clark 1974). This prior research would provide a sounding board for our work.

Transportation concerns were the primary reason behind the selection of the 1984 research area. A team of historians was working in the eastern sector of the park, and the archaeologists and historians were sharing a helicopter. Therefore, archaeological research was conducted in the eastern sector along the North Fork Koyukuk River between Bombardment Creek and Squaw Rapids and along the Itkillik River from Oolah Pass downstream (north) to the confluence of the Itikmalak River. In addition, one of the survey areas, the North Fork Koyukuk River, is one of the more frequently utilized areas of the park. One of the season's objectives was to assess the potential for visitor impact on the cultural resources in this section. Further, intensive archaeological research conducted during the construction of the Trans-Alaska oil pipeline, which lies along the eastern boundary of the park, provided excellent comparative

material for the archaeological work conducted in the eastern sector.

During the fall of 1984 we were advised that the cultural resources inventory project would not be funded beyond fiscal year 1985. Therefore, it was decided to conduct archaeological reconnaissance along the John River and in the Chandler Lake region in order to complete the survey planned in the eastern section of the park. Earlier archaeological and ethnographic work had been done in the Anaktuvuk Pass area and would provide comparative material for our work. Further, the John River below the Hunt Fork is a popular float-trip route; having a reasonable assessment of the cultural resources of the area and an idea of how susceptible they might be to visitor impact will assist in management planning. We also planned work in the Helpmejack Lakes area which would allow data collection from the eastern side of the "Alatna Portage" to complement the 1983 work done on the western side of the portage. Lastly, survey conducted in the Lake Kipmik/Lake Amitchiak area would update our knowledge of the condition of several known sites reported to be suffering degradation in 1973. The archaeological data from Itkillik Lake, included within this report, was obtained during a 1976 archaeological reconnaissance of that area. This work was conducted for the Alyeska Pipeline Service Company, and the author of this report was the principal investigator on that project.

METHODOLOGY

During each of three summer field seasons, a team of four to six archaeologists spent approximately thirteen weeks conducting cultural resource survey. All personnel met NPS standards, and most had extensive backrounds in Alaskan archaeology and field survey operations. Many of the crew members worked for the project for more than one season, adding an important element of continuity. As part of his equipment, each crew member carried 1:65,000 color infrared aerial photographs and USGS topographic maps (1:250,000) applicable to the area being surveyed so they could easily locate themselves and any sites they found.

Division of the park and preserve into large geographical sectors made operating from a single main camp impossible. Therefore, arranging a series of base camps along the way allowed an orderly inspection of the region. The length of stay at most campsites was flexible, allowing the crew to move whenever coverage of the area was complete. During these moves, the crews utilized various forms of transportation such as rafts, and fixed and rotor wing aircraft which have proven to be efficient in primitive and remote areas of Alaska. Occasionally, if a little more time was desirable in a section, either for further work at a specific site, or for extra survey in a small promising area, a one or two person "spike camp" separate from the main party would be established.

All archaeological data obtained through this cultural resources field inventory was collected by employing primary or reconnaissance level survey techniques. This was a sample-oriented survey, designed to locate and record, from surface and exposed profile indications, the cultural resource sites within a portion of the defined area of study. The methodology for the actual survey work was situation-specific, varying with the local conditions including ground cover and terrain. Logically, forested areas or areas of dense ground cover received less thorough attention than open areas where vision was not hampered. While the survey, by definition, was a surface survey, some subsurface testing was carried out. Indeed, any of several methods, including pedestrian transects with or without fixed intervals or, more rarely, shovel testing, might be used to explore a location. Additional subsurface testing in the form of small (approximately 15cm^2) test pits assisted in determining, in some instances, if a site was present and, when necessary, in defining site limits. All subsurface testing was kept to a minimum.

Because the primary objective of the survey was to locate and record as many prehistoric sites as possible in the study area, judgmental sampling was the strategy employed to locate archaeological sites. This type of sampling uses information about the location of known sites from past research, along with the expertise and ideas of the researchers, to predict the types

of physiographic areas in which the greatest proportion of total sites will be found. By definition, then, sampling of this type does not examine equally the entire spectrum of land forms in a study section. Much more time is spent surveying locations of high archaeological potential, particularly those with good visibility, than locations of low archaeological potential. Of course, this means that the sites which occur in places of low potential are, statistically, less likely to be found.

Investigation of several geomorphological/ecological zones, then, formed the basis for stratification of the sampling universe. This approach was taken because these zones often contain land forms of varying levels of importance in relation to the number and type of site occurrences. These land forms include: terraces, glacial (stagnant ice) features, drainage confluences, knolls, ridges, and hills. Local drainage conditions, elevation, exposure, view and proximity to potable water were also taken into consideration. Even in forested sections and/or areas supporting dense ground cover, many of the geomorphological features listed are relatively free of such obstructing vegetation. The circumstance of good visibility in locations of high site potential increases the probability of finding existing sites. Use of this sampling strategy assumes there has been little more than minimal change in the geomorphological/ecological zones over the majority of the period of possible human use in the region. In simple terms this means

that a locale that appears to possess the criteria of a good camping or hunting location or a good travel route today would have appeared similarly inviting to people during the last eight or nine millennia. Sites such as Onion Portage, Mosquito Lake, and the Gallagher Flint Station tend to support this assumption (Anderson 1968, Dixon 1971, Kunz 1977).

A site for the purposes of this survey was considered to be any area of past human activity which was represented by the remains of material culture (Davis et al. 1981). Essentially this means that the location of a single flake, cairn, or tent peg was considered a site and underwent the same documentation procedures as would a larger more complex site.

Site documentation also included the determination of boundaries. In cases where groups of cultural debris, such as lithic scatters, were in close proximity, an arbitrary distance of 100 meters was chosen as a separation guide for this project. In other words, if 100 meters or more of culturally sterile ground separated two surface lithic scatters, then they were considered separate sites. Less than 100 meters separation, and they were considered localities of the same site. The rule was ignored if concentrations of cultural material were less than 100 meters apart but were separated by an abrupt change in the topography such as a creek, river, gully, or glacial feature. By the same token, concentrations that were separated by more than 100 meters

of sterile ground, but were obviously related, such as shooting blinds or tent rings, would be considered a single site. Such a decision was judgmental on the part of the investigator, based on given data.

Artifacts, unless excavated, were not collected. Formal tools, or artifacts exhibiting tool use, when encountered on the surface, were photographed and/or drawn, measured, described in the field notes, and otherwise recorded. If a site map was drawn, artifacts were located on it either by means of triangulation from a baseline extended in a cardinal direction from a datum point, or by direction in degrees and distance from a datum point. The datum point was designated by a ten-inch spike driven into the ground on the site. A metal identification tag bearing the site number, date of discovery, land ownership status, and other information was affixed to the spike. The site numbers were obtained from the State of Alaska's Heritage Resource Survey.

A sampling bias exists when a choice of survey areas is based as much on transportation logistics and frequency of tourist use as on a random stratified sample of the park and preserve. Taking that into consideration, the information obtained from the survey generated a pattern of site density and distribution in the more easily traversed and ecologically attractive portions of the study area. These areas are of primary concern in terms of

management and planning as they are the locations most likely to be impacted through recreational use. Additionally, the surveyed areas produced sufficient data to make some reasonable assumptions concerning the prehistoric inhabitants of the region.

THE ENVIRONMENT

Physiography[1]

While some of the park and preserve lies north of the Continental Divide and some lies south, all of it lies north of the Arctic Circle. The legislated boundaries show an irregularly shaped rectangle the approximate limits of which are 66° 39' to 68° 39' north latitude and 149° 31' to 157° west longitude. Four major physiographic zones run horizontally across Gates of the Arctic. Northernmost is the southern portion of the Arctic Foothills which extend south of Galbraith, Itkillik, Shainin, and Kurupa Lakes and north of Chandler Lake. The terrain consists of east-trending linear ridges and irregular buttes with interspersed tundra plains (Schoenberg 1985; Wahrhaftig 1965). The largest physiographic region of the park and preserve is the central Brooks Range. The Endicott Mountains and the Schwatka Mountains, both part of the Brooks Range, occupy part of the park and preserve. The mountains in the Brooks Range in general are east-trending and rise to heights of 7000-8000 feet in the north and 4000-6000 feet in the south. There are far fewer lakes present in this physiographic zone than would be expected for a

[1]Although sections on the physiography of each of the survey areas had been written, with the exception of a few sentences, two introductory paragraphs explaining the physiography of the park and preserve in general were added by the editor.

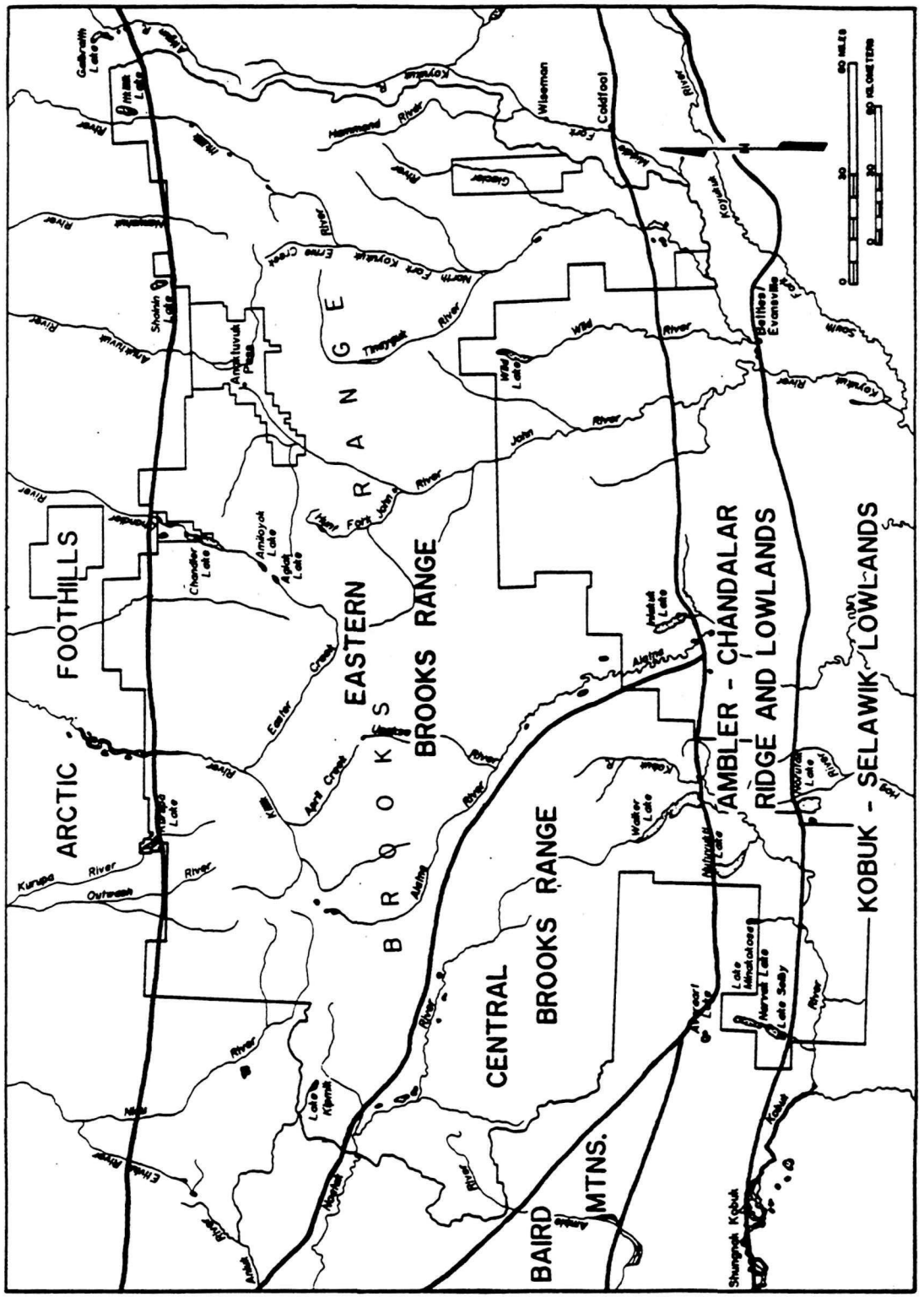

Figure 3. Physiographic Regions within Gates of the Arctic National Park and Preserve (after Wahrhaftig 1965).

region which was subject to several glacial episodes. The Continental Divide partitions the Brooks Range. Rivers on the north flow to the Arctic Ocean and the Beaufort Sea, on the south, to Kotzebue Sound and the Bering Sea. The third physiographic region, the Ambler-Chandalar Ridge and Lowlands, crosses the southern preserve consisting of ridge and lowland lines up to 10 miles long with low passes. Several large lakes are found in this region. Also in the southern preserve area is the last physiographic zone, the Kobuk-Selawik Lowland of lakes and broad river flood plains. Sand and gravel terraces and active sand dune areas occur here. None of the study areas lies more than 50 miles north or south of the crest of the Brooks Range.

1983 Survey Area

In 1983, the survey area included approximately the upper one quarter of the westward-flowing Kobuk River, which drains the Schwatka Mountains of the west Central Brooks Range. The area lies between 154° and 156° west longitude and between 66° 45' and 67° 05' north latitude. All of this region lies west of the Continental Divide. The upper Kobuk River enters the eastern edge of the survey area at an altitude of about 1000 feet and decends to about 250 feet at the western boundary. Bordered on the north by the rising front of the Brooks Range, the river

valley gives way to mountains over 4000 feet high. South of the Kobuk river, the area is ringed by the Lockwood, Norutak, and Helpmejack Hills, which reach altitudes of 3000 feet.

Within the survey area, most of the important tributaries of the Kobuk River enter from the north. The Walker Lake outlet stream is nearly as large as the Kobuk itself at their point of confluence. Fifteen miles to the west and downriver, the Reed River enters the Kobuk from its source in the glacier system of Mt. Igikpak. Below the confluence with the Reed River, the Kobuk Valley broadens and its gradient becomes more gradual. Beaver Creek, which heads at Akurekvik Pass and drains Lake Minakakosa, enters the Kobuk a short distance downstream from the Reed River. Finally, the Selby River, which drains Lake Selby and Narvak Lake, enters the Kobuk at the western edge of the survey area.

1984 Survey Area

In 1984, the study area included approximately the eastern quarter of the park and preserve, lying between 151° 10' and 150° 15' west longitude, and 67° 20' and 68° 30' north latitude. The Itkillik drainage lies north of the Continental Divide while the Koyukuk drainages lie on the southern side. The Itkillik River heads in the Endicott Mountains on the western slopes of the 5000 foot-high Oolah Pass. After flowing 12 miles west through the

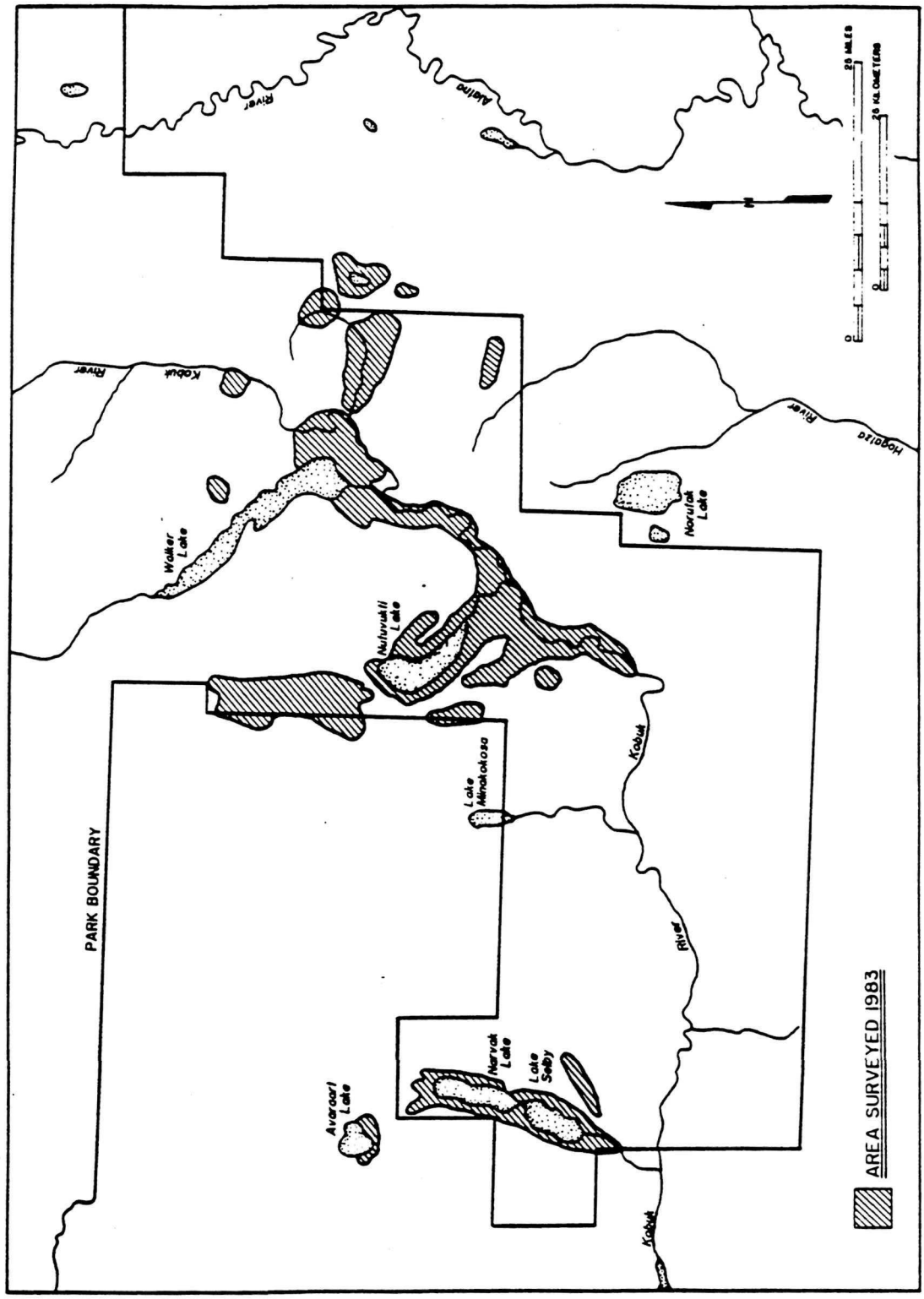

Figure 4. Areas surveyed in 1983.

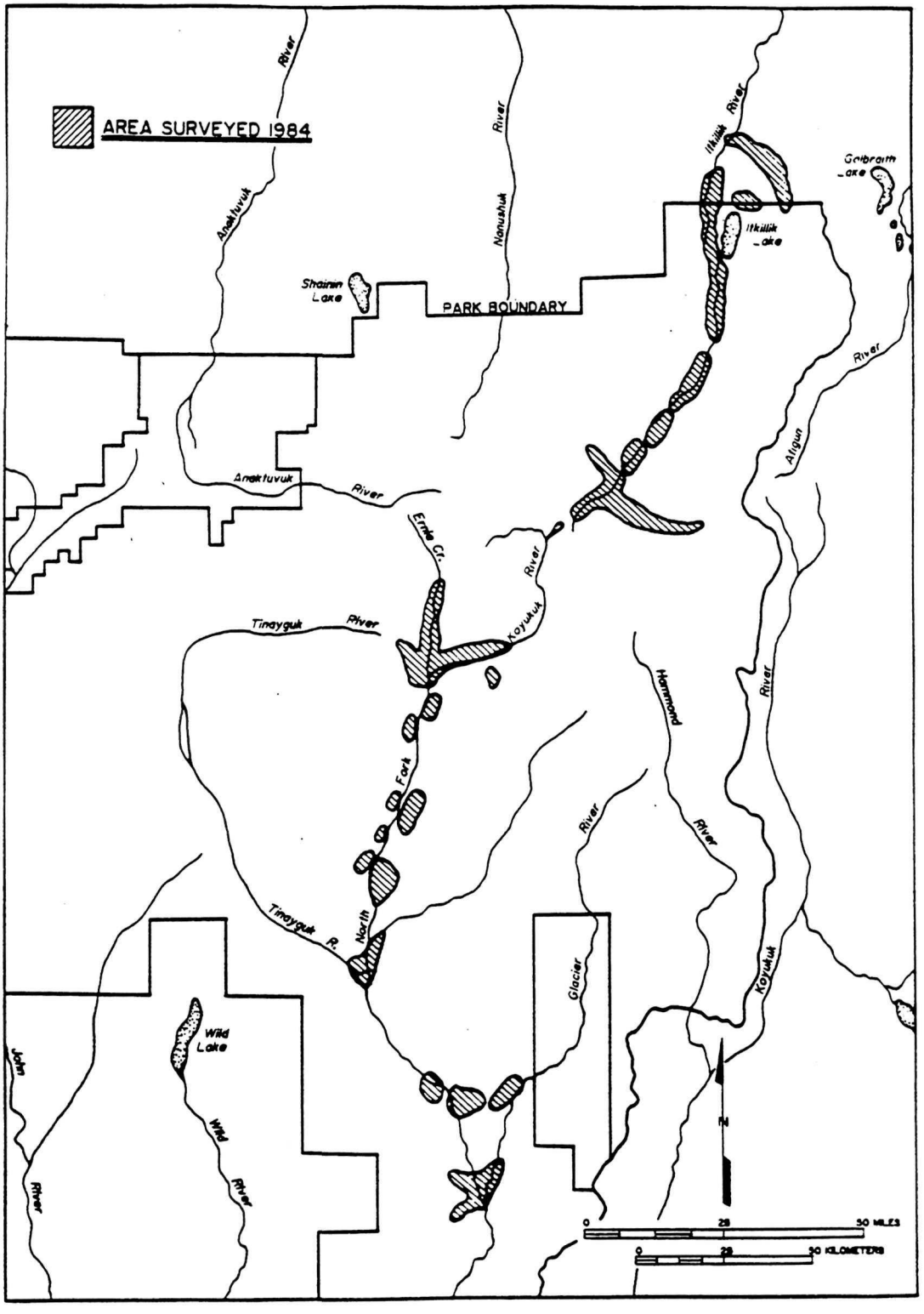

Figure 5. Areas surveyed in 1984.

narrow Ulutagiak Valley, the river enters the broad Oolah Valley which trends northeast for 25 miles before opening onto the rolling northern foothills of the Brooks Range. On the east and west as far north as Itkillik Lake, the river is bounded by mountain peaks, some of which exceed 7500 feet and contain cirque glaciers. The river enters the Oolah Valley at an altitude of 3000 feet and descends 800 feet before leaving the study area north of Itkillik Lake. The Itkillik then continues for another 220 miles northwest, joining the Colville River 25 miles southwest of Harrison Bay, Beaufort Sea.

The North Fork Kuyukuk River heads on the northern slope of Als Mountain at 6905 feet, near Peregrine Pass, and flows south 90 miles where it joins the Middle Fork Koyukuk River. The river enters the study area shortly before its confluence with Ernie Creek at an altitude of 2000 feet. Mountain peaks line the river, creek and confluence area, some in excess of 6500 feet. The river then flows south 42 miles to its confluence with Glacier River. Part of Glacier River was also included in the survey. South of the confluence, the North Fork Koyukuk departs the study area at an altitude of 1000 feet.

1985 Survey Area

During the third year of the project, survey areas were scattered

throughout the park and preserve resulting in more variable physiography. Coverage included sections in the northcentral, central, and western regions of Gates of the Arctic as well as a section completely south of the park and preserve. Each of the four sections will be discussed separately.

The Agiak Lake/Amiloyak Lake/Chandler Lake Valley lies at 68° 15' north latitude and 152° 50' west longitude, straddling the Continental Divide in the northern Endicott Mountains. The valley, at an altitude of 3000 feet, is steeply hemmed in by mountains ranging between 5000-7000 feet, some of which contain small cirque glaciers. The largest of the valley lakes is Chandler, which is five miles in length. The Chandler River heads in Amiloyak Lake and flows north through Chandler Lake, Little Chandler Lake, and Round Lake before eventually leaving the study area, continuing north 125 miles where it joins the Colville River. White Lake to the west of Round Lake is also within the study section. Agiak Lake is the only one of the three large lakes which lies south of the Continental Divide. By a circuitous route, after departing the study area, the lake drains into the Hunt Fork of the John River. In general, this study area is rugged and quite rocky, and supports typical tundra vegetation. The John River heads at an altitude of slightly more than 2000 feet about 1.5 miles south of the village of Anaktuvuk Pass. The river is formed by the confluence of Contact Creek and Inukpasugruk Creek, and flows south 125 miles where it joins the

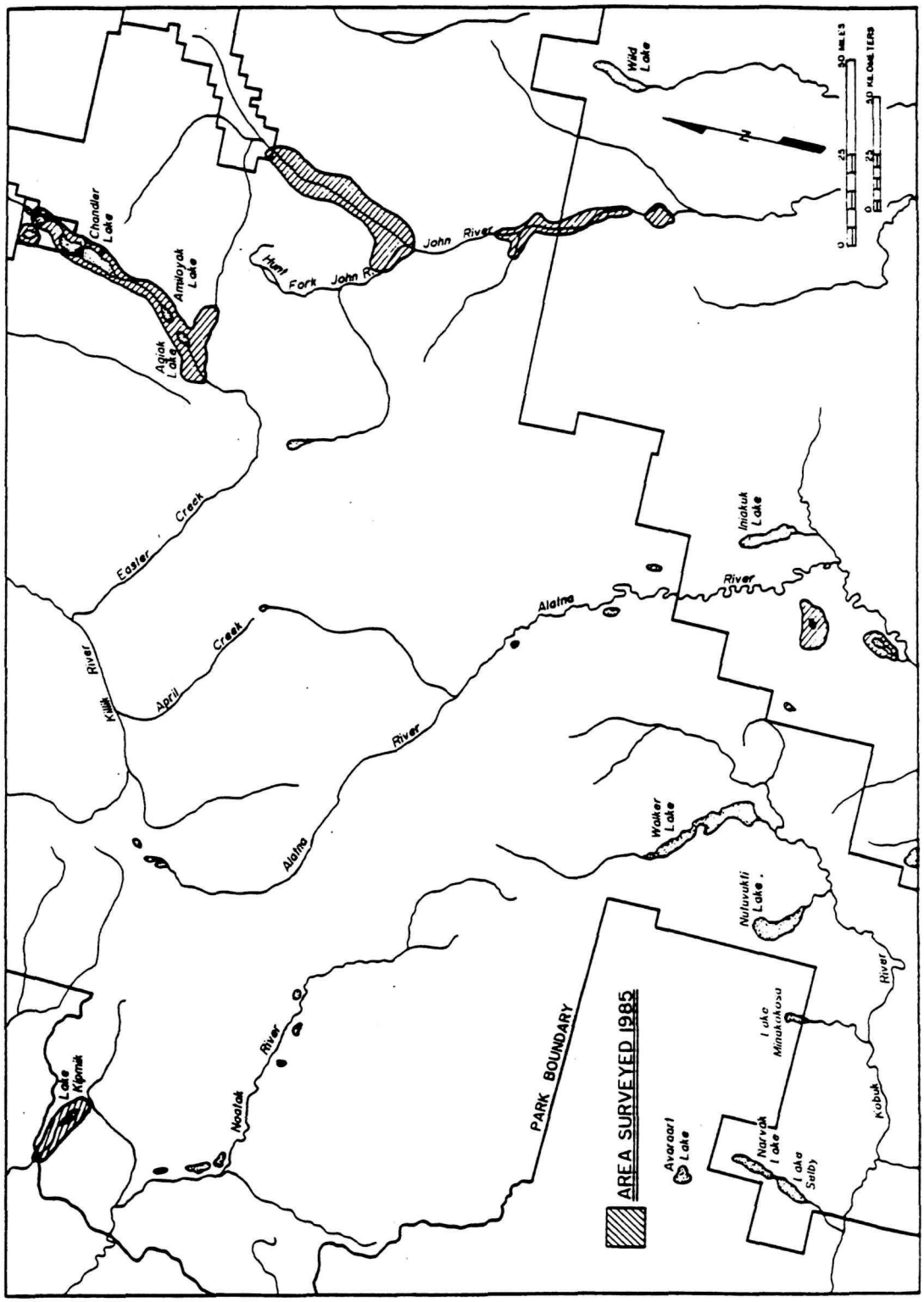

Figure 6. Areas Surveyed in 1985.

Koyukuk River 1 mile northeast of the town of Bettles. The study area started at Till Creek, 16 miles south of the river's beginning and continues south, down the river valley, for a distance of 45 miles to the mouth of McKinley Creek, south of the park boundary. This stretch of river is bordered by 4000-5000 foot mountains which display the effects of recent glaciation. The first 20 miles of the valley are treeless, then spruce and poplar sporadically appear on the valley floor about 5 miles south of Till Creek, thicken, and begin to climb the mountain flanks 6 miles further south. From the confluence of the Hunt Fork south, mixed boreal forest conditions prevail below 2000 feet. By the time the river leaves the study area, its elevation has dropped to less than 1000 feet.

Lake Kipmik/Lake Amitchiak are twin lakes located 67° 57' north latitude, 156° 09' west longitude at the approximate center point. The lakes lie south of the Continental Divide at an elevation of about 2500 feet, are 2 and 2.5 miles long respectively, and drain into the Noatak River. Well beyond both the altitudinal and latitudinal treeline, the lakes are surrounded by 4000-5000 foot mountains. The Midas Creek Valley lies several miles to the east, while the Noatak River flows westward 8 miles to the south. Both lakes contain excellent fish resources.

The Helpmejack Hills are a range of 3500 foot hills, 28 miles

long east to west and 13 miles wide north to south. This section, which is outside of the park, is bounded on the north by Helpmejack and Kichaiakka Creeks, on the east by the Alatna River, and on the west by the Kobuk River. To the south of the eastern portion of the hills lie the Helpmejack Lakes. This area is one of chaotic glacial topography which is mantled by a robust forest that is comprised primarily of spruce with some scattered birch and poplar. Wildfires are common in this area.

Climate

Climatologically, Gates of the Arctic in northern Alaska lies within two zones: Interior Basin or Continental on the south, and Arctic which contains the western one third of the park and most of both preserve regions (Leslie 1989; Searby 1978). While these divisions can experience quite different climates, there are some similarities. In general, the park and preserve endures long, bitterly cold winters where temperatures may reach -70° F., and short, brilliant summers where temperatures may reach 90° F., although normal highs are in the 65-70 degree range. As an example of summer conditions, during the 1985 field season, although daytime temperatures usually remained mild, 3.5" of snow fell on June 13th, and the first frost occurred on July 27th. Winds can be variably strong depending upon terrain, and precipitation is usually light, averaging about 15 inches

annually, most of which falls as rain during the summer.

Geology

Bedrock Geology

The Brooks Range is the northernmost extension of the Rocky Mountains. Lithologically, it consists of a complex series of east-west trending belts of metamorphic, sedimentary, and igneous rocks. The sedimentary rocks of Paleozoic and Mesozoic age are folded, faulted, and locally metamorphosed. Limestone, graywacke, chert, shale, and schist are common rock types. Dark intrusive rocks of the Jurassic-Cretaceous period, as well as other intrusive bodies of granite and diorite, exist in the range (Black 1969). Most of these lithologies are found in or near the survey areas and contribute to the complex substrate that has conditioned the present physiography and surficial geology.

Glacial Geology[2]

Glaciation of the Brooks Range began before the Pleistocene and, to a minor extent, has continued into the Holocene. While the events before and after the Pleistocene will be mentioned, most of the glacial features found in the region are the result of ice advances during the Pleistocene, so the majority of the discussion will focus on those episodes.

The earliest known glaciation in the Brooks Range is known as the Gunsight Mountain advance. Based on evidence from similar deposits in Alaska, a late Tertiary date has been assigned to this drift. Drift deposits from the Gunsight Mountain advance are highly eroded, contain large erratics (Hamilton and Porter 1975; Hamilton 1982, 1986), and occur both north and south of the park and preserve (Hamilton 1986). The next glaciation is termed the Anaktuvuk River advance. In the period between the Gunsight Mountain and Anaktuvuk River advances, downcutting by streams and rivers was not a factor west of the Anaktuvuk River. There was, however, lateral erosion caused by streams as well as large scale pediment development (Hamilton 1986). Other changes in the landscape during this time period included major drainage

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[2]While the summary of glacial history written by the author was acceptable in the early 1980s, data published since then have changed and expanded previous interpretations. For that reason, the editor has made some revisions to this section, particularly using Hamilton's 1986 article.

displacements in some of the river systems north of the park (Hamilton 1986).

Anaktuvuk River is the oldest recognizable drift sheet in the Brooks Range of Pleistocene age (Hamilton 1982, 1986). Although not much is known about the related ice advance, correlation of the deposits which remain with those of the Nome River drift suggest an approximate date of 800,000 years B.P. (before present) (Hamilton 1986). Characteristically identifiable by the types of moraines it left, and by its lithogic variety, remnants of the Anaktuvuk River drift extend as far west as Kotzebue Sound (Hamilton 1982, 1986). Whether a single advance or two separate advances are responsible for the deposits is unknown (Hamilton and Porter, 1975; Hamilton, 1982). There followed, though, a long interval of reduced glacial activity during which stream action and time contributed to drift erosion, pedimentation, and valley enlargement (Hamilton 1982, 1986).

Very little is known concerning the Sagavanirktok River glaciation which occurred between the early Pleistocene Anaktuvuk River and the late Pleistocene Itkillik glaciations. Some valleys contain remnants of one, some of two separate ice sheets. One hypothesis is that there was an early and a late advance, but no actual time frame has been developed (Hamilton 1982, 1986). Hamilton states, "In the absence of finite data the Sagavanirktok River glaciation probably should be considered a generic term for

multiple ice advances of the middle Pleistocene age" (1986:41). In the field, Sagavanirktok River deposits exhibit less erosion and steeper slopes than earlier glacial deposits (Hamilton 1982). Apparently, the interstadial that followed was shorter and more uneven than previous ones. In some areas, for example, permafrost may have persisted until the next glaciation, while in the Koyukuk and Kobuk valleys, deep thaw and reforestation occurred (Hamilton 1986).

More information concerning the Itkillik glaciation is available since it is the last major glaciation in the region. As such, the deposits are less eroded, and steeper than previous glaciations. Presently, reseachers think the Itkillik glaciation consisted of two or three major ice advances now termed Itkillik I or Itkillik IA and Itkillik IB, and Itkillik II (Hamilton 1986). In the past, preliminary dating indicated a late Wisconsin age, around 24,000 B.P., for this glaciation (Hamilton and Porter 1975). However, only Itkillik II, also known as Walker Lake (Fernald 1964), dates to that time period. Studies have shown that, instead, Itkillik I age ice advances are greater than 55,000 years B.P., making dating by radiocarbon methods inaccurate (Hamilton 1982, 1986). Indeed, research indicates an early Wisconsin date (Hamilton and Hopkins 1982). By correlating the earlier advances with other glaciers and by using tephra deposits located in the Koyukuk Valley, dates between 105,000-70,000 years B.P. were obtained for Itkillik IA, while Itkillik

IB probably dates to 75,000-55,000 B.P. (Hamilton 1986). These Itkillik glaciations (Hamilton 1982) formed extensive piedmont lobes in the survey regions which were fed by ice streams flowing down the major stream valleys including the John, Chandler, Alatna, and Noatak Rivers. Not much time passed between Itkillik I and Itkillik II advances. Deposits that formed show immature soils and no major reforestation. Findings of persistant stagnant ice still occur in the kettles of drift sheets today. In fact, some mountain valleys retained their glaciers without any recession (Hamilton 1982, 1986).

The glacial advances that followed were recently studied by Hamilton who revised some of the past interpretations (1986). His view is that the term Walker Lake may be an appropriate name for a set of moraines in the south-central Brooks Range which closely match a definition given by Fernald (1964). These deposits (Hamilton 1982) occur in the survey areas, represented by morainal topography in the vicinity of Walker Lake and the Reed River. The drift deposits associated with the rest of the region are quite different, however, leading Hamilton to believe that Itkillik II is a more fitting characterization of this glaciation (Hamilton 1986).

The Itkillik II glaciation is now dated in the central and south-central Brooks Range (Hamilton 1982, 1986). A period of rapid alluviation in an outwash train traceable to the outer Walker

Lake moraine at Walker Lake indicates a time of maximum ice advance between perhaps 24,500 and 11,500 years ago (Hamilton 1982: fig. 3). This correlates well with the late Wisconsin advance of the Laurentide ice sheet. Subsequent downcutting was followed by construction of a lower outwash train associated with the inner Walker Lake moraine. This moraine is not directly dated, but dated deposits downriver indicate alluviation continued until sometime after 17,700 years ago (Hamilton 1982; Schweger 1976). To the east, Noatak Valley end moraines indicate ice advance occurring between 30,000 and 15,000 B.P. (Hamilton 1986). In the southern part of the Brooks Range, a basal radiocarbon date from Ruppert Lake, a kettle lake at the contact between inner and outer moraines, indicates the area was ice-free by 13,200 years ago (Brubaker et al. 1983: Table 2). On the other hand, on the northern flank of the Brooks Range, a minor readvance of Itkillik II around 13,000-11,500 B.P. caused the formation of a number of lakes (Hamilton 1986). During Itkillik II, glaciers formed piedmont lobes that splayed out onto the lowlands at the valley mouths, but were much less extensive than those of the Itkillik I, stopping just at the range front. This was due, in part, to the sea level being 100m below present levels while the ice was in the process of advancing. This left the Bering Land Bridge exposed making that area unavailable as a water/ice source.

In addition to the major Pleistocene glaciation, some Holocene

neoglaciation occurred during 3,500-2,000 B.P. with sporadic minor advances during 1,500-1,200 B.P. This glaciation is concentrated mainly in cirques along the Continental Divide, Arrigetch Peaks-Mount Igikpak area and along the northern flank of the Brooks Range (Hamilton 1986).

The three major Pleistocene glaciations have left extensive drift sheets in the study areas which are responsible for numerous topographical features. These features are generally well drained, and their topography offers unique vantage points from which to survey the surrounding terrain. As previously mentioned, archaeological sites are associated with these glacial features as well as with the well-drained alluvial terraces and ancient beach deposits surrounding many of the glacially formed lakes.

Soils

The soils of the study areas have not been mapped in any detail; only survey level information is available (Rieger et al. 1979). Due to the young age of most of the surfaces in the study areas, and the cold climate and low precipitation, most of the soils are poorly developed and belong to the Inceptisol order. Among these soils an important line of division is implicit in their internal drainage. On one hand, ice-rich permafrost is common throughout

northern Alaska and poorly drained hydromorphic soils occur where drainage is impeded by the permafrost table. Soils often found in these conditions are wet Inceptisols such as Histic Pergelic Cryaquepts and Pergelic Cryaquepts on rolling upland areas with sedge tussock and dwarf heath vegetation. In very poorly drained muskegs, organic soils such as Pergelic Cryofibrists are found. On the other hand, well-drained soils are found on glacial moraine systems, especially those of the most recent glaciations, and on ridge tops, south facing slopes, and other similar features. Common well-drained soils in the park and preserve are Typic Cryochrepts which are non-acidic soils, or acidic Dystric Cryochrepts, some displaying an albic (A2) horizon indicative of podzolization. Where podzolization had been sufficiently intense, for example, in well-drained spruce forests, Typic Cryorthods may be found. However, recent soil genesis studies at Walker Lake have shown that bleached albic horizons normal with podzolization came from under lichen and dwarf heath cover in the absence of spruce trees (Ugolini et al. 1981). Where well-drained soils are either young or unstable, Entisols such as Pergelic Cryorthents, may be present.

Fauna

In this section very brief mention will be made of some of the mammals, fish and birds that inhabit or migrate through the park

and preserve. During the early peopling of Alaska, now extinct mammoths and mastodons, giant sloths, giant beaver and moose-elk would have been among the potentially exploitable populations in addition to the still extant caribou, moose, bear and other animals utilizing this region (Dufrense 1955). There is no evidence of these more exotic animals being associated with human remains in Alaska, and their contribution to the lives of human inhabitants of the region is unknown. Even if mammoth and other now extinct animals were hunted, the extent of their impact across time is, of course, limited since they died out between 10,000-8,000 years ago, not long after human populations became resident in the region.

The rest of the section will discuss several, but not all, of the mammals, birds and fish that inhabit or migrate through the park and preserve. As an arbitrary beginning, the smaller mammals will be mentioned first. The three smallest mammals to inhabit the area are shrews, voles and lemmings with two or three species of each living in the park and preserve. They have little direct impact on human populations but their availability as game helps sustain preditors such as raptors, weasel, fox and bear. In addition, while all three mammals aerate the soil, the underground runways and burrows these small animals build cause considerable damage to plant growth (Bee and Hall 1956; Smith 1979).

Another small mammal in the area is the ground squirrel. Common, and certainly more conspicuous than the first three mammals, they have played an important part in human subsistence in the the tundra region of the Brooks Range as a starvation food (Campbell 1962).

Many animals of intermediate size that range within the park and preserve are hunted or trapped for their pelts. They vary greatly in their lifestyles and diets as well as their usefulness to human populations. Certain of these animals are usually vegetarian. The marmot lives along talus slopes in the Brooks Range, and is therefore not resident in the less mountainous southern preserve (Bee and Hall 1956). The red squirrel resides in coniferous forests, spending time both in the trees and on the ground. Its range ends along the northern Brooks Range in primarily tundra areas (Smith 1979). Although both the Snowshoe hare and Arctic hare are found in the park and preserve, their ranges do not substantially overlap. The Arctic (or Tundra) hare occupying only the extreme northern edges of the Brooks Range while the Snowshoe hare is widespread throughout the rest of the region (Bee and Hall 1956; Smith 1979). The porcupine is a common resident of the forested regions of the Brooks Range (Bee and Hall 1956; Smith 1979).

One family group of intermediate size hunters includes the least weasel, ermine, mink, marten and wolverine. The ermine is the

most common of the family in the Brooks Range living along river banks, gravel slopes and in damp meadows, while the mink and wolverine are rarest (Bee and Hall 1956). The Arctic fox, Red fox, lynx, coyote, and wolf are preditory mammals that between them hunt most of the other animals in the park and preserve. While the Arctic fox and coyote inhabit the tundra regions of the Brooks Range, and the Red fox is attracted to hillsides, valleys and willow lined creeks, the wolf easily crosses physiographic areas (Bee and Hall 1956). Wolves in particular were important to human inhabitants of the Brooks Range in historic times for the bounty they were worth. The lynx, too, lives in both forested and tundra regions, but it is only an occasional resident (Bee and Hall 1956; Smith 1979).

Although not closely related, the beaver, muskrat and river otter are grouped by their attraction to the water. They can be found in the southern half or forested regions of the park and preserve, though none is plentiful (Bee and Hall 1956; Smith 1979). By their dam building beaver attract muskrat, moose, migratory waterfowl, fish and certain preditory animals such as mink and otter to the area.

Dall sheep are widely distributed among the the steep slopes of the Brooks Range. Normally living at higher altitudes in the summer, and may congregate on canyon floors in the winter (Bee and Hall 1956). Besides preditors and sports hunters, Native

populations catch sheep when caribou are not readily available. Moose, not overly plentiful in the Brooks Range today, were even less common in the past; their presence having little impact on the human resource reserves. They tend to reside along waterways, usually in coniferous forests but also in tundra areas (Bee and Hall 1956; Smith 1979).

Although black bear are only infrequent residents of the park and preserve, brown or grizzly bears are quite common in some areas (Bee and Hall 1956) and were encountered by field crews several times during the project. They have been hunted in the past and present by native populations (Bee and Hall 1956; Smith 1979).

Caribou are the mainstay of the Nunamiut populations within the park and preserve and, as will be discussed, much of their history is closely tied to these animals. Spring and fall caribou migration routes go through the Brooks Range, and some animals remain most of the year. Preferring mountainous areas, caribou inhabit both tundra and coniferous forest areas (Bee and Hall 1956, Smith 1979).

The fish mentioned will be those used most frequently at Anaktuvuk Pass during the time Campbell wrote his dissertation (1962). Because of the short summer season, landlocked bodies of water less than six feet in depth contain no fish and others with surface drainage only contain fish at certain times of the year.

It does appear, though, that species caught in the park and preserve occur on both side of the Continental Divide. Given ice depths, fishing in this region is usually confined to the warmer months, but is sometimes possible when a break or spring is found in the ice during colder months (Campbell 1962). Some species of anadromous salmon and shee enter the major river systems on the peripheries of the park and preserve but do not seem to get far enough in to have an impact on the subsistence of human populations past or present (Campbell 1962, Morrow 1980). Campbell (1962) noted nine species commonly caught in the area of the pass. The four most desirable and dependable species were lake trout, arctic grayling, arctic char and ling (burbot). Morrow (1980) discusses several other species which might be used in other areas of the park and preserve such as the whitefish, cisco and burbot.

Vegetation

The southern portion of Gates of the Arctic is near the northern limit of the boreal forest which lies at an altitude of about 2000 feet and, depending on the micro-environment, latitudinally at roughly 68° north. In the southern park and preserve, White spruce (Picia glauca) dominates the forest on well-drained locations such as mountain slopes and along river terraces, accompanied by White birch (Betula papyrifera) and aspen (Populus

tremuloides).

Black spruce (P. mariana) dominates the poorly drained areas at low altitudes, together with White birch and aspen (Brubaker et al. 1983). Understory plants common to both White and Black spruce forests include Resin birch shrubs (B. glandulosa), and ericaceous species such as Blueberry (Vaccinium uliginosum), Labrador tea (Ledum decumbens ssp. gorenlandicum and L. decumbens ssp. palustre), Crowberry (Empetrum nigrum), and Mountain-cranberry (V. vitis-idaea), as well as lichens (Cladonia sp. and Cetraria sp.). Alder (Alnus crispa) and willow (Salix sp.) are common along stream courses and in draws above the treeline (Brubaker et al. 1983).

In addition to the forest understory shrubs and plants mentioned above, the alpine tundra above the treeline, is characterized by grasses, sedges (Carex sp), Cassiope tetragona, Artemesia arctica, Alpine-azalea (Loiseleuria procumbens), Spirea beauverdiana, and Anemone parviflors. Lowland shrub tussock tundra consists of many of the same understory shrubs and plants along with cottongrass (Eriophorum vaginatum) and sedge tussocks (Brubaker et al. 1983).

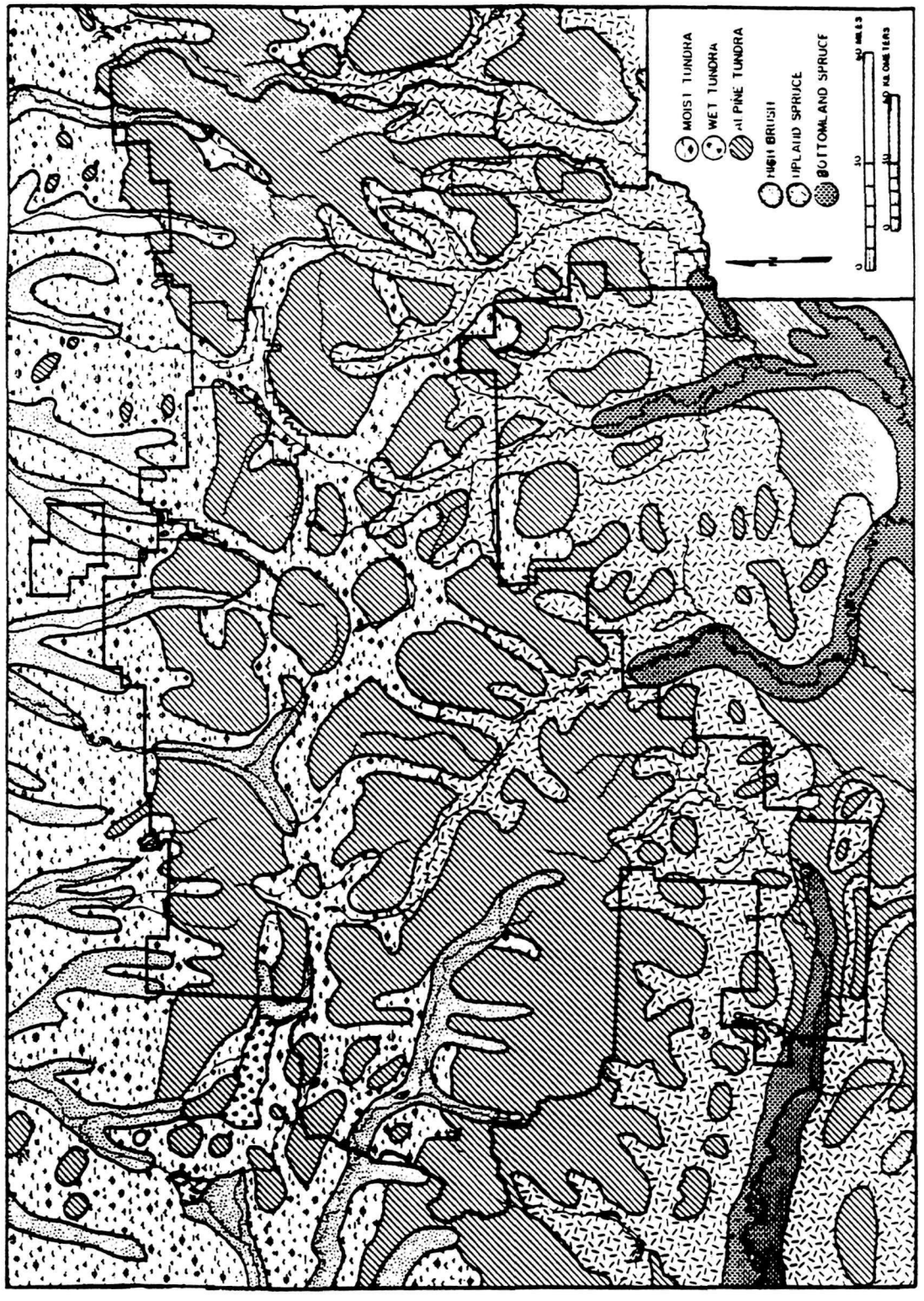

Figure 7. Major Vegetation Types Within Gates of the Arctic National Park and Preserve (after the Joint Federal and State Land Use Planning Commission for Alaska 1973).

Local Vegetational History

During the five years between 1983 and 1988, park personnel, especially those involved in the cultural resources inventory project, worked with and provided some logistic support for Dr. Patricia Anderson's paleo-environmental studies in the Central Brooks Range. Among other benefits, Dr. Anderson's work has provided Gates of the Arctic with a state-of-the-art vegetational history which will have many applications in research and management in the park. Appendix I contains her summary of her findings and ideas.

LOCAL CULTURAL HISTORY[3]

The purpose of the following is to present the cultural history of Gates of the Arctic National Park and Preserve and surrounding areas in the perspective of the thematic framework developed by the National Park Service.

The Prehistoric Period

The American Paleo-Arctic

It is generally accepted that the New World was settled by immigrants from the Old World at least 12,000 years ago and that the vast majoritiy of these people arrived via the Bering Land Bridge which joined the continents of Asia and North America by linking Siberia and Alaska. As the gateway to the New World, the earliest human inhabitants obviously resided in Alaska. In late Pleistocene times the indigenous population was probably not large even by Arctic standards. The archaeological sites which date to this time period in Alaska are considered to lie within

[3]The author had written a cultural history of the park and preserve in conjunction with the summary and conclusions as a frame-work for site discussion. As a complete section, however, it needed editorial additions and revisions. This was done carefully in order to leave the authors thoughts and ideas intact.

the American Paleo-Arctic Tradition (Anderson 1988). These sites appear to be randomly scattered across wide areas with no discernable settlement pattern, although Dumond (1987) notes that they are usually restricted to locations untouched by the most recent major glacial episodes. While some of these sites have contained bone, which is a dateable material, most have been placed in this category based upon the characteristics of their lithic assemblage. In general, throughout Alaska, this may include microblades, small wedge-shaped cores, leaf-shaped bifaces, burins, and lanceolate projectile points (Dumond 1987). Locally, however, it should be noted that of the three radiocarbon dated Paleo-Arctic sites that lie directly adjacent to the park, all three lack lanceolate projectile points and only one displays a core and blade technology. Certainly while Paleo-Arctic populations were in the area, remnant glacial ice was still present in some of the valleys and vegetation was more herbaceous or grassy with areas of balsam poplar, probably closer to water sources (see Anderson in Appendix I). While present-day large mammals roamed the land, a variety of Pleistocene megafauna, although small in number, were still extant. Human adaptation to these environmental conditions, during this time period, seems to favor small, non-sedentary groups. Indeed, the type of sites which represent this time period are small camp/lookouts or isolated lookouts.

Although Pleistocene megafauna were certainly a part of the

GAAR Cultural History

Years B.P.	Generalized Sequence	Project Sequence	Years B.P.
11,500-8,000	American Paleo-Arctic	American Paleo-Arctic	11,500-8,000
8,500-4,000-	Generalized Northern Archaic	Northern Archaic	8,500-4,000
6,500-4,000	Tuktu/ Palisades		
4,500-2,000	Denbigh	Eskimo Continuum	4,500-100
3,200-2,000	Choris		
2,500-1,500	Norton		
2,000-800	Ipiutak		
800-300	Late Prehistoric Eskimo		
300-35	Nunamiut Eskimo		
600-100	Kavik (Athabaskan)	Kutchin (Athabsakan)	600-100

Table 1. Cultural History of Gates of the Arctic: comparison of generalized culture history sequence and the sequence used during the GAAR survey and inventory project.

subsistence resources available, those animals were probably less important to the human inhabitants of the Arctic than they were to the Paleo-Indians of temperate North America. Indeed, more than 95% of the non-culturally associated Pleistocene megafauna remains found in the Arctic pre-date by many millennia the period when it is generally believed that the first humans resided in the region.

Although it is known that many modern species were available at that time, archaeological evidence supporting their role in Paleo-Arctic subsistence is uncommon. Exceptions include bison and sheep remains from Component II at Dry Creek (Powers et al. 1983), caribou, sheep and squirrel from Carlo Creek (Bowers 1978), and small mammals, birds, and possibly caribou from Healy Lake (Cook 1968, Hamilton 1989).

The Northern Archaic

About 8,000 years ago, human populations in most of temperate North America responded to a hemispheric-wide warming trend by beginning to utilize a more diversified subsistence base. Localized specialization in subsistence activities such as fishing, small mammal hunting, or perhaps plant collecting also occurred at this time. These changes, often referred to as Archaic adaptations, are associated with the Archaic period, a

time interval that lasts until three or four thousand years ago. This investigator believes that, in the Arctic, the extinction of Pleistocene megafauna and the growth and expansion of the boreal forest to its modern northern limit are the hallmark characteristics of the Archaic period.

However, as the people of the American Paleo-Arctic had never been true or classic Paleo-Indians, neither were the Northern Archaic people true or classic examples of the people of the Archaic period. Indeed, the words "Paleo" and "Archaic" when applied in the Arctic, reference a period of time rather than the classic cultural manifestations or life styles. Therefore, in the Arctic, with its extremely limited variety of subsistence resources, the cultural or life style differentiation between the people of the American Paleo-Arctic and Northern Archaic periods appears minute.

Within the park, the main difference between Paleo-Arctic and Archaic period sites seems to be size. The more recent Archaic sites are slightly larger and usually contain more artifacts and chipping detritus suggesting longer duration of occupancy or more frequent use. The location of the Archaic sites suggests, unsurprisingly, hunting as the basic endeavour and, at the most complex, most sites appear to be short term camps/lookouts. Geographically, the more numerous Northern Archaic sites demonstrate a wide distribution, as was the case with the

American Paleo-Arctic sites. Their somewhat larger size, however, may indicate regionally larger human populations or, at least, more territorial populations during Archaic times. The paucity of large or long-term occupation archaeological sites representing American Paleo-Arctic and Northern Archaic cultures north of the boreal forest may indicate that these people were mainly exploiting the northern tundra during the more clement months of the year, April-September, and were spending the colder months in the boreal forest where there was more variety and a more regular distribution of subsistence resources.

The interior Arctic lands in Alaska supported hunters; gathering, beyond a miniscule degree, probably was not done. In this sense the descriptive category "hunters and gatherers" does not really apply to Archaic peoples in the Arctic. Plant species valuable as food were limited to a few types of berries and one or two roots. Ethnographic accounts suggest that plant material never amounted to more than 1%-2% of the annual diet of any native group in Arctic Alaska (Gubser 1965, Hall 1961). In addition, the gathering of plants for use as construction materials was limited to willow, spruce, and birch and many of the aboriginal residents of the park had to travel considerable distances to obtain spruce and birch. These people might better be termed Arctic "hunters and foragers", but even foraging implies too much emphasis on non-hunting subsistence methods. Whatever the terminology employed, the first readily apparent major change in

subsistence exploitation methods in interior Arctic Alaska began sometime between 4,000 and 5,000 years ago.

In much of North America the end of the Archaic period is marked by the beginning of agriculture and the development of more sedentary communities. Although neither of these events occurred in the Arctic until well into the historic period and in some cases modern times, it is near the end of the Archaic period that a change in site type, size, and location began to appear.

The Eskimo Continuum[4]

Denbigh Flint Complex

Beginning with the culture known as the Denbigh Flint Complex (Giddings 1964), major changes occurred in technology, environmental exploitation, and social organization of interior Arctic peoples; changes which would manifest themselves through cultural similarity into the mid-nineteenth century. In fact, it is the author's opinion that the people of the Denbigh Flint Complex may represent the beginning of the Eskimo cultures in

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[4]Standard terminology describes this part of the cultural sequence is the Arctic Small Tool Tradition (Irving 1964). The term Eskimo Continuum has been used by Campbell (1962) and is used by the author, but is not generally accepted. Editor.

Alaska and perhaps the entire Arctic. Although we are badly hampered by a meager data base in the Arctic, due to the lack of archaeological exploration over such a vast geographical area, and to a greater extent the lack of excavated and fully investigated sites, the collected data indicates that the Denbigh Flint Complex burst upon the scene as a full blown culture. This suggests that Denbigh represents a significantly different group of people than those who had previously utilized the area. Therefore, if the Northern Archaic peoples were only using interior arctic Alaska marginally and/or seasonally, this new group of people could have quickly become the dominant user group from the fringes of the boreal forest north to the Arctic coast. Not only do the Denbigh people seem to suddenly appear as a totally developed and smoothly functioning culture, but archaeological data suggests that their appearance in the interior and along the coast occurs almost simultaneously, indicating an extremely rapid geographical spread of these people. Although surprising, this circumstance is not unique, as witnessed by the Clovis culture of the North American high plains which suddenly occurs over a wide area as a fully developed culture with no apparent regional progenitor.

The changes initiated by Denbigh culture were numerous and enjoyed a temporal longevity which lasted almost to modern times. For this reason, in 1976 I began using the term "Eskimo Continuum" as a collective phrase, to refer to the prehistoric

Eskimo cultures of Arctic Alaska (Campbell 1962; Kunz 1977). Indeed, the only technological similarity between the Denbigh culture and its predecessor, the Northern Archaic tradition, was a core and blade/burin manufacturing aspect which continued in the sub-arctic Archaic descendant cultures until perhaps as recently as 1,000 years ago. Core and blade technology, however, essentially disappeared from the Eskimo Continuum with the demise of the Denbigh culture about the time of Christ (Kunz 1977).

Denbigh is the first or earliest prehistoric culture to be equally prolific on the Arctic coast as well as in the Arctic interior and yet remain technologically (as determined by lithic cultural remains) the same in both environments. Certainly there were some adaptations in reaction to the difference in ecosystems but, other than harpoon blades, they are not easily detectable in the remains of the material culture found at most sites.

Another marked difference between Denbigh and the earlier traditions is in lithic technology. While not in themselves heavy, crude, or massive, the lithic tools of the Northern Archaic tradition appear so when compared with the stone implements of the Denbigh Flint Complex and the other more recent representatives of the Eskimo Continuum. Indeed, more than any other recognizable cultural aspect the small, almost delicate, aesthetically pleasing form and superlative workmanship which went into the manufacture of the most functional and everyday

lithic tools is the hallmark of the Denbigh Flint Complex and its descendant cultures. It was this unique trait which led William Irving in 1964 to define the Arctic Small Tool tradition around the Denbigh Flint Complex.

Without a doubt, however, the most important difference between Denbigh and the earlier cultures is one of social organization and the resultant exploitation of subsistence resources. In terms of social organization, many of the sites which represent the Denbigh culture in interior Arctic Alaska are small short-term camps or lookout sites. At the same time, a number of these sites are large, showing long-term (by Arctic standards) occupation as well as episodic use. Large, long-term and often-used spring-summer-fall Denbigh camps have been found in the northern Brooks Range and on the North Slope. An extremely large site of this type, more than 8,000 meters square, lies in the western part of the park on the shore of Lake Kipmik. Other large sites are located at Mosquito Lake (Kunz 1977), 16 miles east of the northern preserve area, and on Natvakruak Lake (Campbell 1962), seven miles north of the park's northern boundary in the Anaktuvuk Pass vicinity, and at Kurupa Lake (Schoenberg 1985), in the northwestern part of the park.

Additionally, among the suite of Denbigh sites, there are sites which, for the first time, suggest over-wintering in the Arctic interior. These sites occupy the shores of lakes that have good

fish resources. Midden contents suggest, however, that fish was basically a backup resource when caribou could not be obtained. The dwellings found at these sites are semi-subterranean houses that would have been relatively easy to heat. A large site at Etivluk Lake, just a few miles north of the northwest corner of the park, has a number of semi-subterranean houses which have been attributed to the occupation of the lake shore by Denbigh people. Such a variety of site types did not occur among the earlier cultures and points out how extensive and successful the Denbigh occupation of the region was.

The contents of midden at lakeside sites suggests that caribou was the subsistence mainstay of the Denbigh people in the Arctic interior. To successfully hunt caribou and obtain the number required for survival, especially without the aid of dogs which, in Denbigh times, do not appear to have been a part of their culture, required a communal type of social organization. As evidence, some very old "inuksuk" lines have been observed near large Denbigh sites which suggests communal hunting of caribou may have begun at this time. This method of caribou hunting remained a common practice throughout the cultures of the Eskimo continuum. The Denbigh Flint complex culture enjoyed the greatest longevity and was the most prolific of the cultures of the Eskimo Continuum.

Choris

Recent information (Giddings and Anderson 1986) indicates that the Choris culture, which occupied a time period between the Denbigh and Norton cultures, should be placed within the Continuum. Differences between Choris and earlier cultures include larger projectile points, an absence of microblades and rare polished slate, the addition of oil lamps, and the first pottery in this region of Alaska (Dumond 1987). Like the rest of the Eskimo Continnum cultures (with the exception of the Late Prehistoric and Nunamiut Eskimo), Choris was defined at a coastal type site; as yet, no good, interior Choris site has been documented.

Norton

Although no examples are known within the park, Norton sites have a reasonably good distribution across the Alaskan Arctic interior and are known to occur only a few miles to the east, north, and west of the park. The same evolutionary trends that began in the Choris culture continue here. In some areas, pottery temper evolves from earlier fibre-ware to sand temper and/or different surface decoration. Constructed housing at sites found along the coast suggests a change in the subsistence orientation of the resident populations (Dumond 1987).

Ipiutak

According to Dumond (1987), Ipiutak is a development of Norton culture. Ipiutak sites lack oil lamps, pottery and ground slate items but are known for engravings and carvings. There is little difference, however, between the flaked stone artifacts of the two cultures (Dumond 1987); Norton and Ipiutak lithic assemblages are virtually indistinguishable. Thus, it requires a large site, or one of long term occupation containing a broad spectrum of artifacts, especially those made of bone, antler, and ivory, to identify a site as being specifically Ipiutak, and sites of this size and/or type are not common.

Ipiutak sites have been found along the western coast at such places as Kotzebue Sound and Point Hope, and in the interior along major drainages and lake shores (Anderson 1984). Although only one Ipiutak site is discussed in the sites pertinent to this document, others are present in the park and surrounding area. The Kayuk Site (Campbell 1962) at Anaktuvuk Pass, for instance, has an Ipiutak component. Based on reports from area researchers, interior Arctic sites representing the Ipiutak culture, while not as numerous as Denbigh, appear to be more common than either Choris or Norton and possibly on a par, in terms of site density, with late prehistoric Eskimo sites. The reason for this cultural proliferation may be attributable to the appearance of the domesticated dog during Ipiutak times.

The dog made the people of Arctic Alaska considerably more mobile. In summer, and initially in winter too, the dog was a pack animal, the use of which extended the range of the Ipiutak people in terms of resource exploitation and travel. This was especially true in areas where summertime travel by water was not practical. In winter, whether pulling a sled or packing gear on their backs, dogs made moving over long distances much more attractive and practical. This allowed for a greater opportunity of food procurement, which may have increased the nutrient level of the people involved, securing them better health. As they became healthier, the Ipiutak people may have had longer life expectancies and lower infant mortality rates, contributing to an increase in their numbers. Certainly, at some time between 0-900 A.D., the addition of the dog, and its effect upon Eskimo culture, can be likened to the effect the addition of the horse had upon the culture of the Plains Indians of temperate North America.

Late Prehistoric Eskimo[5]

Late prehistoric Eskimo sites are relatively common throughout interior Arctic Alaska. Apparently, people would travel inland

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[5]Many researchers consider the Late Prehistoric Eskimo culture to be part of the Western Thule (Northern Maritime) tradition, which spread across the Arctic around 1050 B.P. Editor.

from coastal areas to winter in the interior (Anderson 1984). A typical over-wintering site was composed of several semi-subterranean houses, the floors and features of which seem better adapted to coastal than inland conditions (Anderson 1984). Given the number of late prehistoric Eskimo sites that have been noted in interior Arctic Alaska they seem to have been a very successful cultural group.

Nunamiut

Chronologically speaking, the Nunamiut Eskimo are the last member of the Eskimo Continuum. As an archaeological culture they appear to occupy a time period ranging from three hundred to roughly 35 years ago. It was not until 35-40 years ago that the remaining modern Nunamiut Eskimos abandoned their nomadic life styles to become more sedentary. Therefore, any Nunamiut site in the Central Brooks Range older than 35 years can be considered an archaeological site. The cultural and social evolution of the Nunamiut Eskimo is discussed in depth in the next two sections and in Appendix IV so I will be brief here. The main difference between the Nunamiut and their predecessors, besides moving from the stone age into the Atomic Age in less than 100 years, is their change in winter housing. Since Denbigh times, the lakeside semi-subterranean house had been the standard during winter months. The Nunamiut, however, utilized willow patches,

usually located along stream courses, in which they built "ivruliks" (moss/sod houses). This change may indicate a more mobile society as well as a change in the type of winter subsistence resources that were being exploited. The rest of the year, and perhaps occasionally during the winter also, they lived in dome-like or quonset hut-like caribou skin tents.

Not much is known about the lithic tools of the Nunamiuts, since few sites representing their culture prior to Euro-American contact have been found and fewer yet have been investigated. While it appears that metal implements rapidly replaced stone tools, bone and antler tools remained in use considerably longer. These later tools recovered from contact period Nunamiut sites are generally unchanged in style from pre-contact times and maintain a diagnostic similarity with bone and antler tools of the earlier cultures of the Eskimo Continuum.

As the Denbigh culture's sudden appearance and geographical domination of the Arctic 4,000-5,000 years ago begs for more elucidation through research, so too does the pre-contact (before 1850) Nunamiut culture. For unknown reasons, this most recent representative of the Eskimo Continuum departed radically from a four millennia-long pattern of winter living suggesting a dramatic change in subsistence exploitation methodology. Further archeological work within the park, could help answer this exceedingly important question.

Kavik

Another archeological culture from the late prehistoric time period is represented in the park and preserve area. This culture, the Kavik culture, was first described by Campbell in 1962 at a site near Anaktuvuk Pass. At that time, Campbell felt that Kavik was a post-Ipiutak member of the Eskimo Continuum based on the artifacts associated with the distinctive "Kavik" projectile points. However, subsequent excavations of other Kavik sites, most notably the Atigun Site, a deeply buried and stratified site lying 16 miles east of the northern preserve area, demonstrated that the lithic as well as antler and bone technology and formal tools were dissimilar to those of the Eskimo Continuum (Wilson 1978). In fact, the artifacts from Kavik sites in the Brooks Range are much more comparable to artifacts from Athabaskan sites of similar age south of the range. Indeed, Kavik remains in the Brooks Range may be associated with the progenitors of the Dihai Kutchin whom the Nunamiuts claim to have driven from the Brooks Range shortly before 1850.

The Ethnographic Period

In the Anaktuvuk Pass area between the late 1940s and the early 1980s, a number of anthropologists conducted fieldwork with

greater or lesser degrees of intensity. This work includes publications by Helge Ingstad (1954), Helge Larsen (1956), Robert Spenser (1959), Leopold Pospisil (1964), Nicholas Gubser (1965), Charles Amsden (1977), Ernest Burch (1975, 1976, 1980), Grant Spearman (1982), Edwin Hall, S.C. Gerlach and M.B. Blackman (1985), and Michael Kunz and Kimberly Troxel (in preparation). Most of this work has dealt with human occupation and exploitation of the upper John, Anaktuvuk and Chandler River drainages. As a result, a large body of anthropological data is available for the area. However, much of this data is applicable in more than a general sense to the entire northern portion of the park.

In the late 1970s and early 1980s, a number of anthropological works were sponsored by the Yukon-Koyukuk School District which centered on revered elders in some of the villages surrounding the park. These works trace the personal and village history of the elders over the first three-quarters of the 20th century and provide a valuable insight into the radical alterations that have occurred in their cultures since the arrival of Euro-Americans.

In addition, National Park Service and Alaska Department of Fish and Game personnel have collected ethnographic as well as current cultural data from native communities in and around the park. Most of the data collection has been oriented toward subsistence activities although other areas have been addressed.

Aboriginal Use of the Park

Prior to the school district reports, A. M. Clark (1974) published a comprehensive work dealing with the aboriginal cultures of the Koyukuk River drainage. Clark's work suggests that the park and preserve were utilized by three different cultural groups: the Nunamiut Eskimos, the Koyukuk Athabaskans, and the Kobuk Eskimos.

These three aboriginal cultural groups, to a greater or lesser degree, occupied and exploited the park area at the close of the 19th century. While each of the groups utilized different territories, all lived in harsh and rigorous environments. Often their existence was difficult. In this regard Clark states,

> "... there were few times through the year when a sufficiently large surplus could be accumulated that the food quest was not paramount. Their lives were not those of settled village people, and as the seasons changed, so did their places of habitation, as well as their methods and types of hunting and fishing" (Clark 1974).

Of the three groups which utilized the park and preserve, the Nunamiut Eskimo historically occupied the majority of the area. The Koyukuk Athabaskans were the primary users of the southernmost portion of the park, while the Kobuk Eskimos were probably only peripheral users along the southwestern edge of the park, and in the southern preserve, following the Kobuk River not too far beyond the mouth of the Selby River.

A fair amount of data has been collected through the work of modern day anthropologists and from the accounts of the early explorers regarding the annual cyclical movements of the natives of this area at or about the time of Euro-American contact. How far back in time such annual cycles of movement can be applied, however, is debatable, especially when trying to apply such cycles to archaeological cultures. The following is a general outline of the annual movements of the Nunamiut Eskimos, Koyukuk Athabaskans, and Kobuk Eskimos, in the late 1800s, after contact but prior to extensive acculturation.

The Nunamiut Eskimo, at least in late prehistoric times, maintained no permanent base of operations, generally moving with the caribou. In April and May, and in August and September, the Nunamiut hunted the major passes of the Brooks Range. From October to January, they broke into smaller groups and hunted the caribou remaining in the mountains near the treeline, along the south side of the range. February and March, as well as June and July, were often periods of near famine. At these times, they hunted small game, fished, and gathered berries (Campbell, 1962).

From June through August, the Koyukuk Athabaskans lived on the major rivers at the confluence of streams or sloughs. This can be somewhat substantiated by the accounts of Stoney (1899), Cantwell (1889), Mendenhall (1902), and others during explorations along the Kobuk, Koyukuk, and Alatna Rivers between

1884 and 1901. During this season the men left camp, off and on, for periods of a few days to hunt birds and other game. Additionally, berries, meat, and fish were dried for winter use. As fall began, the people moved into the hill country, fishing the lakes, building semi-subterranean houses for winter use, and hunting caribou, sheep, bear, and small game. About March the Koyukuk left their winter dwellings and moved to spring muskrat camps nearer the main rivers. Just before break-up, the families moved to their spring fish camps on the creeks between the lakes and rivers. By June they were back at their summer camps (Clark 1974).

The Kobuk Eskimos had their summer fish camps on the Kobuk River and engaged in the same basic activities as did the Koyukuk Indians. As fall approached, they moved to the low passes of the Brooks Range to hunt caribou. In late fall, they returned to the Kobuk River and built their winter houses near their summer fish camps. At the approach of spring, the Kobuk people moved away from the river to the lakes to hunt caribou and waterfowl, possibly as far east as Wild Lake. In early summer, they moved back to the Kobuk River.

The Nunamiut

As previously mentioned, somewhere between two-thirds and three-

quarters of the park area can be considered to have been traditional Nunamiut Eskimo territory. Additionally, the vast majority of the recorded archaeological sites which can be culturally identified are Nunamiut Eskimo or belong to the Eskimo Continuum. Because the Nunamiut Eskimo were the dominant aboriginal as well as current cultural group within the park and preserve, it would be worthwhile to take a more in-depth look at their cultural history and the establishment of the village of Anaktuvuk Pass.

Cultural Identity

How long the Nunamiut Eskimos have existed as a cultural entity is a matter of conjecture depending to a large extent upon the manner in which the archaeological and/or ethnohistoric data is weighted (Burch 1975, 1976, 1980). Burch believes that as an identifiable cultural group, the Nunamiut did not exist prior to about 1875. On the other hand, there is evidence from both data sources which tends to support the case for Nunamiut cultural identity for roughly the last 250 years (Campbell 1962, Gubser 1965, Spearman 1980).

Ethnohistory

According to Nunamiut ethnohistory, their mythological progenitor, a giant known as Aiyagomakala, created the Nunamiut at the headwaters of the Alatna River, about 80 miles west of Anaktuvuk Pass, sometime prior to 4000 B.C. (Gubser 1965). However, since the creation date predates the age of the oldest known prehistoric Eskimo archaeological sites in Alaska, it appears futile to try to establish a chronologic point of origin based on the Nunamiut creation myth. More recent ethnohistoric accounts or legends, however, especially those involving other cultural groups enjoy various degrees of corroboration in the legends of these others. In addition, references in the reports of early explorers (Allen 1887; Franklin 1828) may also be valuable in trying to determine the extent of Nunamiut cultural longevity.

The earliest creditable ethnohistoric accounts suggest that an Eskimo group (which I consider probably Nunamiut based on their lifestyle and area of exploitation) lived in the central Brooks Range at least by the last quarter of the 18th century. This is supported by Kutchin Athabaskan ethnohistoric accounts relating to their own northward movement, and the establishment of at least a seasonal village in the Howard Pass area of the Brooks Range, 130 miles west of Anaktuvuk Pass, around 1800. In the fifty years following their arrival at Howard Pass, the Kutchin

moved slowly eastward across the north face of the mountains as the result of short periods of peace followed by brief flashes of conflict with the resident Eskimos. This pattern of activity culminated in the Kutchin's departure from the Brooks Range via the drainages of the Itkillik and North Fork Chandalar Rivers about 1850 (Kunz 1976). This ethnohistoric account suggests that the Eskimos, presumably Nunamiuts, encountered by the Kutchin Athabaskans in the Brooks Range were the established regional user group. The account further suggests that, based on their well-established daily and seasonal routines of living, these Eskimos had been utilizing and living in the area for some time.

Archaeological Evidence

According to the author, any Eskimo group which appeared to reside in the general Brooks Range area, more or less year around, within the last 4000 years could be considered Nunamiut or more probably a related precursor to the Nunamiut. Indeed, the regional Eskimo culture of the last 250 years appears to share most of the common material culture traits of the earlier Eskimo cultures with the exception of winter housing.

Sites that are archaeologically determined to represent Nunamiut culture should contain of a variety of hallmarks or diagnostic elements of their material culture particularly when found in

concert with one another. Nunamiut diagnostic elements include round or oval tent rings, moss or sod house remains, inuksuq (lines of stone or sod cairns used to direct caribou into ambushes), stone caribou corrals, and stone and antler sheep or caribou snare anchors.

Tent rings rarely have dateable cultural material associated with them, and it is therefore difficult to obtain chronological radiometric data from such sites. However, the physical condition of a tent ring, such as the degree to which it is incorporated into the vegetation and/or the amount of lichen growth on the tent ring stones can, to the practiced eye, yield at least a relative age. The most common problem with dating cultural material associated with tent rings is the difficulty, except under the best of conditions, in determining if the cultural material and the tent ring are contemporary and truly associated with one another. One apparently reliable suite of tent ring sites is located at Toolik Lake, 64 miles northeast of Anaktuvuk Pass. These sites, excavated and analyzed in 1970, appear to have excellent cultural integrity and even yielded dateable organic material although no dates were run. The excavation and analysis of a number of the tent rings indicated that some of them were only associated with pre-contact cultural material, suggesting an occupational episode prior to the last quarter of the 19th century (Bacon 1971). Another suite of tent rings located near Agiak Lake, about 30 miles west-southwest of

Anaktuvuk Pass, contained only lithic material. So far as could be determined by surface observation, each of the three tent rings had chert waste flakes within its perimeter but none scattered about outside it. This suggests that the lithics and the tent rings are directly associated. The fact that there is nothing but aboriginal cultural detritus present suggests that these tent rings predate contact times. No subsurface testing was conducted at the site, and the occurrence of datable organics is unknown (Kunz 1986).

On the other hand, ivrulik (sod or moss house) remains usually contain dateable cultural material, although few have been dated. Often radiocarbon dating is not conducted on ivruliks because historic items such as cartridge cases, trade beads, or metal knife blades are associated with the structure, and these items easily provide bracketing dates of occupation. By the very nature of their construction components, ivrulik ruins are difficult to recognize after the structures are more than 60-80 years old. For this reason, the vast majority of ivruliks that are located as the result of surface reconnaissance date no later than the last two decades of the 19th century. However, the use of ivruliks by the Brooks Range Eskimos was so common by the 1880s that that type of structure had probably been established as the standard winter dwelling for quite some time. Still, occasionally ivrulik remains are found which contain no post-contact artifacts, and assuming the episode of occupation was

long enough to accumulate historic debris in the willow flooring, the occupation may predate 1875.

In the ivruliks excavated at Aniganigaruk (Corbin 1971, 1975) near Galbraith Lake, about 65 miles northeast of Anaktuvuk Pass, a mix of aboriginal stone, bone, antler, and wood artifacts and cartridge cases, trade beads, pieces of metal, etc. were found. The number of aboriginal artifacts recovered from the houses are far greater than the number of commercially produced items which suggests that the transition from aboriginal material culture to implements of Euro-American manufacture had only recently begun.

Only two types of cartridge cases were recovered from the ivruliks at Aniganigurak: the .44 Henry which was used in the first commercially manufactured repeating rifle (1860-1873), and the .44-40 which was used in the Model 1873 Winchester (1873-1937). Therefore, assuming more recent ivrulik remains are not superimposed over older structures, the earliest the site could have been occupied would be around 1873. Other cartridges often found in contact period Nunamiut sites, such as the .45-70 (Model 1886 Winchester) and the .45-60 (Model 1876 Winchester, cartridge introduced in 1880), plus other cartridges associated with rifles of later manufacture which were available from whalers and traders on the Arctic coast after 1880, are conspicuously absent at Aniganigaruk (Corbin 1971). Therefore, it is reasonable to assume that Aniganigaruk was occupied not much later than 1880.

Additionally, Simon Paneak, a founder of Anaktuvuk Pass village, stated in a 1971 interview that he had spent the winter of 1910 in the Itkillik Lake/Galbraith Lake/Atigun River/Sagavanirktok River area, and that there was no visible camp at Aniganigaruk at that time. This suggests that in 1910 the ivruliks were fairly old and not readily apparent (Corbin 1971).

At present the only radiometrically dated site which suggests that Nunamiut Eskimos may have been present in the central Brooks Range prior to contact times lies in the Atigun Valley roughly 65 miles northeast of Anaktuvuk Pass. The site, Mosquito Lake (Kunz 1977), lies on the opposite side of the Atigun River from the Atigun Site, a well-documented large Kavik (Athabaskan) site (Alexander 1968; Wilson 1978). While most of the localities at Mosquito Lake contain cultural remains classified as Denbigh or Norton (early representatives of the Eskimo Continuum), "Locality A", represents a much more recent occupational episode.

A suite of nine radiocarbon dates from the Atigun Site range from "indistinguishable from modern" to 360 years B.P., while the three radiocarbon dates from "Locality A" at Mosquito Lake range from less than 200 years B.P. to slightly more than 300 years B.P. The Atigun Site is the location of a long-term habitation containing a large variety of artifacts, while "Locality A" appears to be a short duration hunting camp. However, the projectile points (one of the most reliable culturally diagnostic

artifacts) recovered from "Locality A" at the Mosquito Lake Site are stylistically Eskimo and markedly different in technique of manufacture and in morphology from the Kavik projectile points of the radiometrically contemporary Atigun Site lying just across the river.

It is interesting to note that archaeologists and anthropologists that have worked in the Central Brooks Range are in general agreement that when the recent Eskimos, possibly Nunamiut, began utilizing the mountains they gradually entered the area from the west and, as time went on, moved eastward. The Anaktuvuk Pass area is generally considered to be approximately the eastern boundary of the Nunamiut's consistently utilized range. If this hypothesis is correct, then the earliest Nunamiut sites should be found in the western portion of the area, not in the country to the east of the Anaktuvuk Valley as is presently the case.

The problem in this case may simply be a lack of data. The northwestern and north central portions of the park and preserve, as well as certain surrounding areas have experienced only extremely limited archaeological work. At the same time, the area to the east of the Anaktuvuk Valley, in particular the Trans-Alaska Pipeline corridor, has received relatively intensive archaeological investigation, producing considerable data regarding Nunamiut utilization of that area. Therefore, the known data base concerning Nunamiut and other archaeological

cultures, or occupations of the Central Brooks Range may be geographically skewed. While Nunamiut sites are quite possibly older in the west than in the east, and may be generally older than many scholars believe, fieldwork is required to increase our knowledge about the Nunamiut expansion, as well as answer general questions regarding the evolution of the Eskimo and other cultures. Further work in the park could provide the data needed for insights into these problems.

Euro-American Influence

As proposed here, the Nunamiut may have existed as a legitimate cultural entity for the last 250 years. The last 100 years, though, have been increasingly influenced, both materially and ideologically, by Euro-Americans rather than other native cultures. Since the Nunamiut, as roughly described and defined in these last pages, have existed as a cultural entity for so short a time, and because their period of cultural existence coincides with that of the greatest cultural and technological change ever to occur in the Arctic, it is difficult to define what traditional Nunamiut culture would have been.

During the last part of the 1700s, Russian trade influence had an effect on the native cultures of southeastern Alaska and coastal and western interior Alaska south of the Yukon delta.

Additionally, northwest and north coast Alaskan Eskimos shared at least a limited trading relationship with Siberian Eskimos, who had access to Russian trade goods beginning in the mid-18th century. Due to their geographic location, the Nunamiut were able to trade with western coast, Arctic coast, and interior native groups, probably eventually obtaining European trade goods. By the third or fourth decade of the 19th century, the Nunamiut may have used or seen European beads, cooking pots, knives, and maybe a few muzzle loading rifles (Rausch 1951). At first, the metal pots, needles, axes, and knives would have had a greater effect on the Nunamiut's daily lives than a few firearms.

In 1848 the first commercial whaling vessel passed through the Bering Strait and opened Arctic Alaska to the direct influence of a technologically advanced society (Bockstoce 1986). Continuing through the first two decades of this century, the almost continual presence of commercial whalers in Arctic Alaska had a pronounced effect on the indigenous cultures. Natives who worked for, or traded with the ships were almost certain to have a firearm and a reasonable supply of ammunition, not to mention numerous other trade goods. By 1885 most Arctic coast Eskimo males owned a firearm and since the Nunamiut traded regularly with the Point Barrow Eskimos, they too were probably well equipped with firearms as well as a variety of other commercially manufactured goods. In fact, Burch has suggested that prior to the opening of the Arctic whaling grounds, and the subsequent

introduction of commercially manufactured goods in reliable supply, the Nunamiut went north to trade at Point Barrow with the Barrow Eskimos far less frequently, if at all, than the annual trek which many scholars assume had always occurred (Burch personal communication 1984). At least by the last quarter of the 19th century, the impact on the Nunamiut culture of manufactured goods not available prior to contact, may have decidedly altered the traditional lifestyle of a few decades earlier. The process of change, then, due to Euro-American influence began before the Nunamiut abandoned their mountain homeland because of the decline in the caribou population which is believed to have started a decade or two before the turn of the century.

It has been reasonably well documented that several decades prior to the turn of the century the Nunamiut began a slow withdrawal from their Brooks Range homeland to adjacent areas of Alaska. Gubser (1965) estimated a pre-contact population high of about 1500, although based on the number of dwellings in known or reported pre-contact Nunamiut sites, and the frequency of these sites, this population estimate seems a bit high. Within the same homeland area, though, there were only 200-300 Nunamiuts inhabitants by 1900.

As mentioned, the most commonly cited reason for the Nunamiut exodus from the Brooks Range was the rapid decline and ultimate

crash of the caribou population. With or without firearms and other commercially manufactured goods, the mainstay of Nunamiut survival was the caribou, and they could not exist without the animals' presence in reliable numbers. There were, however, economic temptations for leaving the Brooks Range. Along the coast, the Nunamiut could find employment as hunters for the whaling ships which, rather than try to guess at the seasonal movement of the sea ice, had begun to winter-over so as to get an early start on the open water season. Ships' captains preferred to have Nunamiut Eskimos as hunters because they were more familiar with the ways of the caribou, sheep, and moose than the coastal Eskimos (Bockstoce 1986). Stefansson (1912) reported that as typical payment for a year's work for a whaling captain, an Eskimo might receive two new rifles, two cases of ammunition, 25 pounds of powder as well as lead and shot, three bolts of cloth, assorted tools and camp gear, 300 pounds of flour, sixty pounds of tea, two boxes of tobacco, and a variety of other items. He went on to say that natives who worked for the whaling ships lived a life of ease compared to other aboriginal Arctic inhabitants he had observed. Thus, it can be assumed that before the turn of the century, many Nunamiuts were acquainted with Euro-Americans and the useful technologies and kind of economic system they brought with them, and how all of this could combine to make a harsh life a bit easier and more enjoyable.

As the Arctic whaling industry began to die in the first and

second decades of the 20th century, and, simultaneously life in the Brooks Range became worse in terms of resource procurement, another source of income appeared in the form of the fur trade. Fox pelts, especially, were in demand and from 1920 until the stock market crash of 1929 a good living could be made from fur trapping. By late in the decade, a single fox pelt was bringing as much as $50.00 (Spearman 1980).

During the lean times in their homeland, not all of the Nunamiuts moved north to the Arctic coast. Some went south into the forested river country of the interior where the great majority of them worked in the gold fields of Coldfoot, Wiseman, and Nolan, or around the trade center of Bettles; the men as boatmen, freight haulers, hunters, general laborers and the women as cooks and seamstresses. Trade goods were not as plentiful in the south as they were on the coast and Eskimo workers were occasionally paid in gold and then purchased their supplies at the trading posts.

Although most Nunamiuts moved away from the home area, a number remained in the Brooks Range after 1900 getting by as best they could on the diminishing caribou herds and trading with the coastal Eskimo. Finally, by 1920, subsistence resouces in the mountains had decreased to the extent that the last of the Brooks Range Nunamiuts abandoned the area (Rausch 1951; Gubser 1965; Spearman 1980).

The Euro-American Period

Sites representing certain regionally-important historical themes are also present in the park. These themes include Political and Military Affairs (1865-1939), which includes Alaskan exploration by the Federal Government, the Alaskan Fur Trade, and the Alaskan Gold Rushes. Historical themes and the sites relating to them have been addressed by the Gates of the Arctic National Park and Preserve Cultural Resources Inventory Project and are discussed at length in a two volume Historic Resources Study by project historian William Brown (1989). The following is a brief review of the history of Euro-American expansion in the Gates of the Arctic area.

Miltary Exploration

The earliest recorded information concerning the Native peoples who inhabited the area which is now Gates of the Arctic National Park and Preserve can be found in the journals of: Lt. Henry T. Allen, United States Army, who explored the Koyukuk River in 1885; Assistant Engineer S. B. McLenegan, United States Revenue Marine, who explored the Noatak River in 1885; Lt. John C. Cantwell, United States Revenue Marine who explored the Kobuk River in 1885; Lt. George M. Stoney, United States Navy, who made a winter reconnaissance from the Kobuk River via the Alatna River

to Chandler Lake and returned to the Kobuk in 1885; and Ensign W. L. Howard, United States Navy, who made an overland trip from the Kobuk River, via the Nigu, Etivlik, Colville, Ikpikpuk, and Chipp Rivers to Point Barrow during the spring of 1886.

In 1885, Allen conducted an exploration of the upper Koyukuk River, travelling up the river about as far as the confluence of the John River. Allen's journal contains numerous notes regarding the aboriginal inhabitants of interior northern Alaska at a time when these people were still living a lifestyle basically uninfluenced by the modern technology of the day (Allen 1887).

Following orders from Capt. M. A. Healy, who also instructed Cantwell, McLenegan explored the Noatak River in 1885. He acquired much of the same type of information that Cantwell did during his expedition, from which he concluded that no Eskimos resided on the northern side of the Brooks Range (Gubser 1965).

In 1885, Cantwell made a complete ascent of the Kobuk River from Kotzebue to Walker Lake. Cantwell noted the location of a native fishing village at the mouth of the Selby River and indicated that no villages were located further up the Kobuk than this. Cantwell and Stoney were probably the first and last white men to see this type of a traditional, seasonally oriented native village prior to the intervention of strong non-native cultural

influences (Cantwell 1889).

In 1885, Stoney made an overland winter trip up the Kobuk River from Fort Cosmos to the Alatna River, then north to Chandler Lake, and back to Fort Cosmos. However, Stoney's journal was lost prior to the publication of the account of his explorations, and the published document appears to have been written basically from memory fourteen years after the fact. As a result, the information contained in the report in regard to locations could be somewhat inaccurate (Stoney 1899).

During the winter of 1885-86, W. L. Howard, one of Stoney's junior officers at Fort Cosmos, made an overland trip in the company of Eskimos from the Kobuk River, through the Brooks Range to Point Barrow. His description of the journey is the first written eyewitness account of winter living and travel routes utilized by the Nunamiut Eskimos (Stoney 1899).

The Gold Rush

After the initial surge of interior northern Alaska exploration (which appears to have been sparked more by rivalries between the armed services for feats of daring-do than actual interest), a hiatus of roughly 15 years ensued when no organized exploration or research was conducted in the area of the park. It was not

until the discovery, around the turn of the century, that gold could be found in most areas of Alaska that the "white man" returned to this remote region in relatively great numbers.

During the Kobuk River Goldrush, 1898-99, more than 800 men wintered on the Kobuk River. This was the greatest influx of non-natives in the area that had ever occurred, and very probably was the most significant factor in changing the aboriginal way of life. An excellent account of this event can be found in the diary of Joseph Grinnell (Grinnell 1983). No significant gold deposit was found along the Kobuk, and most men had left the area by 1900.

Although prospecting seems to have begun a bit earlier on what is now the eastern boundary of the park, a larger, more lasting gold rush was occurring on the Middle Fork of the Koyukuk River about the same time. According to George Bettles, a trader who established the trading post and community of Bettles near the confluence of the Koyukuk and John Rivers, gold was first discovered in 1890 at Tramway Bar, Evans Bar, and Hughes Bar on the Middle Fork Koyukuk River (Carlson 1973). Regardless of the order of discovery, Marshall (1933) estimates that between 1887 and 1897 there were approximately eighteen to twenty different prospectors in the Upper Koyukuk drainage.

In 1898, the Koyukuk received roughly 1,000 individuals from the

Klondike Gold Rush. They rapidly established a series of transient communities along the river when they found themselves caught in the winter freeze-up. After break-up, and the opening of transportation routes, probably fewer than 100 of these remained (Marshall 1933). In 1899, Knute Ellington made a strike on Myrtle Creek, a tributary of Slate Creek. Further discoveries of gold on Emma and Gold Creeks resulted in a small rush to the Slate Creek Mining district, located some 70 miles upstream from the store at Bettles. The town of Coldfoot sprang up at the mouth of Slate Creek as a result of this activity, followed several years later by the establishment of the town of Wiseman, which remains an extant community.

Geological Survey Research

The discovery and mining of gold in northern Alaska was the main impetus behind the next period of exploration and research which, as in the last quarter of the 19th century, was sponsored by the federal government. Due to the apparent mineral wealth of Alaska, the United States Geological Survey (USGS) undertook a number of mineral reconnaissance and mapping expeditions which began in 1899 and continued through the first quarter of the 20th century.

F. C. Schrader of the USGS was the first to conduct a scientific

data gathering expedition within what is now the park. In 1899 Schrader conducted fieldwork along the North Fork Chandalar River, Bettles River, Dietrich River, and the Middle Fork Koyukuk River. While Schrader was basically concerned with the mineral potential of the region, he did make numerous notations in his journals concerning the environment in general, and native peoples of the areas through which he traveled (Schrader 1900).

In 1901, W. C. Mendenhall conducted a USGS reconnaissance from the mouth of the Alatna River to Kotzebue via the Alatna Portage and the Kobuk River. The Kobuk River portion of his trip paralleled, in reverse, Cantwell's route of 1885. It is interesting to note the changes which had occurred in the lifestyle of the natives along the river in the seventeen years which had elapsed between the two reconnaissances (Mendenhall 1902). For example, there was absolutely no trace of the native village which Cantwell had noted at the mouth of the Selby River.

At the same time that Mendenhall was engaged in his fieldwork, Schrader, on another expedition, was engaged in a similar reconnaissance, ascending the John River through the Brooks Range and descending the Anaktuvuk and Colville Rivers to the Arctic coast. Schrader encountered some native groups in the area that was to become the park and made notations in his journals regarding these meetings (Schrader 1904). It is interesting to note that he saw few natives along the John/Anaktuvuk Rivers, one

of the main travel routes through the mountains.

In 1911, P. S. Smith, a USGS geologist, conducted a geologic reconnaissance of the Alatna and Noatak Rivers. In the published account of the expedition, Smith states that they encountered none of the native villages on the upper Noatak that McLenegan reports existed in 1885 (Smith 1913). While there may be a number of explanations for this, two of the more logical possibilities will be mentioned. The first concerns the lack of sedentism by natives in the region. People moved several times a year, in a seasonal round, in order to exploit certain animals, such as caribou or anadromous fish, at an optimal time and location. While the time-frame would remain the same from year to year, the exact locations might change. Depending on the amount of resources expected at any location, and the number of people needed to cooperate in the hunt, group population size also tended to vary during the year. This lifestyle could easily account for differences recognized by Mendenhall, Schrader and Smith in their expeditions. The second reason concerns the more long-term movement of natives out of the area by the late 1800s to seek work from Euro-Americans along the coastlines and in the gold fields, especially as the caribou hunts began to fail. This will be discussed in greater depth later.

Written Accounts of Euro-American Settlement

Prior to this cultural resources inventory project, little historical data concerning Euro-American use of the present park and preserve area had been collected. Most of the work that had been done dealt with the Coldfoot-Wiseman-Nolan area which lies outside the park on its eastern boundary. Robert Marshall's books, "Arctic Village" (1933) and "Arctic Wilderness" (1956) trace the history of the "white man's" arrival in the area as well as describing the natural beauty of the region. More recently, Susan Will, Bureau of Land Management archaeologist, collected data which led to the writing of two in-depth reports concerning the history of the towns of Wiseman and Coldfoot as well as the physical condition of many of the extant buildings (Brown 1989). In fact, they are now part of a two-volume history of the entire park which was compiled by William Brown, the cultural resources project historian (Brown 1989). Brown's work is undoubtedly the most comprehensive history of Euro-American use of the area and will be the definitive work regarding interior northern Alaska for years to come.

PREVIOUS ARCHEOLOGICAL RESEARCH

The first known archaeological work near Gates of the Arctic National Park and Preserve area occurred in the late 1930s and early 1940s when J. L. Giddings conducted archaeological and ethnohistorical work along the upper Kobuk River. This was the first work done in the area and was responsible for the discovery of the Onion Portage site, probably the most important western Arctic archaeological site yet found (Giddings 1952). The significance of the site was later demonstrated by the work of Douglas Anderson in the mid-1960s when excavation revealed sequential occupation by different cultural groups at a single location over a period of approximately 10,000 years (Anderson 1968, 1988). Giddings also conducted preliminary archaeological work at Norutak Lake, which lies roughly 16 miles south of Walker Lake in the eastern portion of the southern preserve. He reportedly recovered Denbigh Flint Complex material and located a Norton-Choris dwelling site (Campbell 1964).

During the mid-1940s through the early 1950s, the federal government again became active in sponsoring research, this time in the extreme northern portion of the park. During this period, the USGS had a large number of field crews surveying the area in an effort to determine its potential as a National Petroleum Reserve. Associated with the geologists was archaeologist Ralph Solecki, who conducted the first archaeological reconnaissance of

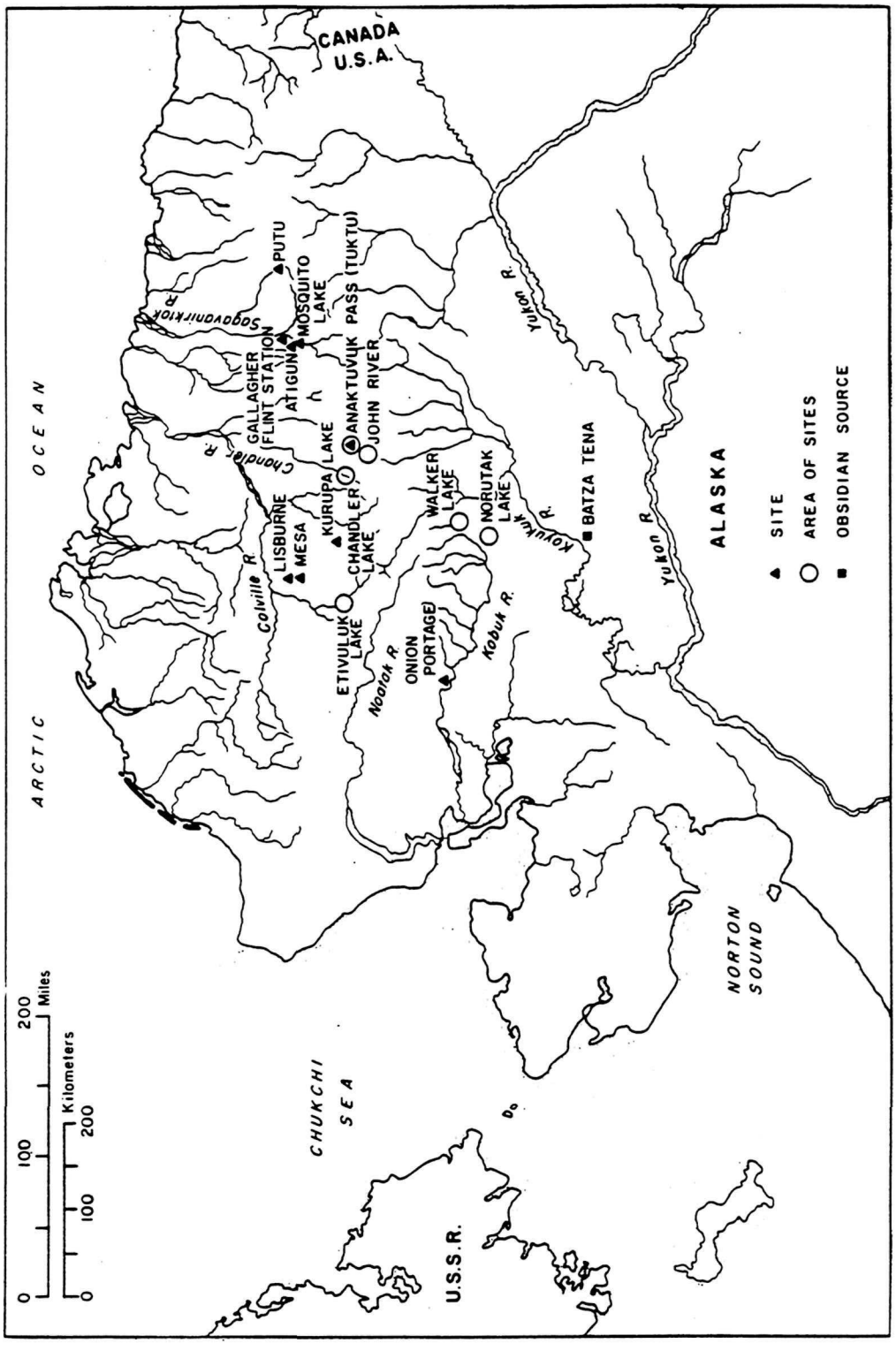

Figure 8. Archaeological sites mentioned in text. Adapted from Hall and Gal 1982; Anderson 1980; and Wilson 1978.

that area (Solecki 1950).

Enlarging upon Solecki's work, William Irving, working out of the Naval Arctic Research Laboratory at Point Barrow, engaged in archaeological survey and site excavation from the early 1950s through the early 1960s in, and adjacent to, the northern portion of the park. His work at Etivluk Lake, slightly more than six miles north of the northwestern corner of the park, culminated in the definition of the Arctic Small Tool tradition, which delineated the beginnings of Eskimo culture in Arctic Alaska, Canada, and perhaps Greenland as well (Irving 1951, 1953, 1964).

In the early 1950s Helge Larsen conducted archaeological investigations in the Anaktuvuk Pass area. Larsen's work marked the beginning of almost two decades when most archaeological and anthropological work conducted in interior northern Alaska was centered around Anaktuvuk Pass. During the late 1950s through the mid-1960s John Campbell concentrated his archaeological fieldwork in the Anaktuvuk Pass/John River/Chandler Lake area. Through his work Campbell created a data base which still serves as a generalized "yardstick" for regional prehistoric study. Campbell's work indicated that human occupation in the north-central Brooks Range extended back at least 8000 years, and that both Eskimos and Athabaskans had inhabited the area (Campbell 1962).

During the early to mid-1960s, H. L. Alexander conducted archaeological investigations in the Anaktuvuk Pass and Chandler Lake area, expanding on the earlier work of Irving and Campbell (Alexander 1967, 1968, 1969). Additionally, Alexander worked in the Atigun River Valley located just outside the eastern boundary of the northern preserve. It was in this area that he discovered the Atigun Site (Kavik) and the Putu Site (American Paleo-Arctic), both of which have contributed valuable data to the effort to establish a regional cultural chronology. During the late 1960s through the early 1970s, Lewis Binford conducted ethnoarchaeological fieldwork in the Anaktuvuk Pass area. This work explored the lifestyle of the recent Eskimo inhabitants of the area, offering a perspective on contact period aboriginal life which might be applied to the older archaeological cultures of the area (Binford 1976, 1978a, 1978b, 1980).

During the decade of the 1970s the focus of archaeological investigation in interior northern Alaska shifted away from the Anaktuvuk Pass area. Over the first three-quarters of the decade the University of Alaska conducted archaeological survey and excavation along the route of the trans-Alaska oil pipeline in the largest archaeological mitigation project ever conducted in the Arctic. The surveys and mitigation work in most of the area just outside the park's eastern boundary was under the field direction of Michael Kunz and Dale Slaughter. Over 100 prehistoric and historic sites were located along the eastern

park boundary through this work (Cook 1970, 1971, 1977). A number of the sites investigated during the pipeline project were quite large and their excavation contributed important data necessary to the basic unraveling of area prehistory. The Mosquito Lake Site near Galbraith Lake is primarily a Denbigh Flint Complex (Eskimo) manifestation which shows recurrent use between 3800 and 1500 years ago (Kunz 1977). Two of the oldest dated sites in Alaska, the Gallagher Flint Station (Dixon 1971) and the Putu Site (Alexander 1973) lie only a few miles north and east of the park boundary. This work along the Pipeline Corridor indicated that the great majority of the archaeological sites, 4000 years old or younger, which lie north of the 67° latitude are Eskimo, while those which lie south of 67° latitude are primarily Athabaskan. Archaeologists from the University of Alaska again worked in the Pipeline Corridor during 1980 and 1981, conducting an archaeological survey for the Northwest Alaskan Pipeline Company along the proposed route of the Alaska Natural Gas Transportation System. This work added additional information to an already extensive cultural resources data base for the Pipeline Corridor (Aigner and Gannon 1980, 1981).

During the late 1960s and early 1970s, archaeological work was also conducted in and adjacent to the southwestern portion of the park and preserve. In 1968 D. W. Clark spent ten days locating and testing sites at Norutak Lake as a follow-up to Giddings' earlier work. From his report, it appears that Clark only

surveyed and tested the northern end of the lake where he found seven sites, two of which were large enough or showed enough potential to warrant more than preliminary testing. Clark stated that one of the sites appeared to have Choris and Itkillik complex associations, while the other demonstrated Choris, Norton, and Denbigh characteristics.

In 1967, 1973, and 1974, E. S. Hall conducted archaeological survey and testing work at Walker Lake. During the course of Hall's survey, 35 sites along the shores of the lake were located and tested (Hall 1974). Although no sites were found around the northern third of the lake, the survey did not range very far inland. All of the Walker Lake sites lie on bedrock knolls or elevated, dry, glacial features at least ten feet above the present lake level. Flat, dry areas close to the lake edge which were tested proved negative. According to Hall, artifactual evidence indicates that most of the sites in the area he explored were lookout-secondary manufacturing localities, although a few may have served as short-term habitation sites. The lack of diagnostic artifacts from the sites makes the assignment of cultural affinities difficult. Hall (1974) thinks there are some similarities with the middle layers at the Onion Portage Site (Anderson 1968), as well as the Tuktu Site at Anaktuvuk Pass (Campbell 1961). Using these comparisons, he postulates dates at some of the Walker Lake sites as early as 6000 years B.P., while assuming the majority are probably more recent.

During the late 1970s the National Park Service and the Bureau of Land Management conducted archaeological reconnaissances in the National Petroleum Reserve-Alaska, which borders the park's northwestern boundary. A large number of sites were located and some mitigation excavation undertaken. This work resulted in numerous papers, reports, and publications of both a general and site specific nature. The Lisburne (Bowers 1982) and Mesa (Kunz 1982) sites which lie but a few miles outside the park, have proven to be unique sites that have strongly affected early Holocene cultural chronology in the area. Additionally, an extensive site at Kurupa Lake, which now lies within the park, was excavated by Ken Schoenberg (1985) and has provided further data which bears strongly on the prehistory of the northwestern portion of the park, an area which has received little archaeological investigation.

REGIONAL AND AREAL QUESTIONS

By its nature, a general, Phase I primary or reconnaissance level archaeological survey is limited in the degree to which its results can be applied to specific regional and areal problems. However, some general questions can be and were addressed as follows:

1. Within the various study areas, are there apparent preferences by prehistoric peoples for site location based on geomorphology?

The data suggests that the answer to this question is an unqualified yes (Vol. II, Site Physical Aspects Tables). Indeed, most archaeologists who have worked in Northern Interior and Northern Alaska acknowledge that such is the case after a single season of fieldwork.

Because the upper limit of permafrost is so near the ground surface in most of this region of Alaska, much of the landscape is poorly drained. This results in the formation of numerous shallow ponds, swamp-bog-muskeg areas, and wet sedge/cotton grass meadows. These poorly drained areas cover much of the land's surface where slope gradiants are only gradual or level and/or where bedrock is not at or near surface. This means that areas of dry or stable ground are at a premium and are, for the most

part, limited to steep and often rocky mountain or hillsides, old beach ridges, lake and river terraces, or stagnant ice (depositional) glacial features. Areas of stable ground and glacial features such as kames, eskers, and moraines are well drained and therefore relatively dry due to a physical composition of gravel, sand, cobbles, and boulders, mantled by a thin layer (10-25 cm.) of well-developed soil. Further, following the conditions necessary for their formation, these features usually litter valley floors, becoming less common near the valley walls as the slope gradiant increases.

Morphologically, kames usually resemble gently rounded, somewhat linear hillocks rising from five to twenty meters above the surrounding landscape. Kame terraces usually occur closer to the valley walls than do kames, their linear orientation usually paralleling the sides of the valley. Terraces of this type are rather undulating in surface character and, because they often occur at the higher valley edge altitudes, may lie up to fifty meters above the valley floor. Eskers are usually serpentine in physical character, less common than kames and kame terraces and, when present, often remain in close proximity to the active flood plain of the valley floor. In some cases, an esker may be a determining factor in the orientation of the valley floor stream channel. Eskers in this area rarely attain elevations in excess of ten meters above the valley floor. Again in this area, distinctive lateral moraines are uncommon due to the nature of

the montane glaciations and the geomorphology of the region. Terminal moraine complexes,though, usually occur at or near valley mouths and, in most cases, traverse the width of the valley. Characteristically they appear as a chaotic jumble of kettle lakes and hills and ridges, which may attain elevations up to 100 meters above the valley floor. In addition, since these complexes often have a damming effect on valley streams, they are commonly associated with extant lakes or older semi-drained lake basins which are presently pond-dotted, wet lowlands.

The preceding description of the regional valley floor topography is a generalization. Specific areas may vary significantly, depending upon the age of past glacial activity, local bedrock structures, and valley width. Our investigations in Gates of the Arctic National Park and Preserve revealed that the vast majority of the prehistoric sites were located on stagnant ice glacial features, glacially altered bedrock features, old beach ridges, or lake or river terraces. Regardless of local variations, glacial features, especially those of depositional origin, were apparently the most likely areas for prehistoric human activity to take place, as usually they, more than most other land forms, exhibit the desirable characteristics for good camping and/or operational base locales. These characteristics include a firm, dry foundation, preferably on the valley floor, that is sufficiently elevated above the surrounding local landscape to offer a good view and freedom from mosquitos. In the spring

these areas usually become snow-free and dry before the surrounding lower terrain.

Terminal moraine and, to a lesser degree, lateral moraine complexes also offer excellent camping locales. However, these features occur less frequently and are often not as strategically placed as the smaller and more numerous valley floor stagnant ice glacial features. Old river and lake terraces, and beach ridges have archaeological sites associated with them because they are also well drained and therefore relatively dry and have valley floor placement. However, ridges and terraces are far less numerous than glacial features. Finally, mountains and hillsides usually do not offer good camping areas although such locations are used to some extent as hunting lookouts and for hunting.

The fact that the preferred site locations occur on or near the valley floor where the majority of the subsistence resources are located, lends yet another aspect to their attractiveness. Many valley floor glacial features have well-established and often-used game trails traversing them. Regular game movement allows a solitary hunter to employ ambush techniques and have relatively reliable food sources near at hand. Additionally, dependable emergency rations exist in the form of ground squirrels which are almost always present on well-drained ground.

In summary, then, in terms of site location, in most cases,

irrespective of size, the evidence strongly suggests that the vast majority of prehistoric sites in this region of Arctic Alaska will occur on any river valley or lake shore where well-drained elevated locales such as glacial features or features of similar composition are present. The strength of association between well-drained elevated locales and human exploitation is strong enough to be reliably predictable. (The relationship of sites to features is 0.8:1.0). The exception to this near-axiom is the location of special use sites such as fish camps, winter camps, or quarry sites.

Artifacts found on glacial feature sites generally indicate hunting as the main activity. It is inferred, therefore, that the majority of archaeological sites found on glacial features were occupied during the spring, summer and fall, since these locations are, in most cases, too exposed for prolonged winter occupation.

2. Is seasonal occupation reflected in site location?

At the level of data collection of a reconnaissance survey, this is a difficult question to address except in very general terms. As previously mentioned, most "glacial feature sites" were probably occupied during the spring, summer, or fall. However, without associated faunal material the specific season of occupation is difficult to determine. One indication of

seasonality are "inuksuit" which are cairn or scarecrow-like structures arranged in order to channel caribou into an ambush. Sites which include, or are associated with, inuksuk are assumed to be caribou hunting locales. Mass caribou movements through this region of Alaska occur in the spring and fall and, therefore, these structures would suggest site occupation during either or both of those seasons. In three summers of fieldwork, the crews located a number of inuksuk sites. Interestingly, all were above the tree line, suggesting that inuksuk hunting was not widely practiced in the northern fringes of the boreal forest or possibly that destruction of the inuksuit occurred during periodic forest fires.

Another possible seasonal indicator is the type of habitation postulated for a site. Semi-subterranean house remains and cache pits are normally located on the shores or islands of large lakes and may reflect winter occupation. Several sites of this type were found throughout the region in the course of the fieldwork. Also present in the northern study areas were several "ivrulik" or moss house sites which are the common over-wintering dwellings of the Nunamiut Eskimo. More indicative of occupation during non-snow months were the numerous tent ring sites occurring in the northern and northwestern study areas.

3. Are varying levels of population density through time perceptible in the archaeological record at the Phase I

primary or reconnaissance level of investigation?

Unless fortuitous circumstances favor the investigator, any attempt to determine population density in a region through an initial cultural resources survey must be restricted to the most general level. While examining site size is important, the first necessity is the ability to place a site in time. Finding certain elements at a site can assist the investigator in assigning it to a time period. Often, however, the items which would make dating possible do not occur on the surface. Occasional testing of the sites allowed collection of a few charcoal samples, but most of the thoughts concerning population density at this stage rely on lithic evidence. In addition, consideration is given to the relationship between population density and periodic wildfire.

Some artifacts are diagnostic of a temporal span. In a reconnaissance level survey, if such artifacts do not appear on the surface of an archaeological site or are not fortuitously excavated in a test pit, little temporal information can be obtained. Additionally, if all sites that are located do not exhibit temporally diagnostic artifacts, population densities through time can be little more than guessed at. However, the data collected during the three seasons of fieldwork does allow some general comments concerning aboriginal population density.

In addition, an obsidian hydration chronology that is being developed for the study region, does hint at prehistoric population levels over the last 10,000 years. The specifics of this will be discussed in the obsidian hydration chronology portion of this report and need not be dealt with here. Some radioactive carbon dates have also yielded useful chronological data.

The data collected for the region under study suggests human presence for at least 10,000 years. Human exploitation in the southern part of the park, however, would have followed a different pattern until after 5500 B.P. Between 10,000-5500 B.P., the tundra environment was receding but establishment of the boreal forest was not complete. Although the environment and its changes over time would have influenced population levels and lifestyles, the degree and manner of direction is difficult to discern from lithic artifacts.

As mentioned, much of the data regarding human population levels in this study relies on observed culturally diagnostic lithics. Based on stone artifacts at 171 sites, the following, very general, statements can be made. There is little evidence for high levels of use or population density prior to about 4000 years ago. This, however, is not uncommon when compared to other areas of Arctic Alaska. Still, sites which are greater than 4000 years old are more difficult to recognize because the diagnostic

or "hallmark" artifacts are fewer in number and less commonly found than in more recent sites. Use of the area both north and south of the Brooks Range appears to begin to increase about 4000 years B.P. and continues to increase until roughly 1000 years B.P. After 1000 years B.P., population or use levels seem to stabilize or perhaps decline slightly. In the northern study areas, evidence suggests that the most intensive human use occurred during the last 200 years. Again, it must be pointed out that these conclusions, or inferences, are founded on a limited data base.

In addition, during the course of the fieldwork, one of the natural forces of the regional environment became quite obvious. Observations, both surface and subsurface, indicate that cyclical burning by wildfire in the forested portion of the park occurs approximately every 150-250 years. Surface encounters of "burned" areas ranged in age from 10 to over 100 years old. These age determinations depended on visual inspection and the coring of living trees. In places where there was no surficial evidence of wildfire, test excavations usually revealed bands of charcoal in the soil profile. This occurrence of subsurface charcoal suggests that the areas had been burned in excess of 150 years ago. In these cases, vegetation conditions were usually approaching that of a climax forest, represented by large spruce, birch, and poplar with trunk diameters exceeding 60cm. and heights up to 30 meters. Dense brush such as alder, willow, and

shrub birch often accompanied the large trees on hillsides and in poorly drained areas. Vegetation of this type was not only difficult to travel through, and in some localities almost impenetrable, but visibility ranged from limited to non-existent. Certainly, areas, when vegetated to this degree, are not easily exploitable. Game procurement, as well as game abundance, are adversely affected by these conditions. Such observations suggest that there may be a definite link between human exploitation (increased areal population density) of an area and the occurrence of wildfire. Recently burned areas (10-40 years) permit easier mobility and better visibility, which allows more efficient hunting, while the plant species diversification and population percentage changes that follow a wildfire usually produce an increase in area subsistence fauna.

It is hypothesized, therefore, that human population density in the forested region, after about 5500 years B.P., is directly linked to wildfire episodes. Additional in-depth work will have to be done before it can be determined if this hypothesis is testable.

4. Much of the park area, particularly the southern half, encompasses territory used by both Athabaskan and Eskimo groups. An attempt was made to see if it was possible at the Phase I reconnaissance level of investigation to determine if the primary users of the surveyed sections of

the park were Athabaskan or Eskimo.

The 1983 fieldwork was inconclusive in regard to this research question. Most of the artifacts observed at the various sites were not diagnostic and, therefore, cultural assignment was difficult. However, in an overall sense, a cultural "flavor" was detected in various areas.

Because only one site found in the Kichaiakaka Creek drainage contained lithic debris which seemed, morphologically, to be Eskimo, at a general level, this portion of the study area appears to show more utilization by Athabaskans than Eskimos. In the Walker Lake area, the same flavor prevailed. The same was true for the Kobuk River as far downriver as the Lower Canyon. The suite of archaeological sites at Nutuvukti Lake was so small that not even a general level determination could be made. The Reed River, not surprisingly, revealed a number of sites along its course, between the Walker Lake pass and the Walker Lake Glaciation terminal moraine, which appeared in a general way to be Eskimo. However, even in the valley of the Reed River, one cultural group could not be determined to be dominant over the other. Of all the areas surveyed in this region, the Lake Selby locale is the only one which definitely, from a typological standpoint, demonstrated exploitation by Eskimos. Even so, there is no indication Eskimos utilized the Lake Selby area more heavily than the Athabaskans.

From this unclear data, a inductively reasoned picture can be developed. It is simply this: The sites located furthest to the west, those west of the Reed River, show more evidence of use by Eskimos, while to the east, the sites appear to indicate predominant use by Athabaskans. Without additional detailed investigation in the area, this picture will remain vague. The possibility does exist, however, that this survey showcases the cultural mixing that would be expected along the boundary of two culture areas.

Both the 1984 and 1985 field seasons were more conclusive in regard to this research question. Many of the artifacts observed at the various sites were non-diagnostic, adding to the difficulty in assigning them to a particular culture. Most of the diagnostic artifacts, however, appeared to reflect Eskimo use of the region. The 1984 survey in the eastern half of the park indicates that Eskimos were certainly the main users of the Itkillik drainage, at least for the past 4000 years. The North Fork Koyukuk, at least as far south as the Glacier River, also has an Eskimo flavor about it. As seen from the 1985 study, Eskimos, for the last 4000 years, appear to have been the main user group in the northern one-half of the John River drainage, the Chandler Lake/Agiak Lake basin area, and the Kipmik Lake area. The Helpmejack Hills and Lakes area, which are south of the park, appear to exhibit more Athabaskan than Eskimo usage.

5. Are the mechanics affecting settlement patterning and population aggregation and distribution recognizable in archaeological reconnaissance Phase I data?

The answer to this question is a qualified yes because the circumstances are somewhat unique. In terms of limitations placed on human inhabitants, northern Alaska is probably as close to an area of environmental determinism as anywhere in the world. In the Interior and in northern Alaska, a mobile hunter-forager society (with a decided emphasis on hunting rather than foraging) was the only viable option opent to aboriginal inhabitants. Based on ethnographic analogy, estimates by a number of researchers concerning the amount of plant food in the annual diet of Eskimo people range from 1% - 5% (Hall 1961, Gubser 1965).

Located in a remote area, the park has remained essentially unaltered since the end of the Pleistocene. The only significant change has been the establishment of the boreal forest in the southern portion of the Brooks Range between 10,000-5500 B.P. Modern technology has not invaded the park and preserve for the most part, permitting the rivers to flow and the animals to move about as they always have, unimpeded. Given such stable conditions, it is relatively easy to see why an archaeological site occurs where it does even at a cursory investigation level. The following examples, the first below and the second above the

tree line, point this out.

In the area surrounding the confluence of Ernie Creek and the North Fork Koyukuk, roughly eight square miles were intensively surveyed but the recorded sites were concentrated within a one square mile area. The reason for this high site density may be the presence of excellent site locales and concentrated subsistence resources within a relatively small area. Along the North Fork Koyukuk River, and throughout the North Fork Valley, at least as far south as the mouth of the Glacier River, high site densities and temporarily high population levels in discrete areas appear to occur in response to the local topography, such as well-drained land forms and availability of subsistence resources. It should be noted that the conditions necessary for good site placement seem to be as much appreciated by animals as by humans, as these areas frequently seem to experience higher game populations.

Lacking an obvious explaination, one area in the North Fork Valley, Long Lake, did not fit this scenario. While Long Lake appears to possess all the location and subsistence requirements, survey crews located only two sites there.

Archaeological sites in the northern treeless portion of the Brooks Range, in this case along the Itkillik River, appear less clustered or concentrated at special locations than in the

forested areas to the south. In fact, sites in the Itkillik River drainage seem to be reasonably well dispersed along the valley. Evidence suggests that there are two reasons for this, both related to the fact that this area is above the tree line. First, since there are no forests to obscure long range views such as those along the North Fork, almost any little bump or rise can serve as a reasonable hunting lookout/camp. Second, while strategic hunting locations are important in this area, they are less so than in the forested regions. Caribou numbers are much greater along the Itkillik than they are along the North Fork, and because the Itkillik country is open, they and other game animals move more freely and tend to wander. An exception to this occurs in the Agiak Lake area where site density is extremely high within a small area. The reason for this deviation from the pattern is unknown.

6. Are fluctuations in regional subsistence potential suggested by site density and/or the occurrence of multi-component sites?

Data regarding this question is difficult to obtain from a reconnaissance level survey. However, some general observations can be enumerated as a result of the project fieldwork.

The density of prehistoric sites in most environments will usually be linked to the subsistence potential of the area.

Therefore, a basic correlation might be stated thusly: If the subsistence resource potential of an area is high (all other factors being equal), the area should exhibit high site density or a number of large, often-used sites. If subsistence resources fluctuate through time, then this fact should be reflected in the archaeological record, through time, by fluctuations in site size, use, or density.

Judgements regarding regional subsistence potential on sites dating prior to 4000 B.P. must be speculative due to the limited amount of data recovered concerning that period of time. This circumstance, coupled with the previously mentioned forestation process in the southern part of the park, which occurred between 10,000-5500 B.P., creates problems in establishing a clear picture of the ebb and flow of subsistence resources. While sites known or assumed to be older than 4000 years B.P. are numerically in the minority in all study areas, this alone cannot be accepted as an indication of low subsistence potential. However, in contrast, site density maximums may indicate that the population had reached the carrying capacity limits of the region.

Data collected during the course of the project indicate peak site density occurred at different times in different areas of the park. For example, in that portion of the park which lies north of the Continental Divide, site density appears to be

highest during the last 300-400 years. Although much work remains to be done, preliminary data suggest that site density south of the Continental Divide was at its maximum between 1000-2000 years ago.

Extremely large sites seem to be small in number, as do multi-component sites, which can be difficult to recognize at the survey level of data collection. Large sites are typically over-wintering locales and are often located on the shores of large lakes where fish were a reliable subsistence resource and, therefore, do not appear to be good indicators of area-wide subsistence potential. Multi-component sites, on the other hand, if clustered in an area, would seem to indicate the reliability of subsistence resources through time. Such a situation was found to occur in the Red Star Creek area above the forest fringe, on the North Fork Koyukuk River.

SUMMARY[6]

Preface

During the three seasons of the Gates of the Arctic National Park and Preserve cultural resource inventory project, 564 archaeological sites were recorded. A number of these sites were found outside park and preserve boundaries. Also, in 1983 and 1984, a total of ten cultural locations possibly less than 50 years old were noted, but not given state site numbers. In addition, data from another 52 sites are consistantly included in this volume of the report. These last sites were located under my field direction at Itkillik Lake in 1976 as part of a project sponsored by Alyeska Pipeline Service Company. Although the findings have been published, Itkillik Lake is now within the northern preserve and since all the field notes were available, using the data for this report seemed proper. Thus, a total of 626 sites are used in the tables and calculations for the report. There are a number of archaeological sites in the park that have been recorded and documented, to varying degrees, by other

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[6]Some of the text in this section was revised to reflect the actual research done and number of sites recorded. With the large volume of data spanning several years, there seemed to be some confusion about what was available and how to present it. The information in the summary tables, with some corrections, remains the same, but the organization was changed for better reader understanding. The explanations concerning the tables were also expanded and revised. Editor.

researchers. In order to provide a more complete picture of the known cultural resources in the park and preserve, some of this research is presented below.

William N. Irving, searching the Anaktuvuk Pass area in the early 1950s, found archaeological sites both within and outside the present park boundaries (1953). John M. Campbell in his work along the John and Anaktuvuk Rivers, and in the vicinity of Chandler Lake between 1956 and 1961 recorded in excess of 35 archaeological sites (1962). Later, in the mid-1960s Herbert L. Alexander examined and recorded approximately 20 archaeological sites in the vicinity of Chandler Lake and Agiak Lake (1969). Between the late 1960s and the early 1970s Lewis R. Binford and his graduate students located, examined and recorded roughly 100 archaeological sites in the Anaktuvuk area. Data from the majority of these sites were not specifically mentioned by Dr. Binford in his publications and he graciously made it available to this project. Grant Spearman presented these findings in succinct form in the 1985 Gates of the Arctic (GAAR) Cultural Resources Inventory Report (Kunz 1986) and they will be available in volume II of this report. Also important to this writing, in 1974 Edwin S. Hall Jr. reported on 34 archaeological sites he encountered along the southern shores of Walker Lake (Hall 1974). These sites were reviewed in the 1983 GAAR Cultural Resources Inventory Report (Kunz 1984) and their data are included in this report in the Walker Lake Survey Area Summary Table in the

computation for area site density. In 1979 Kenneth M. Schoenberg located 52 archaeological sites at Kurupa Lake (Schoenberg 1985).

Of course, other archaeological sites have been recorded by researchers both before and after the area became a park and preserve. In fact, even while members of this project were in the field in 1985, another crew was conducting an archaeological survey and finding sites in the park as part of a compliance action. In addition to recorded sites, there are archaeological sites which have been reported to park staff which have not been examined. Conservatively, there are more than 260 known archeological sites in the park and preserve which are not included in this cultural resource survey. In formulating the tables and charts found in this volume and in Volume II, and in compiling summary statistics of the park and preserve, only the sites found in the three years of field work for this project and in the field work completed on Itkillik Lake in 1976 were used. The one exception to this, as mentioned, was the inclusion of 34 sites located by Hall (1974) for site density calculations around the Walker Lake area.

Survey Results Tables

There are two types of tables presented in this report; the Survey Results Tables (Tables 3-17) that present a summary of survey results for each survey area, and the Consolidated Summary Table (Table 18), that summarizes the survey results for all of the survey areas. A third type of table, containing more detailed location information and the physiographic and cultural aspects of each specific site will be presented and discussed in a forthcoming volume (Volume II).

The Survey Results Tables summarize data from the sites according to 15 arbitrarily circumscribed survey areas, usually defined by a geographic feature such as a lake or water course. Each areal table is composed of four sub-tables: two defining the placement of sites in each area in a regional sequence, one explaining their physiographic settings, and the fourth categorizing the type of sites encountered. Six of the tables contain data from the 1983 field season, four from 1984, four from 1985 and one from the 1976 Alyeska Pipeline project. The data from Hall's 1974 survey is used in the Walker Lake table site density calcultions for 1983. The last type of table, the Consolidated Summary Table, compiles the information assigned to the fifteen survey areas into the same types of sub-tables described above. Under certain conditions, starting with this table would be advisable since it will allow the reader to quickly obtain data

in a compact form. The following is an explanation of the various data categories found in the tables in this volume. Hopefully, by judging the objectivity and/or subjectivity of the data sets presented, the reader will be able understand and utilize the information without misinterpretation and/or misapplication of the data.

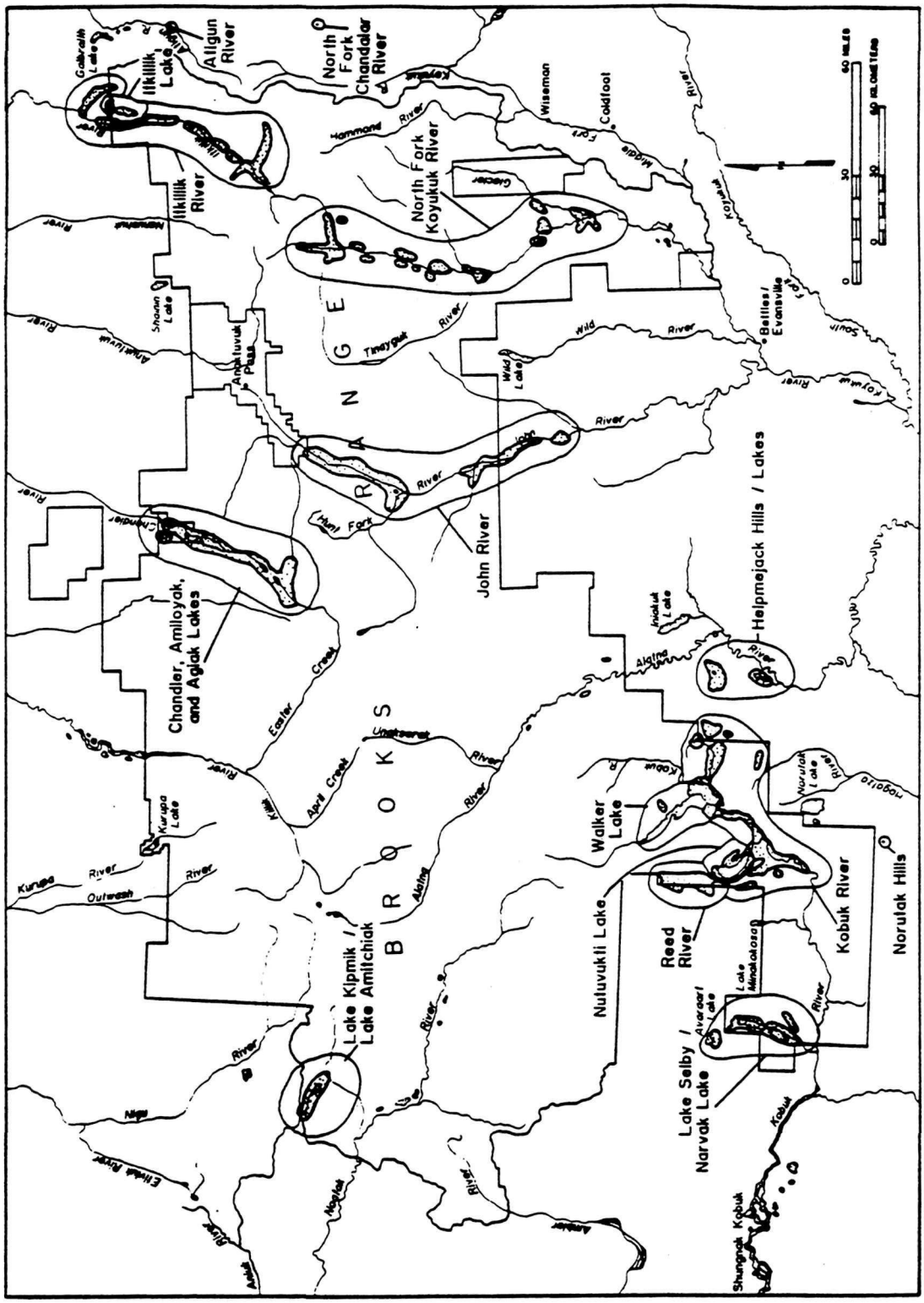

Figure 10. Survey Areas. Each circle encompasses an arbitrarily defined survey area from the Survey Results Tables.

The Survey Results Tables

There are 15 Survey Results Tables (Tables 3-17) that summarize the project survey results according to survey area (each table occupies two facing pages). Twelve of the tables relate to specific survey areas examined during the three field seasons of this project and during the 1976 work in the Itkillik Lake area. These areas are arbitrarily defined, covering from three to thirty-eight square miles, and from six to over one hundred sites (Table 2 identifies the survey areas by year of investigation). Although the survey areas are named for the major waterway or lake covered in the area, sites may be associated with other waterways or lakes in the area. The survey areas may include terrain both within and outside the park and preserve boundaries. An additional three tables describe one site each; these sites were located by happenstance rather than planned areal survey.

Each of the 15 Survey Results tables is composed of four sub-tables characterizing the sites located within a given survey area by their traditional and cultural affiliations if possible, their physiographic and gross vegetational placement, and their site type, such as camp or kill site. All four sub-tables contain a column which should result in a 100% total. Some of the totals, however, are one or two tenths away from that score due to number rounding. Most of the table headings used are self-explanatory, but a short discussion of each follows.

General location is defined according to approximate north latitude and west longitude. The category "% of recorded sites in the survey", compares the number of sites in the area to the project total of 626 sites. Area of site density again compares the number of sites found in the area, this time to the next catagory, "total area surveyed".

The area surveyed is listed in square miles and refers to the total area examined in the survey area. Much of the terrain in the river valleys is quite rugged or boggy and not suited for the type of use which generates archaeological sites. Experience and judgement were important factors in the consideration of surveyed area. If more than 60% of the area within a section (square mile) of land which could support an archaeological site, or at least had reasonable archaeological potential, was surveyed, the entire section was considered sufficiently investigated. Given conditions including the topography of the region, the expertise of the crews, and the techniques and methodology employed, the author is confident that the majority of locatable surface sites were found.

All of the survey areas were either along drainage systems or in lake basins, with the exception of a single site in the Norutak Hills. The linear distance surveyed is the length or portion of the valley or drainage system that was examined. Shoreline distance is self-explanatory. Except for Walker, Chandler and

Amitchiak Lakes the entire shoreline of all other lakes was surveyed.

Over the course of the project, 196.5 square miles of park and preserve were surveyed. By comparing the total area surveyed in each section with the final total, the figure, "% of total area surveyed", is found. In terms of area, this represents 1.5% of the land within the park and preserve. Adding the "% of total park areas" covered from the twelve tables, where this figure is applicable, results in approximately that number. The last heading figure concerns the number of sites in the area in which obsidian occurs and the percentage that represents.

Sub-Tables

The two sub-tables on the first page of each set of tables delineate the regional sequence of cultural traditions (as used by the project), alongside a generalized sequence of cultures. Hopefully, the manner in which the sub-tables were arranged will allow useful comparisons to be formulated. As is obvious after glancing at the tables the number of sites that have a traditional or cultural affiliation is far smaller than those that have none. An affiliation was not assigned to a site unless the diagnostic or other feature evidence was indisputable. Obsidian hydration and radiocarbon dating were not always an

accepted means of assigning a site to a tradition or culture. Many sites exuded a "cultural flavor" strong enough to tempt the investigator to make a traditional or cultural placement. Although temporal assignment based on "cultural flavor" criteria would probably be valid in the majority of cases, such criteria are very subjective, even when based upon years of research experience in the region. Therefore, only the sites displaying unarguable evidence as to their traditional or cultural association were so listed. The columns in the charts list the number of sites in the area, the percentage of each traditional or cultural temporal division to the total number of sites in the area and the percentage of each temporal division to the total of that type of site found within the complete survey.

The Site Physiography category lists the physiographic features upon which the site is located. As is often the case, some of the categories can overlap such as knoll and hill, or bench and terrace. The use and application of these terms often varies with individual site recorders. However, project personnel remained fairly constant throughout the three years of field work, and as a result the physiographic feature nomenclature has remained relatively consistent. Much of the descriptive terminology is specific to a landscape of recently glaciated mountains. Besides the same three columns associated with the first two sub-tables, this sub-table also contains two columns broadly dividing the park and preserve into tundra or forest.

Site Type is a category containing overlapping definitions and criteria which were often arrived at somewhat subjectively, although liberal use was made of Binford's ideas from "Willow Smoke and Dogs Tails" (1980). Definitions for site types follow. The terms can apply to more recent or mining sites as well as prehistoric sites.

A long term camp is a site at which the occupants remained for an extended period of time, in this region, six weeks or more. The extent of the stay is determined either by the size of the site, the amount of cultural detritus present, cultural features, or some combination of these factors. For example, a site with ivruluk (sod house) or semi-subterranean house remains is considered to be a long term camp, as is a large site containing hearths and a lot of lithic debitage. Tent rings, on the other hand, would be considered short term camps.

A short term camp is any site that was obviously a camp, usually determined by the presence of a hearth or other feature, which was occupied for less than 6 weeks. The estimate concerning the duration of the occupation is primarily based on the amount of cultural detritus present.

A camp/lookout is a site that appeared to be briefly occupied in a location which allows a good view of the surrounding terrain. Most regular camp sites are located in sheltered areas which do not provide the type of view normally desired by a hunter.

A lookout/flaking station is a site the primary function of which seems to have been to provide hunters with an excellent view of the surrounding area. Additionally, the site displays lithic debitage suggesting that the occupants were manufacturing or repairing stone tools while they surveyed the area, waiting for game. A site of this type may have been occupied many times, although each occupational episode was brief. These sites display no evidence of camping.

A lookout is a site the location of which posses the same criteria as a lookout/flaking station. The difference is that a lookout displays very little lithic debitage or other cultural detritus suggesting that it is less frequently occupied, and when occupied, only for very brief periods of

time.

A kill site is self-explanatory. However, it is interesting to note that most of these sites are associated with recent Eskimo cultures and are comprised of shooting pits or hunting blinds.

Storage sites are isolated stone caches or storage pits. Usually they represent the short term storage of meat in the field.

Semi-subterranean houses fall into the category of long term camps but because of their specialized nature are considered separately.

Driveline inuksuit are rows of cairns or scarecrow-like structures of stick, and skins or cloth which are used to channel caribou into ambush.

Unknown or unclassified sites are self-explanatory.

Multi-Cultural Occupations cross traditional cultural lines. For instance, two occupations within the Eskimo continuum, such as a site with a Denbigh and an Ipiutak component, would not be considered multi-cultural. The components found in a multi-cultural site must appear to have been deposited by groups of different ancestry according to the definitions used by this project. Of course, this category is not used when compiling totals.

An isolate refers to the location of an isolated artifact. For example, the discovery of a projectile point lying on the surface with no other cultural indications in the vicinity.

Consolidated Survey Results Table

Table 18 consolidates figures from the fifteen Survey Results tables. Consistent headings have been used in the Survey Results tables and in Table 18. Table 18 reveals the total number of sites falling within each subdivision of the Survey Results

tables, and indicates the number of sites per vegetation category. The conclusions that can be drawn from Table 18 are discussed in the Conclusions section of the report.

Survey Area	Year Surveyed
Itkillik Lake	1976
Kobuk River	1983
Walker Lake	1983
Reed River	1983
Nutuvukti Lake	1983
Lake Selby/Narvak Lake	1983
Norutak Hills*	1983
N. Fork Koyukuk River	1984
Itkillik River	1984
Atigun River*	1984
N. Fork Chandalar River*	1984
John River	1985
Helpmejack Hills/Lakes	1985
Lake Kipmik/Lake Amitchiak	1985
Chandler/Amiloyak/Agiak Lakes	1985

Table 2. Survey Areas, by Year of Survey (* indicates isolated site rather than area survey).

SURVEY RESULTS TABLES

KOBUK RIVER

GENERAL SURVEY AREA LOCATION: 67°05'-66°50' N. LAT. 154°42'-154°00' W. LONG.
TOTAL AREA SURVEYED: 38 SQ. MILES
OF SITES IN SURVEY AREA: 56
LINEAR DISTANCE SURVEYED: 38 MILES
% OF RECORDED SITES IN SURVEY: 8.9%
% OF TOTAL AREA SURVEYED IN PARK: 19.3%
AREA SITE DENSITY: 1.47 SITES PER SQUARE MILE
% OF TOTAL PARK AREA: 0.28%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)	1	1.8	16.7
NORTHERN ARCHAIC (8,500-4,000)	1	1.8	16.7
ESKIMO CONTINUUM (4,500-100)			
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)	2	3.6	28.5
UNKNOWN	52	92.9	10.2
TOTAL	56	100.1	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)	1	1.8	16.7
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)	1	1.8	16.7
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)	2	3.6	28.5
UNKNOWN	52	92.9	10.2
TOTAL	56	100.1	

Table 3A. Survey Results: Kobuk River.

Table 3B. Survey Results: Kobuk River (Continued).

KOBUK RIVER

GENERAL SURVEY AREA LOCATION: 67°05'-66°50' N. LAT. 154°42'-154°00' W. LONG.

OF SITES IN SURVEY AREA: 56

AND % OF AREA SITES WITH OBSIDIAN: N=29 / 51.8%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE					
WILLOW PATCH					
KAME / ESKER / MORAINE	4		4	7.1	3.3
DUNE					
HILLSIDE BENCH					
TERRACE	2		2	3.6	2.3
HILLTOP	22		22	39.3	15.2
BLUFF	3		3	5.4	12.5
LOW RISE	1		1	1.8	3.7
BEDROCK OUTCROP	6		6	10.7	9.7
RIDGE	14		14	25.0	16.5
SPUR	3		3	5.4	50.0
ALLUVIAL FAN					
OTHER	1		1	1.8	12.5
TOTAL	56		56	100.1	

* Because this type combines sites already included in other categories, figures in this row are not included in the total tabulations.

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM	3	5.4	8.8
CAMP: SHORT TERM	2	3.6	4.3
CAMP/ LOOKOUT	2	3.6	3.4
LOOKOUT/ FLAKING STATION	21	37.5	11.5
LOOKOUT	4	7.1	5.3
KILL SITE			
STORAGE / CACHE			
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE	6	10.7	35.3
UNKNOWN / UNCLASSIFIED	18	32.1	9.8
MULTI-CULTURAL OCCUPATION*	1	1.8	5.0
TOTAL	56	100.0	

WALKER LAKE

GENERAL SURVEY AREA LOCATION: 67°04' N. LAT. 154°15' W. LONG.
TOTAL AREA SURVEYED: 17 SQ. MILES
OF SITES IN SURVEY AREA: 26
LINEAR DISTANCE SURVEYED: 8 MILES
% OF RECORDED SITES IN SURVEY: 4.2%
% OF TOTAL AREA SURVEYED IN PARK: 8.7%
AREA SITE DENSITY: 3.53 SITES PER SQUARE MILE (E.S. HALL'S 1974 SITES INCLUDED)
% OF TOTAL PARK AREA: 0.5%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)			
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING	1	3.8	50.0
RECENT (35-0)	4	15.4	44.4
UNKNOWN	21	80.8	4.1
TOTAL	26	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC	1	3.8	50.0
RECENT (35-0)	4	15.4	44.4
UNKNOWN	21	80.8	4.1
TOTAL	26	100.0	

Table 4A. Survey Results: Walker Lake.

Table 4B. Survey Results: Walker Lake (Continued).

WALKER LAKE

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE	3		3	11.5	42.9
LAKE SIDE					
WILLOW PATCH					
KAME / ESKER / MORAINE	11		11	42.3	9.2
DUNE					
HILLSIDE BENCH	1		1	3.8	0.5
TERRACE	2		2	7.7	2.3
HILLTOP	2		2	7.7	1.4
BLUFF	1		1	3.8	4.2
LOW RISE					
BEDROCK OUTCROP					
RIDGE	6		6	23.1	7.1
SPUR					
ALLUVIAL FAN					
OTHER					
TOTAL	26	0	26	99.9	

GENERAL SURVEY AREA LOCATION: 67°04' N. LAT. 154°15' W. LONG.

OF SITES IN SURVEY AREA: 26

AND % OF AREA SITES WITH OBSIDIAN: N=12 / 46.1%

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM	2	7.7	5.9
CAMP: SHORT TERM	3	11.5	6.5
CAMP/ LOOKOUT	1	3.8	1.7
LOOKOUT/ FLAKING STATION	1	3.8	0.5
LOOKOUT	8	30.8	10.5
KILL SITE			
STORAGE / CACHE			
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE			
UNKNOWN / UNCLASSIFIED	11	42.3	6.0
MULTI-CULTURAL OCCUPATION			
TOTAL	26	99.9	

REED RIVER

GENERAL SURVEY AREA LOCATION: 67°08'-67°03' N. LAT. 154°45' W. LONG. TOTAL AREA SURVEYED: 21 SQ. MILES

OF SITES IN SURVEY AREA: 54 LINEAR DISTANCE SURVEYED: 8 MILES

% OF RECORDED SITES IN SURVEY: 8.6% % OF TOTAL AREA SURVEYED IN PARK: 10.7%

AREA SITE DENSITY: 2.57 SITES PER SQUARE MILE % OF TOTAL PARK AREA: 0.15%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)			
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)			
UNKNOWN	54	100.0	10.6
TOTAL	54	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)			
UNKNOWN	54	100.0	10.6
TOTAL	54	100.0	

Table 5A. Survey Results: Reed River.

Table 5B. Survey Results: Reed River (Continued).

REED RIVER

GENERAL SURVEY AREA LOCATION: 67°08'-67°03' N. LAT., 154°45' W. LONG.

OF SITES IN SURVEY AREA: 54

AND % OF AREA SITES WITH OBSIDIAN: N=30 / 55.5%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE					
WILLOW PATCH					
KAME / ESKER / MORAINE	18		18	33.3	15.0
DUNE					
HILLSIDE BENCH					
TERRACE	8		8	14.8	9.2
HILLTOP	18		18	33.3	12.4
BLUFF					
LOW RISE	1		1	1.9	3.7
BEDROCK OUTCROP	2		2	3.7	3.2
RIDGE	7		7	13.0	8.2
SPUR					
ALLUVIAL FAN					
OTHER					
TOTAL	54	0	54	100.0	

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM			
CAMP: SHORT TERM	2	3.7	4.3
CAMP/ LOOKOUT	4	7.4	7.0
LOOKOUT/ FLAKING STATION	16	29.6	8.8
LOOKOUT	6	11.1	7.9
KILL SITE			
STORAGE / CACHE			
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE	2	3.7	11.8
UNKNOWN / UNCLASSIFIED	24	44.4	13.1
MULTI-CULTURAL OCCUPATION			
TOTAL	54	99.9	

NUTUVUKTI LAKE

GENERAL SURVEY AREA LOCATION: 67°00' N. LAT. 155°45' W. LONG.
TOTAL AREA SURVEYED: 3 SQ. MILES
OF SITES IN SURVEY AREA: 6
LINEAR DISTANCE SURVEYED: 18 MILES
% OF RECORDED SITES IN SURVEY: 0.96%
% OF TOTAL AREA SURVEYED IN PARK: 1.5%
AREA SITE DENSITY: 2.00 SITES PER SQUARE MILE
% OF TOTAL PARK AREA: 0.02%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)			
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING	1	16.7	50.0
RECENT (35-0)			
UNKNOWN	5	83.3	1.0
TOTAL	6	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC	1	16.7	50.0
RECENT (35-0)			
UNKNOWN	5	83.3	1.0
TOTAL	6	100.0	

Table 6A. Survey Results: Nutuvukti Lake.

Table 6B. Survey Results: Nutuvukti Lake (continued).

NUTUVUKTI LAKE

GENERAL SURVEY AREA LOCATION: 67°00' N. LAT. 155°45' W. LONG.

OF SITES IN SURVEY AREA: 6

AND % OF AREA SITES WITH OBSIDIAN: N=3 / 50.0%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE					
WILLOW PATCH					
KAME / ESKER / MORAINE					
DUNE					
HILLSIDE BENCH					
TERRACE	4		4	66.7	4.6
HILL TOP	2		2	33.3	1.4
BLUFF					
LOW RISE					
BEDROCK OUTCROP					
RIDGE					
SPUR					
ALLUVIAL FAN					
OTHER					
TOTAL	6	0	6	100.0	

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM	2	33.3	5.9
CAMP: SHORT TERM			
CAMP/ LOOKOUT			
LOOKOUT/ FLAKING STATION			
LOOKOUT			
KILL SITE			
STORAGE / CACHE			
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE			
UNKNOWN / UNCLASSIFIED	4	66.7	2.2
MULTI-CULTURAL OCCUPATION			
TOTAL	6	100.0	

LAKE SELBY / NARVAK LAKE

GENERAL SURVEY AREA LOCATION: 66°52' N. LAT. 155°42' W. LONG. TOTAL AREA SURVEYED: 12 SQ. MILES
OF SITES IN SURVEY AREA: 79 LINEAR DISTANCE SURVEYED: _____
% OF RECORDED SITES IN SURVEY: 12.6% % OF TOTAL AREA SURVEYED IN PARK: 6J%
AREA SITE DENSITY: 6.58 SITES PER SQUARE MILE % OF TOTAL PARK AREA: 0.09%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)			
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)			
UNKNOWN	79	100.0	15.6
TOTAL	79	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)			
UNKNOWN	79	100.0	15.6
TOTAL	79	100.0	

Table 7A. Survey Results: Lake Selby/Narvak Lake.

Table 7B. Survey Results: Lake Selby/Narvak Lake (continued).

LAKE SELBY / NARVAK LAKE

GENERAL SURVEY AREA LOCATION: 66°52' N. LAT, 155°42' W, LONG.

OF SITES IN SURVEY AREA: 79

AND % OF AREA SITES WITH OBSIDIAN: N=57 / 72.2%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE	2		2	2.5	20.0
WILLOW PATCH					
KAME / ESKER / MORAINE	13		13	16.5	10.8
DUNE					
HILLSIDE BENCH					
TERRACE	17		17	21.5	19.5
HILLTOP	11		11	13.9	7.6
BLUFF	3		3	3.8	12.5
LOW RISE	8		8	10.1	29.6
BEDROCK OUTCROP	14		14	17.7	22.6
RIDGE	9		9	11.4	10.6
SPUR					
ALLUVIAL FAN					
OTHER	2		2	2.5	25.0
TOTAL	79	0	79	99.9	

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM	2	2.5	5.9
CAMP: SHORT TERM	3	3.8	6.5
CAMP/ LOOKOUT	6	7.6	10.2
LOOKOUT/ FLAKING STATION	18	22.8	9.9
LOOKOUT	10	12.7	13.2
KILL SITE			
STORAGE / CACHE	1	1.2	12.5
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE	1	1.2	5.9
UNKNOWN / UNCLASSIFIED	38	48.1	20.8
MULTI-CULTURAL OCCUPATION			
TOTAL	79	99.9	

NORUTAK HILLS

GENERAL SURVEY AREA LOCATION: 68°36'-66°37' N. LAT. 154°28'-154°29' W. LONG.
TOTAL AREA SURVEYED: N/A
OF SITES IN SURVEY AREA: 1
LINEAR DISTANCE SURVEYED: N/A
% OF RECORDED SITES IN SURVEY: 0.2%
% OF TOTAL AREA SURVEYED IN PARK: N/A
AREA SITE DENSITY: UNKNOWN
% OF TOTAL PARK AREA: N/A

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)			
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)			
UNKNOWN	1	100.0	0.2
TOTAL	1	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)			
UNKNOWN	1	100.0	0.2
TOTAL	1	100.0	

Table 8A. Survey Results: Norutak Hills.

Table 8B. Survey Results: Norutak Hills (continued).

NORUTAK HILLS

GENERAL SURVEY AREA LOCATION: 66°36'-66°37' N. LAT. 154°28'-154°29' W. LONG.

OF SITES IN SURVEY AREA: 1

AND % OF AREA SITES WITH OBSIDIAN: N=1 / 100.0%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE					
WILLOW PATCH					
KAME / ESKER / MORAINE					
DUNE					
HILLSIDE BENCH					
TERRACE					
HILLTOP	1		1	100.0	0.7
BLUFF					
LOW RISE					
BEDROCK OUTCROP					
RIDGE					
SPUR					
ALLUVIAL FAN					
OTHER					
TOTAL	1	0	1	100.0	

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM			
CAMP: SHORT TERM			
CAMP/ LOOKOUT	1	100.0	1.7
LOOKOUT/ FLAKING STATION			
LOOKOUT			
KILL SITE			
STORAGE / CACHE			
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE			
UNKNOWN / UNCLASSIFIED			
MULTI-CULTURAL OCCUPATION			
TOTAL	1	100.0	

NORTH FORK KOYUKUK RIVER

GENERAL SURVEY AREA LOCATION: 67 54'-67 19' N. LAT. 150 45' W. LONG. TOTAL AREA SURVEYED: 29 SQ. MILES
OF SITES IN SURVEY AREA: 104 LINEAR DISTANCE SURVEYED: 50 MILES
% OF RECORDED SITES IN SURVEY: 16.6% % OF TOTAL AREA SURVEYED IN PARK: 14.8%
AREA SITE DENSITY: 3.59 SITES PER SQUARE MILE % OF TOTAL PARK AREA: 0.21%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)	2	1.9	33.3
NORTHERN ARCHAIC (8,500-4,000)	1	1.0	16.7
ESKIMO CONTINUUM (4,500-100)	3	2.9	3.2
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)	1	1.0	11.1
UNKNOWN	97	93.3	19.1
TOTAL	104	100.1	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)	2	1.9	33.3
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)	1	1.0	16.7
DENBIGH (4,500-2,000)	2	1.9	20.0
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)	1	1.0	50.0
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)	1	1.0	11.1
UNKNOWN	97	93.3	19.1
TOTAL	104	100.1	

Table 9A. Survey Results: North Fork, Koyukuk River

Table 9B. Survey Results: North Fork, Koyukuk River (continued).

NORTH FORK KOYUKUK RIVER

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE	1		1	1.0	10.0
WILLOW PATCH					
KAME / ESKER / MORAINE	8		8	7.7	6.7
DUNE					
HILLSIDE BENCH	4		4	3.8	20.0
TERRACE	10		10	9.6	11.5
HILLTOP	34		34	32.7	23.4
BLUFF	5		5	4.8	20.8
LOW RISE	8		8	7.7	29.6
BEDROCK OUTCROP	15		15	14.4	24.2
RIDGE	18		18	17.3	21.2
SPUR					
ALLUVIAL FAN					
OTHER	1		1	1.0	12.5
TOTAL	104	0	104	100.0	

* Because this type combines sites already included in other categories, figures in this row are not included in the total tabulations.

GENERAL SURVEY AREA LOCATION: 67°54'-67°19' N. LAT. 150°45' W. LONG.

OF SITES IN SURVEY AREA: 104

AND % OF AREA SITES WITH OBSIDIAN: N=26 / 25.0%

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM			
CAMP: SHORT TERM	7	6.7	15.2
CAMP/ LOOKOUT	12	11.5	20.3
LOOKOUT/ FLAKING STATION	39	37.5	21.4
LOOKOUT	10	9.6	13.2
KILL SITE			
STORAGE / CACHE			
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE	2	1.9	11.8
UNKNOWN / UNCLASSIFIED	34	32.7	18.6
MULTI-CULTURAL OCCUPATION*	5	4.8	25.0
TOTAL	104	99.9	

ITKILLIK RIVER

GENERAL SURVEY AREA LOCATION: 68°28'-68°05' N. LAT. 150°00' W. LONG. TOTAL AREA SURVEYED: 18 SQ. MILES
OF SITES IN SURVEY AREA: 75 LINEAR DISTANCE SURVEYED: 43 MILES
% OF RECORDED SITES IN SURVEY: 12.0% % OF TOTAL AREA SURVEYED IN PARK: 9.2%
AREA SITE DENSITY: 4.17 SITES PER SQUARE MILE % OF TOTAL PARK AREA: 0.13%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)	19	25.3	20.2
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)	2	2.7	10.0
UNKNOWN	54	72.0	10.6
TOTAL	75	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)	1	1.3	10.0
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)	14	18.7	20.3
UNKNOWN ESKIMO CONTINUUM (4,500-100)	4	5.3	25.0
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)	2	2.7	10.0
UNKNOWN	54	72.0	10.6
TOTAL	75	100.0	

Table 10A. Survey Results: Itkillik River.

Table 10B. Survey Results: Itkillik River (continued).

ITKILLIK RIVER

GENERAL SURVEY AREA LOCATION: 68°28'-68°05' N. LAT., 150°00' W. LONG.

OF SITES IN SURVEY AREA: 75

AND % OF AREA SITES WITH OBSIDIAN: N=2 / 2.7%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE		1	1	1.3	14.3
LAKE SIDE					
WILLOW PATCH		3	3	4.0	42.9
KAME / ESKER / MORAINE		24	24	32.0	20.0
DUNE		5	5	6.7	50.0
HILLSIDE BENCH		2	2	2.7	10.0
TERRACE		9	9	12.0	10.3
HILLTOP		15	15	20.0	10.3
BLUFF		1	1	1.3	4.2
LOW RISE					
BEDROCK OUTCROP		2	2	2.7	3.2
RIDGE		7	7	9.3	8.2
SPUR		1	1	1.3	16.7
ALLUVIAL FAN		5	5	6.7	62.5
OTHER					
TOTAL	0	75	75	100.0	

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM	4	5.3	11.8
CAMP: SHORT TERM	9	12.0	19.6
CAMP/ LOOKOUT	14	18.7	23.7
LOOKOUT/ FLAKING STATION	26	34.7	14.3
LOOKOUT	10	13.3	13.2
KILL SITE	1	1.3	9.0
STORAGE / CACHE	1	1.3	12.5
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE			
UNKNOWN / UNCLASSIFIED	10	13.3	5.5
MULTI-CULTURAL OCCUPATION			
TOTAL	75	99.9	

ATIGUN RIVER

GENERAL SURVEY AREA LOCATION: 68°15'-68°30' N. LAT. 149°00'-150°00' W. LONG.
TOTAL AREA SURVEYED: N/A
OF SITES IN SURVEY AREA: 1
LINEAR DISTANCE SURVEYED: N/A
% OF RECORDED SITES IN SURVEY: 0.2%
% OF TOTAL AREA SURVEYED IN PARK: N/A
AREA SITE DENSITY: UNKNOWN
% OF TOTAL PARK AREA: N/A

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)			
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)			
UNKNOWN	1	100.0	0.2
TOTAL	1	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)			
UNKNOWN	1	100.0	0.2
TOTAL	1	100.0	

Table 11A. Survey Results: Atigun River.

Table 11B. Survey Results: Atigun River (continued).

ATIGUN RIVER

GENERAL SURVEY AREA LOCATION: 68°15'-68°30' N. LAT., 149°00'-150°00' W. LONG.

OF SITES IN SURVEY AREA: 1

AND % OF AREA SITES WITH OBSIDIAN: N=0 / 0.0%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE					
WILLOW PATCH					
KAME / ESKER / MORAINE					
DUNE					
HILLSIDE BENCH					
TERRACE					
HILLTOP					
BLUFF					
LOW RISE					
BEDROCK OUTCROP					
RIDGE					
SPUR		1	1	100.0	16.7
ALLUVIAL FAN					
OTHER					
TOTAL	0	1	1	100.0	

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM			
CAMP: SHORT TERM			
CAMP/ LOOKOUT			
LOOKOUT/ FLAKING STATION			
LOOKOUT			
KILL SITE			
STORAGE / CACHE	1	100.0	12.5
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE			
UNKNOWN / UNCLASSIFIED			
MULTI-CULTURAL OCCUPATION			
TOTAL	1	100.0	

NORTH FORK CHANDALAR RIVER

GENERAL SURVEY AREA LOCATION: 67°45'-68°00' N. LAT. 149°00'-149°30' W. LONG.
TOTAL AREA SURVEYED: N/A
OF SITES IN SURVEY AREA: 1
LINEAR DISTANCE SURVEYED: N/A
% OF RECORDED SITES IN SURVEY: 0.2%
% OF TOTAL AREA SURVEYED IN PARK: N/A
AREA SITE DENSITY: UNKNOWN
% OF TOTAL PARK AREA: N/A

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)			
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)			
UNKNOWN	1	100.0	0.2
TOTAL	1	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)			
UNKNOWN	1	100.0	0.2
TOTAL	1	100.0	

Table 12A. Survey Results: North Fork, Chandalar River.

Table 12B. Survey Results, North Fork, Chandalar River (continued).

NORTH FORK CHANDALAR RIVER

GENERAL SURVEY AREA LOCATION: 67°45'-68°00' N. LAT., 149°00'-149°30' W. LONG.

OF SITES IN SURVEY AREA: 1

AND % OF AREA SITES WITH OBSIDIAN: N=0 / 0.0%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE					
WILLOW PATCH					
KAME / ESKER / MORAINE					
DUNE					
HILLSIDE BENCH					
TERRACE					
HILLTOP					
BLUFF					
LOW RISE					
BEDROCK OUTCROP		1	1	100.0	1.6
RIDGE					
SPUR					
ALLUVIAL FAN					
OTHER					
TOTAL	0	1	1	100.0	

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM			
CAMP: SHORT TERM			
CAMP/ LOOKOUT	1	100.0	1.7
LOOKOUT/ FLAKING STATION			
LOOKOUT			
KILL SITE			
STORAGE / CACHE			
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE			
UNKNOWN / UNCLASSIFIED			
MULTI-CULTURAL OCCUPATION			
TOTAL	1	100.0	

JOHN RIVER

GENERAL SURVEY AREA LOCATION: 68°00'-67°22' N. LAT. 152°10' W. LONG. TOTAL AREA SURVEYED: 29.5 SQ. MILES

OF SITES IN SURVEY AREA: 57 LINEAR DISTANCE SURVEYED: 50 MILES

% OF RECORDED SITES IN SURVEY: 9.1% % OF TOTAL AREA SURVEYED IN PARK: 15.0%

AREA SITE DENSITY: 1.93 SITES PER SQUARE MILE % OF TOTAL PARK AREA: 0.22%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)	5	8.8	5.3
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)			
UNKNOWN	52	91.2	10.2
TOTAL	57	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)	5	8.8	5.3
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)			
UNKNOWN	52	91.2	10.2
TOTAL	57	100.0	

Table 13A. Survey Results, John River.

Table 13B. Survey Results: John River (continued).

JOHN RIVER

GENERAL SURVEY AREA LOCATION: 68°00'-67°22' N LAT. 152°10' W. LONG.

OF SITES IN SURVEY AREA: 57

AND % OF AREA SITES WITH OBSIDIAN: N=8 / 14.0%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE					
WILLOW PATCH					
KAME / ESKER / MORAINE	7		7	12.3	5.8
DUNE					
HILLSIDE BENCH					
TERRACE	9	3	12	21.1	13.8
HILLTOP	6	6	12	21.1	8.3
BLUFF	1	2	3	5.3	12.5
LOW RISE	1	1	2	3.5	7.4
BEDROCK OUTCROP	18		18	31.6	29.0
RIDGE	3		3	5.3	3.5
SPUR					
ALLUVIAL FAN					
OTHER					
TOTAL	45	12	57	100.0	

* Because this type combines sites already included in other categories, figures in this row are not included in the total tabulations.

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM	3	5.3	8.8
CAMP: SHORT TERM			
CAMP/ LOOKOUT	4	7.0	6.8
LOOKOUT/ FLAKING STATION	28	49.1	15.4
LOOKOUT	6	10.5	7.9
KILL SITE	1	1.8	9.1
STORAGE / CACHE	1	1.8	12.5
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE	1	1.8	5.9
UNKNOWN / UNCLASSIFIED	13	22.8	7.1
MULTI-CULTURAL OCCUPATION*	4	7.0	20.0
TOTAL	57	100.1	

HELPMEJACK HILLS / LAKES

GENERAL SURVEY AREA LOCATION: 67°03'-66°55' N. LAT. 153°3' W. LONG. TOTAL AREA SURVEYED: 5.5 SQ. MILES
OF SITES IN SURVEY AREA: 15 LINEAR DISTANCE SURVEYED: 12 MILES
% OF RECORDED SITES IN SURVEY: 2.4% % OF TOTAL AREA SURVEYED IN PARK: 2.8%
AREA SITE DENSITY: 2.73 SITES PER SQUARE MILE % OF TOTAL PARK AREA: 0.04%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)			
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)	2	13.3	22.2
UNKNOWN	13	86.7	2.6
TOTAL	15	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)	2	13.3	22.2
UNKNOWN	13	86.7	2.6
TOTAL	15	100.0	

Table 14A. Survey Results: Helpmejack Hills/Lakes.

Table 14B. Survey Results: Helpmejack Hills/Lakes (continued).

HELPMEJACK HILLS / LAKES

GENERAL SURVEY AREA LOCATION: 67°03'-66°55' N. LAT. 153°31' W. LONG.

OF SITES IN SURVEY AREA: 15

AND % OF AREA SITES WITH OBSIDIAN: N=8 / 53.3%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE	2		2	13.3	20.0
WILLOW PATCH					
KAME / ESKER / MORAINE	4		4	26.7	3.3
DUNE					
HILLSIDE BENCH					
TERRACE					
HILLTOP	2		2	13.3	1.4
BLUFF					
LOW RISE					
BEDROCK OUTCROP	1		1	6.7	1.6
RIDGE	6		6	40.0	7.1
SPUR					
ALLUVIAL FAN					
OTHER					
TOTAL	15	0	15	100.0	

*Because this type combines sites already included in other categories, figures in this row are not included in the total tabulations.

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP / LONG TERM	2	13.3	5.9
CAMP / SHORT TERM			
CAMP / LOOKOUT			
LOOKOUT / FLAKING STATION	6	40.0	3.3
LOOKOUT	4	26.7	5.2
KILL SITE			
STORAGE / CACHE			
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK			
ISOLATE	2	13.3	11.8
UNKNOWN / UNCLASSIFIED	1	6.7	0.5
MULTI-CULTURAL OCCUPATION*	2	13.3	10.0
TOTAL	15	100.0	

LAKE KIPMIK / LAKE AMITCHIAK

GENERAL SURVEY AREA LOCATION: 67°59'-67°56' N. LAT. 156 17'- 156 07' W. LONG.
TOTAL AREA SURVEYED: 4 SQ. MILES
OF SITES IN SURVEY AREA: 21
SHORELINE/LINEAR DISTANCE SURVEYED: 18 MI / 7 MI
% OF RECORDED SITES IN SURVEY: 3.4%
% OF TOTAL AREA SURVEYED IN PARK: 2.0%
AREA SITE DENSITY: 5.25 SITES PER SQUARE MILE
% OF TOTAL PARK AREA: 0.03%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)	1	4.8	16.7
NORTHERN ARCHAIC (8,500-4,000)			
ESKIMO CONTINUUM (4,500-100)	9	42.9	9.6
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)			
UNKNOWN	11	52.4	2.2
TOTAL	21	100.1	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)	1	4.8	16.7
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)			
DENBIGH (4,500-2,000)	2	9.5	20.0
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)	1	4.8	50.0
NUNAMIUT ESKIMO (300-35)			
UNKNOWN ESKIMO CONTINUUM (4,500-100)	6	28.6	50.0
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)			
UNKNOWN	11	52.4	2.2
TOTAL	21	100.1	

Table 15A. Survey Results: Lake Kipmik/Lake Amitchiak.

Table 15B. Survey Results: Lake Kipmik/Lake Amitchiak (continued).

LAKE KIPMIK / LAKE AMITCHIAK

GENERAL SURVEY AREA LOCATION: 67°59'-67°56' N. LAT. 156°17'-156°07' W. LONG.

OF SITES IN SURVEY AREA: 21

AND % OF AREA SITES WITH OBSIDIAN: N=3 / 14.3%

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE					
LAKE SIDE		3	3	14.3	30.0
WILLOW PATCH					
KAME / ESKER / MORAINE		1	1	4.8	0.08
DUNE					
HILLSIDE BENCH		1	1	4.8	5.0
TERRACE		2	2	9.5	2.3
HILLTOP		6	6	28.6	4.1
BLUFF		3	3	14.3	12.5
LOW RISE					
BEDROCK OUTCROP		1	1	4.8	16.7
RIDGE		2	2	9.5	2.4
SPUR		1	1	4.8	16.7
ALLUVIAL FAN		1	1	4.8	12.5
OTHER					
TOTAL	0	21	21	100.2	

* Because this type combines sites already included in other categories, figures in this row are not included in the total tabulations.

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM	3	14.3	8.8
CAMP: SHORT TERM	1	4.8	2.2
CAMP/ LOOKOUT	3	14.3	5.1
LOOKOUT/ FLAKING STATION	4	19.0	2.2
LOOKOUT	2	9.5	2.6
KILL SITE			
STORAGE / CACHE	2	9.5	25.0
SEMI-SUBTERRANEAN HOUSE / HOUSES	2	9.5	50.0
DRIVE LINE / INUKSUK	1	4.8	16.7
ISOLATE	1	4.8	5.9
UNKNOWN / UNCLASSIFIED	2	9.5	1.1
MULTI-CULTURAL OCCUPATION*	1	4.8	5.0
TOTAL	21	100.0	

CHANDLER, AMILOYAK, AGIAK LAKES

GENERAL SURVEY AREA LOCATION: 68°21'-68°04' N. LAT. 153 00'- 152 32' W. LONG.
TOTAL AREA SURVEYED: 14 SQ. MILES
OF SITES IN SURVEY AREA: 78
SHORELINE/LINEAR DISTANCE SURVEYED: 15 MI / 22 MI
% OF RECORDED SITES IN SURVEY: 12.5%
% OF TOTAL AREA SURVEYED IN PARK: 7.1%
AREA SITE DENSITY: 5.57 SITES PER SQUARE MILE
% OF TOTAL PARK AREA: 0.10%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
NORTHERN ARCHAIC (8,500-4,000)	1	1.3	16.7
ESKIMO CONTINUUM (4,500-100)	45	57.7	47.9
KUTCHIN (600-100)			
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)			
UNKNOWN	32	41.0	6.3
TOTAL	78	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)			
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)	1	1.3	20.0
DENBIGH (4,500-2,000)			
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)			
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)	43	55.1	62.3
UNKNOWN ESKIMO CONTINUUM (4,500-100)	2	2.6	16.7
KAVIK (ATHABASKAN) (600-100)			
HISTORIC			
RECENT (35-0)			
UNKNOWN	32	41.0	6.3
TOTAL	78	100.0	

Table 16A. Survey Results: Chandler/Amiloyak/Agiak Lakes.

Table 16B. Survey Results: Chandler/Amiloyak/Agiak Lakes (continued).

CHANDLER, AMILOYAK, AGIAK LAKES

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE		1	1	1.3	14.3
LAKE SIDE		1	1	1.3	10.0
WILLOW PATCH		1	1	1.3	14.3
KAME / ESKER / MORAINE		9	9	11.5	7.5
DUNE					
HILLSIDE BENCH		4	4	5.1	20.0
TERRACE		21	21	26.9	24.1
HILLTOP		18	18	23.1	12.4
BLUFF		1	1	1.3	4.1
LOW RISE		5	5	6.4	18.5
BEDROCK OUTCROP					
RIDGE		13	13	16.7	15.3
SPUR					
ALLUVIAL FAN		2	2	2.6	25.0
OTHER		2	2	2.6	25.0
TOTAL	0	78	78	100.0	

✲ Because this type combines sites already included in other categories, figures in this row are not included in the total tabulations.

GENERAL SURVEY AREA LOCATION: 68 21'-68 04' N. LAT. 153 00'-152 32' W. LONG.

OF SITES IN SURVEY AREA: 78

AND % OF AREA SITES WITH OBSIDIAN: N=7 / 9.0%

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM	6	7.7	17.6
CAMP: SHORT TERM	17	21.8	37.0
CAMP/ LOOKOUT	8	10.3	13.6
LOOKOUT/ FLAKING STATION	14	17.9	7.7
LOOKOUT	4	5.1	5.3
KILL SITE	9	11.5	81.8
STORAGE / CACHE	2	2.6	25.0
SEMI-SUBTERRANEAN HOUSE / HOUSES			
DRIVE LINE / INUKSUK	3	3.8	50.0
ISOLATE	1	1.3	5.9
UNKNOWN / UNCLASSIFIED	14	17.9	7.7
MULTI-CULTURAL OCCUPATION✲	4	5.1	20.0
TOTAL	78	99.9	

ITKILLIK LAKE

GENERAL SURVEY AREA LOCATION: 68°23' N. LAT. 149°55' W. LONG.
TOTAL AREA SURVEYED: 5.5 SQ. MILES
OF SITES IN SURVEY AREA: 52
LINEAR DISTANCE SURVEYED: 9 MILES
% OF RECORDED SITES IN SURVEY: 8.3%
% OF TOTAL AREA SURVEYED IN PARK: 2.8%
AREA SITE DENSITY: 9.45 SITES PER SQUARE MILE
% OF TOTAL PARK AREA: 0.04%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)	2	3.8	33.3
NORTHERN ARCHAIC (8,500-4,000)	3	5.8	50.0
ESKIMO CONTINUUM (4,500-100)	13	25.0	13.8
KUTCHIN (600-100)	1	1.9	5.0
HISTORIC EXPLORATION/ MINING			
RECENT (35-0)			
UNKNOWN	33	63.5	6.5
TOTAL	52	100.0	

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
AMERICAN PALEOARCTIC (11,500-8,000)	2	3.8	33.3
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)			
TUKTU / PALISADES (6,500-4,000)	3	5.8	50.0
DENBIGH (4,500-2,000)	5	9.6	50.0
CHORIS (3,200-2,000)			
NORTON (2,500-1,500)			
IPIUTAK (2,000-800)	1	1.9	100.0
LATE PREHISTORIC ESKIMO (800-300)			
NUNAMIUT ESKIMO (300-35)	7	13.5	10.1
UNKNOWN ESKIMO CONTINUUM (4,500-100)			
KAVIK (ATHABASKAN) (600-100)	1	1.9	5.0
HISTORIC			
RECENT (35-0)			
UNKNOWN	33	63.5	6.5
TOTAL	52	100.0	

Table 17A. Survey Results: Itkillik Lake.

Table 17B. Survey Results: Itkillik Lake (continued).

ITKILLIK LAKE

SITE PHYSIOGRAPHY	FOREST	TUNDRA	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
STREAM SIDE		2	2	3.8	28.6
LAKE SIDE		1	1	1.9	10.0
WILLOW PATCH		3	3	5.8	42.9
KAME / ESKER / MORAINE		21	21	40.4	17.5
DUNE		5	5	9.6	50.0
HILLSIDE BENCH		8	8	15.4	40.0
TERRACE					
HILLTOP		2	2	3.8	1.4
BLUFF		4	4	7.7	16.7
LOW RISE		2	2	3.8	7.4
BEDROCK OUTCROP		2	2	3.8	3.2
RIDGE					
SPUR					
ALLUVIAL FAN					
OTHER		2	2	3.8	25.0
TOTAL	0	52	52	100.0	

✡ Because this type combines sites already included in other categories, figures in this row are not included in the total tabulations.

GENERAL SURVEY AREA LOCATION: 68°23' N. LAT. 149°55' W. LONG.

OF SITES IN SURVEY AREA: 52

AND % OF AREA SITES WITH OBSIDIAN: N=1 / 1.9%

SITE TYPE	# OF SITES	% OF SITES IN AREA	% OF SITE TYPE IN SURVEY
CAMP: LONG TERM	7	13.5	20.6
CAMP: SHORT TERM	2	3.8	4.3
CAMP/ LOOKOUT	3	5.8	5.1
LOOKOUT/ FLAKING STATION	9	17.3	4.9
LOOKOUT	12	23.1	15.8
KILL SITE	1	1.9	9.1
STORAGE / CACHE			
SEMI-SUBTERRANEAN HOUSE / HOUSES	1	1.9	25.0
DRIVE LINE / INUKSUK	2	3.8	33.3
ISOLATE	1	1.9	5.9
UNKNOWN / UNCLASSIFIED	14	26.9	7.7
MULTI-CULTURAL OCCUPATION✡	1	1.9	5.0
TOTAL	52	99.9	

AREA SURVEYED: 196.5 SQ. MILES (TUNDRA 47.5, FOREST 149.0)
OF SITES INCLUDED IN THIS SUMMARY: 626
FOREST SITE DENSITY: 2.58 SITES PER SQ. MILE
TUNDRA SITE DENSITY: 5.07 SITES PER SQ. MILE
AVERAGE SITE DENSITY: 3.19 SITES PER SQ. MILE

SHORELINE SURVEYED: 84 MILES
LINEAR DISTANCE SURVEYED: 238 MILES
% OF TOTAL PARK AREA SURVEYED: 1.5%

REGIONAL SEQUENCE AS PER PROJECT

TRADITION (YEARS B.P.)	# OF SITES	FOREST	TUNDRA
AMERICAN PALEOARCTIC (11,500-8,000)	6	3	3
NORTHERN ARCHAIC (8,500-4,000)	6	2	4
ESKIMO CONTINUUM (4,500-100)	94	5	89
KUTCHIN (600-100)	1	0	1
HISTORIC EXPLORATION/ MINING	2	2	0
RECENT (35-0)	9	7	2
TOTAL IDENTIFIABLE SITES	118	19	99
UNKNOWN	508	366	142
TOTAL	626	385	241

GENERALIZED REGIONAL SEQUENCE

COMPLEX / CULTURE (YEARS B.P.)	# OF SITES	FOREST	TUNDRA
AMERICAN PALEOARCTIC (11,500-8,000)	6	3	3
GENERALIZED NORTHERN ARCHAIC (8,500-4,000)	1	1	0
TUKTU / PALISADES (6,500-4,000)	5	1	4
DENBIGH (4,500-2,000)	10	2	8
CHORIS (3,200-2,000)	0	0	0
NORTON (2,500-1,500)	0	0	0
IPIUTAK (2,000-800)	1	0	1
LATE PREHISTORIC ESKIMO (800-300)	2	1	1
NUNAMIUT ESKIMO (300-35)	69	2	67
UNKNOWN ESKIMO CONTINUUM (4,500-100)	12	0	12
KAVIK (ATHABASKAN) (600-100)	1	0	1
HISTORIC	2	2	0
RECENT (35-0)	9	7	2
TOTAL IDENTIFIABLE SITES	118	19	99
UNKNOWN	508	366	142
TOTAL	626	385	241

Table 18A. Combined Survey Results: Regional traditional/cultural sequence and local vegetation for the 15 area summaries.

Table 18B. Combined Survey Results: Physiographic location, site type, and vegetation for the 15 area summaries.

SITE PHYSIOGRAPHY	# OF SITES	FOREST	TUNDRA
STREAM SIDE	7	3	4
LAKE SIDE	10	5	5
WILLOW PATCH	7	0	7
KAME / ESKER MORAINE	120	64	56
DUNE	10	0	10
HILLSIDE BENCH	20	5	15
TERRACE	87	52	35
HILLTOP	145	98	47
BLUFF	24	13	11
LOW RISE	27	19	8
BEDROCK OUTCROP	62	56	6
RIDGE	85	63	22
SPUR	6	3	3
ALLUVIAL FAN	8	0	8
OTHER	8	4	4
TOTAL	626	385	241

OF SITES INCLUDED IN THIS SUMMARY: 626

AND % OF SITES WITH OBSIDIAN: N=187 / 29.9%

SITE TYPE	# OF SITES	FOREST	TUNDRA
CAMP: LONG TERM	34	13	21
CAMP: SHORT TERM	46	17	29
CAMP / LOOKOUT	59	28	31
LOOKOUT / FLAKING STATION	182	124	58
LOOKOUT	76	47	29
KILL SITE	11	0	11
STORAGE / CACHE	8	2	6
SEMI-SUBTERRANEAN HOUSE / HOUSES	4	1	3
DRIVE LINE / INUKSUK	6	0	6
ISOLATE	17	13	4
TOTAL IDENTIFIABLE SITES	443	245	198
UNKNOWN / UNCLASSIFIED	183	140	43
MULTI-CULTURAL OCCUPATION	20	12	8
TOTAL	626	385	241

CONCLUSIONS

Summary Observations

During the three years of fieldwork for the Gates of the Arctic cultural resource inventory project, a total of 196.5 square miles of park and preserve were surveyed for prehistoric and historic native archaeological sites. In terms of total area this represents 1.5% of the land within the park and preserve. However, a more realistic assessment would consider the usable area or areas more likely to be used by human populations operating within the park over the last 10,000 years. While the determining criteria is subjective, in general, optimal locations for human habitation are most often associated with stream drainages and lake basins.

In the park and preserve, as in most extremely rugged and mountainous areas, the river valleys and other sizable stream drainages are the best routes of transportation since they are usually surrounded by more subdued topography. Additionally, the terrain around lake basins is often exploited by human populations. Of the 13,238 square miles included in the park and preserve, this investigator estimated that roughly one third, or 4,412 square miles is comprised of land which could be expected to be used by humans in pursuit of their livelihood. In this

instance, the 196.5 square miles surveyed during this project are about 4.5% of the area of the park and preserve which, for these purposes, would be considered exploitable by aboriginal populations. Even given this "best case" scenario, the amount of land that has been examined for cultural resources is pitifully small. It would require considerable time and an involved process to precisely determine the usable land area found in the major drainages and lake basins. Therefore, a comparison will be made using the number of major drainages and lakes in the park and preserve.

There are approximately 50 major drainage systems in the park and preserve. Of these, six, or 12%, have been surveyed for cultural resources by this project. Unfortunately, because these data are not randomly distributed over the geography of the park and preserve, they cannot be said to be representative, and site density models, parkwide, cannot be generated. On the other hand, of the 45 lake basins to which major status can be assigned, 10 or 22% have been examined for prehistoric or historic native archaeological remains by this project. Our survey data from the lake basins generated a model that appears to be reasonably representative of the types of sites that can be expected to be found along the shores of large lakes. This should be expected from a sample size of 22% which is well distributed, geographically, over the park and preserve.

Geographically and/or physiographically speaking the park can be divided into the forested southern half, which is basically homogenous in character from the eastern to western boundaries, and the tundra covered northern half. The northern half of the park and preserve is sufficiently dissimilar in physiographical character to be divided into three provinces, the eastern, the central, and the western. During this survey only drainages in the northeastern and southern sections were investigated. The lack of data from drainages in the northcentral and northwestern provinces of the park indicate that additional field work is necessary if a uniform picture of prehistoric cultures is to be developed for the entire area. Not only is data from these regions necessary to form a cultural picture of the park and preserve through time, it should also be noted that a greater variety of sites are found within river drainage systems than are associated with lake basins.

As previously mentioned, the portion of the park that lies on the southern flank of the Brooks Range is homogenous enough in physical character to be considered a single physiographic province. Therefore, the archaeological data that has been collected from that region can produce a reasonable indication of past human use of the area and, to a lesser degree of certainty, a predictive model of the type of archeological sites that might be found in the southern locales. Unfortunately, the only major south-flowing river in the central portion of the area, the

Alatna, has not yet been investigated. This work needs to be done to produce a reasonable level of confidence for even limited predictive modelling. However, that caveat aside, at present the data suggests the following.

During survey of the 149 square miles of the southern or forested part of the park and preserve, 385 sites were located. Of this number only 19 or 4.9% were culturally identifiable at the Phase I level of investigation. Almost two-thirds of these sites are less than 300 years old. Because of the extremely slow rate of soil development in the Arctic, the more recent sites usually exhibit higher visibility due to their degree of surface exposure. The more cultural material that is exposed, the better the chance of observing a culturally diagnostic feature or artifact.

Site density in the forested southern portion of the park and preserve is approximately 2.5 sites per square mile. This is about half the site density that is found in the tundra covered northeastern sector of the park. At first glance, apparently three times more area in the forest is needed to produce one and a half times fewer sites than in the tundra. However, there is no suggestion from the accumulated environmental and paleoecological data that the forested portion of the park and preserve experienced less intensive exploitation by past human populations than did the tundra covered areas. Observations made

over the past five years while working in the area suggest that fewer archaeological sites are found in the forested locales simply because reconnaissance level survey techniques are less effective in areas of heavy surface cover. This situation is exemplified by the fact that more sites are located in forested areas that have experienced wildfire burns within the last 40 years than in areas without recent burns. When relying on surface survey techniques, it is much easier to locate archaeological sites when most of the understory as well as the trees have been burned off. By the same token, it is suspected by this investigator that recently burned areas were much more attractive to aboriginal populations in terms of exploitation because such locales were easier to operate in and supported greater than average subsistence resources. In many site locations which are now at or near climax growth conditions, it is obvious that the occupation of the site would logically have had to occur following a wildfire or before the forest was established in the area, roughly 6,000 years ago.

A total of 47.5 square miles of tundra environment were surveyed in the northeastern quadrant of the park and preserve, and 241 archeological sites were located. This reflects a site density of 5.07 sites per square mile. Of these sites 99 or 40.2% were culturally identifiable. In common with the forest to the south, two-thirds of these sites are less than 300 years old and, generally, are more easily located because they exhibit greater

surface exposure than the older sites. A good cross section of area was surveyed in this region and the collected data is sufficient to generate a reasonable picture of past human use of the area as well as produce a credible predictive model applicable to the unsurveyed areas in the northeast sector of the park. However, due to physiographic differences these data are not necessarily applicable in the northcentral and northwestern regions of the park.

In the forest approximately 95% of the archeological sites are not culturally identifiable while in the tundra area the total of culturally unidentifiable sites is approximately 59%. The main reason for the marked difference is that the cultures which have dominated the northern Brooks Range for roughly the last 5,000 years have several common lithic tool types or features that are diagnostic on the culture, complex, or tradition level. Conversely, the aboriginal cultures that most commonly utilized the forested southern flanks of the Brooks Range produced fewer diagnostic artifacts or features of the type that have a chance of being recognized during a reconnaissance level survey.

Diagnostic artifacts and features are much more common among the cultures of the Eskimo Continuum than any other cultural group found in the general Brooks Range area and, indeed, the vast majority of culturally identifiable sites are found in the region where these cultures are dominant. In fact, our data suggests

that the distribution of Eskimo Continuum sites is almost eighteen times greater in the tundra environment than in the forest. The cultures of the Eskimo Continuum as used during the project by this investigator include the Denbigh Flint Complex, Choris, Norton, Ipiutak, Late Prehistoric Eskimo, and Nunamiut Eskimo.

The distribution of the sites representing older traditions is of interest in that they are fairly evenly divided between the forest and tundra regions. Of the six American Paleo-Arctic sites that were located in the park and preserve by this survey, three were found in each region. Further, five of the six sites were located on high prominent hills that provided long range panoramic views of the surrounding area. Of the six Northern Archaic sites that were found during the survey, two were encountered in the forest while four were located in the tundra region.

Obsidian

Obsidian tools or chipping detritus were found in 187 of the 626 sites described in this report. Although these numbers indicate that almost 30% of the sites have obsidian present, the distribution is not consistent parkwide. Of the 385 sites located in the southern forested area of the park, 171 or 44.4%

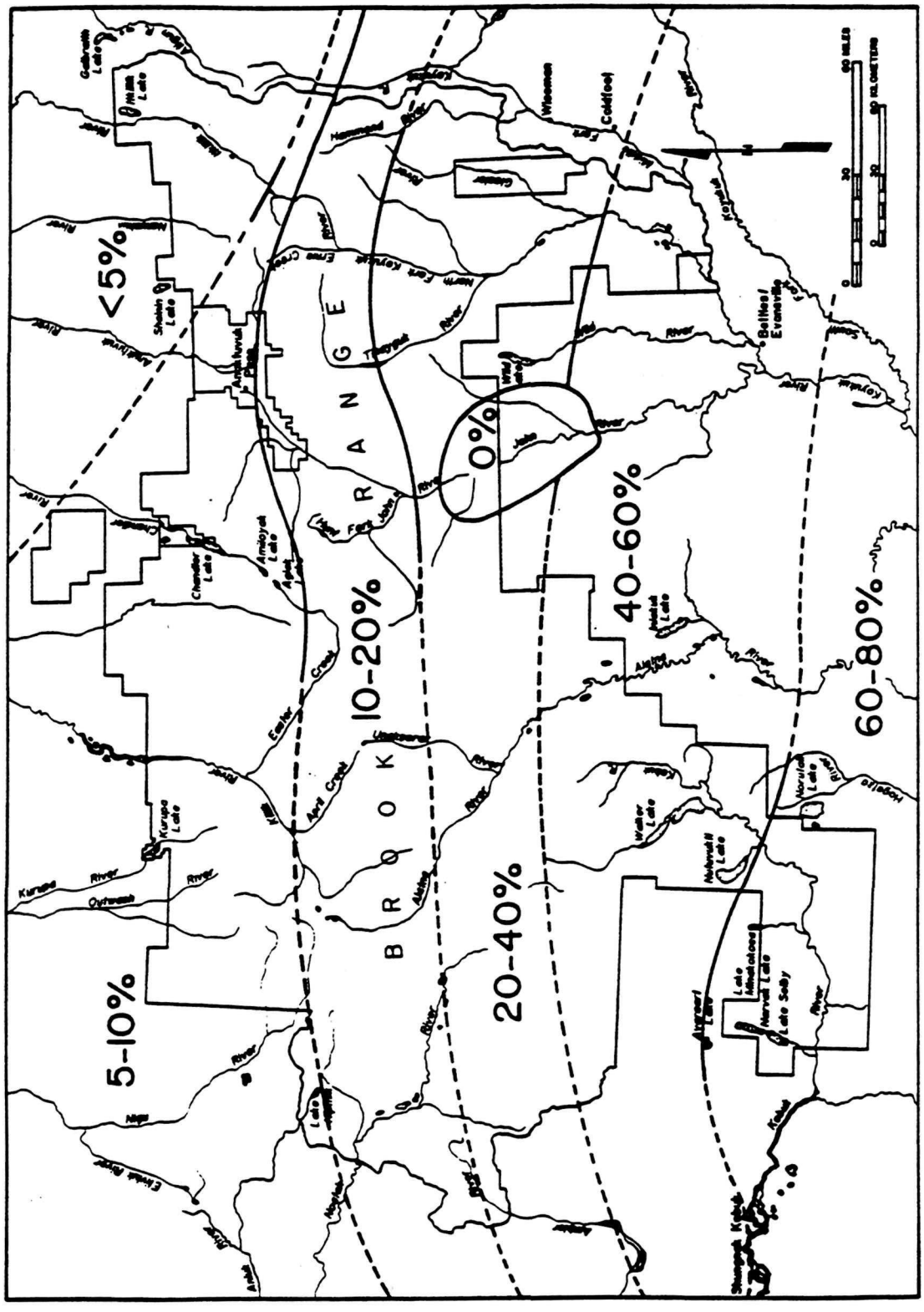

Figure 11. Obsidian Presence: One interpretation of obsidian presence within Gates of the Arctic National Park and Preserve. Based on percentages of sites containing obsidian noted in the fifteen summary tables.

contain obsidian. On the other hand of the 241 archeological sites which were located in the northern tundra area only 16 or 6.6% contained obsidian. Survey-wide, 91.4% of the sites with obsidian lie in the forested southern area while only 8.6% are found in the tundra region. These numbers produce a ratio, south to north, of about 10.5:1. Even when a projection is made to equalize the area surveyed/site density the ratio is still about 6.5:1. The apparent reason for the high differential in the ratio is site distance from the obsidian source.

The only known source of obsidian in interior northern Alaska is located at Batza Tena, near the village of Hughes on the Koyukuk River about 60 miles south of the park's southern boundary. As indicated by the Survey Results tables, the frequency per survey area of sites with obsidian decreases as distance from the obsidian source increases. Although this situation is certainly not surprising, it is interesting to note certain changes in the physical form of the obsidian as the sites get farther from the source area.

Along the southern boundary of the park and preserve, sites with obsidian usually contain a considerable amount of chipping detritus, much of which exhibits cortex. The presence of cortex suggests that the obsidian was transported to the site(s) primarily in unaltered cobble form and that the cobbles were reduced to tool form on site.

In sites further to the north, but still well south of the Continental Divide, obsidian is quite common. These sites typically contain less chipping debitage and only rarely do the waste flakes display cortex, suggesting that the vast majority of the obsidian is being transported from the source area to the site(s) as pre-forms or blanks. Since the blanks/pre-forms are partially reduced cobbles, the outer layers of material have been removed so that little cortex remains. Therefore when they are reduced on-site to their final tool form, the resulting chipping detritus displays little or no cortex material. Again, this situation appears to be a function of distance from the source area to the site. In this instance the distance is great enough so that carrying the extra weight of cobbles is prohibitive, but transporting partially completed tools in the form of pre-forms or blanks is still productive.

On the north side of the Brooks Range only one site out of every fifteen contains obsidian while on the south side slightly less than one site out of two contain obsidian. Of added interest is the fact that the obsidian found in the northern sites is usually in the form of finished tools. Only rarely, and then usually only in the case of large sites, are obsidian waste flakes found. Again, this is apparently a function of the distance between the source area and the site. Sites on the north side of the range are more than 150 miles from the source area. Evidence suggests that aboriginal people considered this too far to transport

obsidian in any form other than completed tools. In other words, the weight of cobbles or pre-forms outweighed their material value and therefore only rarely was obsidian transported in those forms that distance. This has been graphically pointed out through the excavation of several large sites in the area. At Mosquito Lake (Kunz 1977), of the roughly 300 formal lithic artifacts that were recovered from the site only fifteen were obsidian and of the more than 35,000 waste flakes that were recovered none were obsidian. At the Bateman Site on Itkillik Lake (Reanier in preparation) less than 3% of the formal lithic artifacts were of obsidian and less than .001% of the lithic debris was obsidian. Additionally, this evidence suggests that groups residing between the people living north of the range and the obsidian source area were trading finished obsidian tools to the northern people, or that the northern inhabitants were sending parties south to manufacture obsidian tools and return north with them.

Brief Cultural History of Sites[7]

The purpose of the following is to present a short written summary of the sites found during this survey of Gates of the

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[7]While the paragraphs or sentences describing the sites used by the project have had little editing done to them, many of the connecting paragraphs are paraphrased from the earlier section on cultural history.

Arctic National Park and Preserve and the 1976 Itkillik Lake Survey which are included in this part of the report in the framework used by this project.

American Paleo-Arctic

As mentioned, this tradition began at least 12,000 years ago when immigrants, probably in small groups, crossed the Bering Land Bridge from Asia into Alaska. Within the confines of the park and preserve, six archaeological sites which date within this period of early peopling of North America have been found or used by this project. Their placement in this category is based upon artifact typology/morphology, usually fluted, lanceolate projectile points, one of which is supported by an obsidian hydration date of about 12,500 years B.P. These sites appear to be randomly scattered across the areas that have been surveyed and seem to indicate an area-wide settlement pattern. They tend to be small sites with good views of the landscape supporting the contention that these were small, non-sedentary groups whose subsistence was primarily hunting.

Northern Archaic

About 8,000 years ago and lasting until 3000 or 4000 years ago, a

different tradition or culture, termed Northern Archaic appears in this region. While in other areas south of the Arctic and sub-arctic, this time period is accompanied by profound changes in the environment, in these northern regions, including Gates of the Arctic, the only apparent major changes are the final extinction of Pleistocene megafauna and the boreal forest reaching its northern limits about 6000 B.P.

A total of six sites belonging to the Northern Archaic tradition were found in the park and preserve. Of these six sites, five were identifiable on the cultural level as Tuktu/Palisades (Giddings and Anderson 1986). The remaining site was placed in the Archaic time period by an obsidian hydration date rather than by diagnostic artifacts. Four of the Tuktu/Palisades sites lie in the northern tundra while one lies in the forested southern region. The Archaic period site which was assigned to that period through obsidian hydration analysis also lies in the forested region of the park.

Within the park and preserve the main difference between the American Paleo-Arctic and Northern Archaic period sites seems to be an increase in size through time along with an increase in artifacts and chipping debitage. Geographically, the sites are distributed parkwide as was the case with the American Paleo-Arctic sites, and indicate a hunting lifestyle, but their somewhat larger size suggests perhaps a larger regional

population, or at least a more territorial population. The similarities between the two traditions, though, are greater than the differences, producing a strong link of commonality. Site locations and site type are the most typically shared elements. From the northern fringes of the boreal forest north through the Brooks Range and out onto the North Slope the sites belonging to these two temporal/cultural periods are, with one or two exceptions, short term hunting camp/lookout sites. It is not until the south flank of the Brooks Range is reached in the Koyukuk, Kobuk, and Jim River valleys that larger sites suggesting repeated use are often found. The reason for the existence of larger and more complex sites of this time period south of the mountains may be associated with winter living. For people limited by stone-age technology, winter survival in the Arctic forests is difficult but is easier than survival on the northern tundra.

The Eskimo Continuum

The Denbigh Flint Complex. The differences manifested by the Denbigh Flint Complex as the parent culture of the Eskimo Continuum demonstrate a dramatic change from the cultural similarities of the American Paleo-Arctic and Northern Archaic Traditions. Beginning 5000-4000 years ago, developments occur in technology, environmental exploitation, and social organization

which are visible in the archaeological sites of this time period located and used by this survey.

While many of the sites are small, short-term camps, similar to the sites of the preceeding periods, other site types now become apparent. Large, long term and often-used spring-summer-fall Denbigh camps have been found in the Brooks Range and on the North Slope. One of the sites found during the 1985 survey is an extremely large site of this type, more than 8000 meters square, located in the park on the shore of Lake Kipmik. Unfortunately, none of the over-wintering sites with semi-subterranean houses dating to this time period which are found in the forested Alaskan interior were encountered by this survey. Ten Denbigh sites were found in the surveyed areas of the park and preserve, and range in size from the huge camp at Lake Kipmik to a small camp/lookout on the North Fork Koyukuk River. Of these ten sites, eight are located in the northern tundra and two in the forest.

Choris. No sites relating to the Choris culture or time period were located during the Cultural Resources Inventory project.

Norton. The next culture of the Eskimo Continuum, Norton, is not represented by any sites in the park and preserve, including those from this survey, although such sites are known

to occur only a few miles from the park. Unless this project's investigators were sure of a site's culture affinities no cultural designation was assigned and the site was placed in the category of "culture unknown." There is an excellent chance, however, that were additional work done at some of the sites located in the northern tundra region of the park, several would prove to be Norton or Ipiutak sites.

Ipiutak. Both Norton and Ipiutak sites have a reasonably good distribution across the Alaskan Arctic interior. However, Norton sites do not seem to occur as often as sites of the Ipiutak culture. Although only one Ipiutak site is recorded in this document, others are present in the park. The single Ipiutak site, found during 1976, lies on the shore of Itkillik Lake and consists of the remains of a single semi-subterranean house. Because the site was slowly being destroyed by wave action, it was excavated as a dissertation project in 1985, and the resultant document should be the definitive work regarding Ipiutak over-wintering sites in the Brooks Range (Reanier in preparation).

Late Prehistoric Eskimo. Although late prehistoric Eskimo sites are relatively common throughout interior Arctic Alaska only two sites were recorded in the park and preserve during this survey. One of these sites, a short term camp, lies above treeline on the upper reaches of the North Fork Koyukuk River and

has been assigned to the late prehistoric Eskimo culture based on artifact topology and a radiocarbon date. The other site lies on the shore of Lake Kipmik and is a typical over-wintering site composed of several semi-subterranean houses. There are several other sites in the Lake Kipmik area that are quite probably assignable to the late prehistoric Eskimo culture, and they appear to be over-wintering sites, but further work needs to be done before a cultural designation can be made.

Nunamiut. Nunamiut Eskimo is the last of the Eskimo Continuum cultures. As an archaeological culture, it appears to occur from three hundred to roughly 35 years ago. The direct descendents of the prehistoric Nunamiuts still reside in the area. One of the hallmarks of Nunamiut culture was a shift in winter-time settlement that consisted of a shift away from semi-subterranean houses along lakes in favor of ivruliks or moss houses built in willow patches along tributary streams. During the rest of the year, and perhaps occasionally during the winter also, they lived in caribou skin tents. Although tool types remain relatively the same, this change in winter living may have been accompanied by, or resulted from, a shift in subsistence exploitation methodology.

As a result of this survey, and the 1976 Itkillik Lake survey, 69 Nunamiut Eskimo sites have been identified. These range from stone meat caches, drive lines, and shooting blinds to multiple

or single ivrukiks and tent rings. The vast majority of Nunamiut sites, 67, occur in the northern tundra area, while the remaining two sites are located in the forested region of the park.

Kavik

Certain archaeological sites, known as Kavik sites, which fall late within the Eskimo Continuum time frame, exhibit a different style of lithic technology. These artifacts are more properly associated with Athabaskan sites found further south, and, indeed, may have been made by Kutchin Athabaskans or their ancestors who reportedly lived in the park and preserve regions until the mid-nineteenth century. A single Kavik site was located during the 1976 survey on the outlet of Itkillik Lake in the tundra covered country along the north flank of the Brooks Range. While there are undoubtedly other Kavik sites in the region, none was encountered during the rest of the project.

Euro-American

Only eleven sites representing historic exploration or mining, or more recent encampments are included as part of this report. The two volume Historic Resources Report written by historian William Brown (1989) addresses the historic themes and the sites relating

to them for that part of the Gates of the Arctic National Park and Preserve Cultural Resources Inventory Project.

Closing Statement

The baseline cultural resources work in Gates of the Arctic National Park and Preserve cannot be considered complete. As is readily apparent from the preceding pages, the most basic steps, a discovery survey and site inventory, have been conducted in only a portion of the park. Many more years of work including fieldwork and write-up are necessary before a survey and inventory of the various physiographic regions can be adequately completed or the data understood. Although the archaeological research which has been conducted in the park to date is incomplete and of a preliminary nature it has indicated that the park possesses the potential to answer key questions in regional prehistory.

Straddling the Central Brooks Range, the park encompasses what is generally considered to be the traditional territory of the Nunamiut Eskimos, the area between the Killik River on the west and the Itkillik River on the east. Obviously, if the mysteries of pre-contact Nunamiut culture history are ever to be unraveled it will have to be done by the excavation of sites within the park. Similarly, the park is located in the heart of the area

which was utilized by the inland ancestors of the Nunamiut, the earlier cultures of the Eskimo Continuum, particularly the Denbigh Flint Complex people. It would be of extreme value in determining coastal versus inland orientation of these archaeological cultures to excavate several large sites which lack semi-subterranean dwellings. Several locations at which such research could be conducted have been discovered in the park, and additional locations may be found when the survey work is continued. Additionally, the excavation of a large Denbigh site at which numerous occupational events occurred, should produce data that will shed light on the circumstances of this culture's sudden appearance in the region.

There is also a desperate need for more information concerning the American Paleo-Arctic and Northern Archaic traditions if we are ever to gain insight into the lives of these earliest Alaskan residents. Sites, usually small, representing these early traditions are only occasionally found, and in the case of American Paleo-Arctic sites, often nothing more than the location of an isolated diagnostic artifact such as a fluted projectile point. Continuing and completing the survey and inventory in the park could result in the discovery of additional and much needed information from these poorly represented time periods. Based on previous work, the potential for locating such ancient sites in the park and preserve appears to be quite good. Two sites which appear to represent the American Paleo-Arctic tradition and

which, from preliminary investigations seem to be large enough to produce valuable data, were found in the southeastern portion of the park. Additionally, the two oldest radiometrically documented sites in the Brooks Range, the Gallagher Flint Station (Dixon 1977) and the Putu Site (Alexander 1973, 1987), lie within twenty miles of the northeast corner of the Itkillik Preserve and the third oldest similarly documented site, the Mesa Site (Kunz 1982), lies within six miles of the northwest corner of the park.

Obviously, there is a vital need for more information concerning regional prehistory, and the potential for obtaining that information within the park and preserve is high. Therefore, the problem which must be addressed is: What is the best way to accomplish the task? The most logical method would be that following the completion of a Phase I survey and inventory in the park and preserve certain sites should be selected for Phase II testing. Those sites which, after testing, demonstrate a potential for supplying data that would begin to fill in the gaps and answer important questions in regional culture history would then be excavated. The extremely limited archaeological data base from interior Arctic Alaska is proof of the need to conduct such research.

While some well organized, discovery survey work has been conducted in Arctic Alaska over the past two decades, the bulk of the archaeological fieldwork during that period has been

undertaken in response to specific impacts such as construction of the Trans-Alaska oil pipeline, exploration of the National Petroleum Reserve-Alaska, and development associated with Red Dog Mine. In each of these cases, the work was mitigation-oriented and the location of the archaeological work was determined by the construction project. Selection of sites for formal excavation was based on the possibility of site impact or destruction by construction or drilling operations if left unexcavated; sites were not selected for excavation according to their potential to answer the important questions of regional culture history. Only rarely during the last twenty years has an archaeological site been located, investigated, or excavated in Arctic Alaska for scientific rather than mitigative reasons.

In interior Arctic Alaska, an area exceeding 100,000 square miles, perhaps as few as ten truly definitive archaeological sites have ever been formally excavated and documented. The majority of prehistoric archaeologic cultures which have been recognized in the Arctic have been defined at coastal sites, and little data is available regarding the inland adaptations of these cultures, or the possible existence of exclusively inland peoples. The few archaeological "type sites" discovered in the interior Arctic, such as Putu (Alexander 1973, 1987), Tuktu (Campbell 1961, 1962a, 1968), Kavik (Campbell 1961, 1962a, 1968), Mesa (Kunz 1982), and Gallagher Flint Station (Dixon 1971), exist primarily as isolated cases with little or no areal or regional

corroboration other than a scattering of untested sites which have been found as a result of the limited survey work of the past twenty years.

The archaeological cultures of interior Arctic Alaska are at best vaguely defined, a circumstance which up to this point in time was largely due to the remote location and vast size of the area. Indeed, without the enormous scale and almost endless resources of past construction and exploration projects which supported 90% of the archaeological fieldwork conducted in the region from the late 1960s through the early 1980s, the archaeological data base for the region would be practically non-existent. However, the opportunity presently exists to greatly improve this situation.

The founding directive for Gates of the Arctic National Park and Preserve in 1980 included a mandate for survey, inventory, and study of the park's cultural as well as natural resources. For the first time since the Euro-Americans began exploration of Alaska's Arctic interior, the planned, long-term, hands-on, active management of an enormous tract of land dedicated to conservation, preservation, and research while providing recreational opportunities, was established. The creation of the park and its management by the National Park Service can allow research to be conducted in this region without the limitations of a mitigative orientation and, as a result, greatly increase the scientific data base for the interior Arctic. The park and

preserve, along with its management personnel, physical plant, and logistic support capabilities could provide both the forum and infrastructure for conducting research for reasons of scientific inquiry and management application. The establishment of the park made obvious a tremendous need for scientific research in interior Arctic Alaska, and complementing this need, its creation provided the vehicle by which this research could be accomplished with greater ease and more cost effectiveness than ever before. Not since the pioneering efforts of the Naval Arctic Research Laboratory, which, in the 1950s and 1960s promoted and supported scientific research in the Alaskan Arctic, has the potential for conducting a variety of scientific investigations been developed. The capabilities of the park to conduct and support archaeological investigation should not be left untapped, especially in view of what the data from that continuing research would mean to the understanding of the culture history of the region.

In terms of the regional archaeology and culture history, the surface of Gates of the Arctic National Park and Preserve has barely been investigated. Most of the region's definitive archaeological work was conducted prior to 1965. Few large or major archaeological sites have been formally excavated and documented in interior Arctic Alaska in the last dozen years although sites that can provide answers to problems exist and can be located. There are answers to be found in the park; answers

to important questions of regional culture history that, for a variety of reasons, are unlikely to be found elsewhere in interior Arctic Alaska. In the interest of science, as well as interpreting the culture history of the park both for visitors and the resident descendants of the park's prehistoric inhabitants, these answers should be actively sought.

APPENDIX I

Vegetational History of Gates of the Arctic National Park and Preserve

By Patricia M. Anderson

During full glacial times (24,500 to 14,000 yr B.P.), the landscape of the park differed markedly from that of today. Large glaciers dominated the mountains and bordering valleys of the Brooks Range (Hamilton 1986). Mean annual temperatures were cooler and conditions very much drier. There may have been a larger number and greater diversity of herd animals living along the flanks of the Brooks Range (Guthrie 1982). Certainly the kinds, if not the amount, of animals that roamed the park (e.g., bison, mammoth, horse) during these times differed greatly from those seen today.

Pollen assemblages that date to this time are unlike any produced by modern vegetation, thus making vegetational reconstructions difficult. These assemblages are dominated by herb pollen, especially sedges (Cyperaceae), grasses (Gramineae), and wormwood (Artemisia) with trace amounts of other herb pollen and small amounts of willow (Salix) pollen. The current interpretation of the western and central Brooks Range pollen data suggests that upland sites beyond glacial margins supported a very sparse,

polar desert (Barnosky et al. in review). In lower elevations where effective moisture, temperature, and shelter were greater, a more continuous vegetation cover probably existed. This meadow-like herb tundra was likely the focus of animal activity, providing them with a relatively abundant food source and easy access to water. It is equally probable that river valleys were the focus of human activity, although as yet no sites have been dated to this time period in northern Alaska.

Between 14,000 and 13,000 years ago, a dramatic change in vegetation occurred throughout northern Alaska. The herb meadows were invaded by shrub birch (Betula nana/glandulosa), and the appearance of heath (Ericales) pollen and moss (Sphagnum) spores suggest that shrub tussock tundra was common in better drained areas of the valley lowlands and surrounding hillsides. Shrub birch apparently did not recolonize higher elevation sites until approximately 12,000 years B.P. This local asynchrony may relate to differences in the timing of local deglaciation and/or distance from ice-age refugia of shrub birch. Evidently, the change in vegetation and climate, coupled with a major alteration of the landscape from an even, relatively hard-packed substrate to a wetter tussock-dominated one was sufficient to cause the extinction of the full-glacial fauna. Major changes in global climate, in particular a postulated plunge in winter temperatures, also were important in causing additional stress on animal populations and eventual extinction of those that could

not adapt to the new environments (Barnosky et al. in review). If human populations were present in the area at this time, they, too, would have needed to adapt to declining food supplies and severe winter climate.

At 11,000 years B.P. populations of poplar (presumably balsam poplar, Populus balsamifera) increased. The spread of poplar has been attributed to increased summer temperatures and/or the increased availability of disturbed ground as a result of greater spring floods or greater aeolian activity (Brubaker et al. 1983). I think that although their precise distribution on the land is unknown, if floods played a major role in the distribution of poplar, these trees were probably limited to river courses. Ager and Brubaker (1985), however, have suggested that a more probable characterization of the vegetation at this time would show broad areas of poplar-willow scrub forest. Balsam poplar populations declined about 9000 years B.P. reflecting decreased summer temperatures, reduced spring floods, or widespread development of organic soils poorly suited for poplar growth (Brubaker et al. 1983). The rise and decline in poplar populations likely had little effect on subsistence resources, but the trees would provide a ready source of building material and fuel for human inhabitants.

Prior to 9000 years ago, there was little variation in vegetation between eastern and western areas of the park. Important

differences become evident with the development of the modern boreal forest between 9000 to 7000 years B.P. Pollen data from a lake near Wiseman indicates the arrival of spruce around 8500 years B.P., whereas a continued presence of spruce is not evident in the Walker Lake area, 100 miles to the west, until around 6000 years B.P. (Brubaker et al. 1983; Edwards et al. 1985). Data from the Kiana area show that spruce was absent from the lower reaches of the Kobuk River until 4000 to 5000 years ago (Anderson 1985) and suggest an east to west migration of spruce across northern Alaska. The pattern of alder migration, however, seems to be opposite in direction from that of spruce. Alder is first evident in the Kotzebue Sound region by 9000 years B.P. and appears to migrate eastward across the southern flanks of the Brooks Range, recolonizing the park area by 7000 years B.P. (Anderson 1982).

If different archeological cultures or traditions are related to different ecological systems as suggested by Anderson (1968), then an east-west component of change should be visible in the archeological record. The period between 9000 and 7000 years B.P. is a time of relatively fast vegetational change. The altered landscapes probably had significant impact on subsistence resources, in particular caribou and species that inhabit the boreal woodlands, that in turn would have affected human subsistence strategies.

In addition to the broad change from shrub tundra to mixed forest-tundra, interesting differences in amounts of spruce and alder occurred between 9000 to 3000 years B.P. Increased percentages of spruce pollen near Walker Lake may indicate that the treeline was located this far west as early as 8500 years B.P. (Anderson unpublished data; Brubaker et al. 1983). Then, trees were either absent or sparsely dispersed in this area between 8000 to 6000 years B.P. This postulated retreat of the treeline is the first major palynological evidence for the presence of cooling after a post-glacial thermal maximum, an event that is well documented in northwestern Canada (Ritchie et al. 1983). In the western and central Brooks Range, percentages of alder pollen (and presumably populations of alder) increased to a maximum by 6000 years B.P. and achieved their modern pollen frequencies by 3000 years B.P. (Anderson 1982). This change in alder appears to correspond to changes in precipitation through the mid-Holocene with a precipitation maximum occurring at 6000 years B.P. (Barnosky et al. in review).

Vegetational change over the past 3000 years is poorly documented. Current palynological research at Itkillik and Etivlik Lakes is attempting to correlate minor fluctuations in the pollen record with neoglacial activity in the Brooks Range.

APPENDIX II

Obsidian Hydration Chronology[8]

By Richard E. Reanier and Michael L. Kunz

Introduction

A large majority of archeological sites recorded by the Gates of the Arctic National Park and Preserve Cultural Resource Inventory Project are shallow surface sites without associated radiocarbon-dateable organic materials. Estimates of site age can be made by typological comparisons with other dated assemblages, but sites often lack suitable diagnostic materials. At the inception of this project we realized that the common occurrence of obsidian in Brooks Range sites made it feasible to use obsidian hydration dating to gain chronological control over many of the sites independent of typological comparisons.

In this project's first report, "Upper Kobuk River Drainage Archaeology" (Kunz 1984), a number of hydration measurements were given and a hydration rate for the South-central Brooks Range was developed. Since the 1983 report was released a number of revisions were included in the 1984 report (Kunz 1985) and dealt

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[8]Revised from: Cultural Resource Survey and Inventory in Gates of the Arctic National Park compiled by Michael L. Kunz 1986.

mainly with effective hydration temperatures and recalculation of the hydration rate. Additionally, some of the hydration rind measurements in the 1983 report were in error and we suggested that the measurements in that report be disregarded. The data in this chapter reflect our calculations based on newly acquired thermal cell and radiometric data and a discussion of what our data have determined to be the most critical factors in the implementation and use of obsidian hydration dating method.

The Dating Method

The obsidian hydration dating method is based on the phenomenon that freshly exposed glass surfaces become coated with a thin layer of water which then begins to diffuse into the glass surface. In optical thin section the thickness of the hydration rind is visible under crossed polarization as a bright birefringent band produced by strain resulting from incorporation of water into the glass. In plain light the inner boundary of the hydration rind is marked by a thin, dark line indicating a change in the refractive index of the glass. Under high magnification the thickness of the hydration rind can be measured with various kinds of ocular micrometers. Since the thickness of the hydration rind increases with age, suitable calibration of the rate of hydration results in a means of determining the age of manufacture of a given artifact, the time since the fresh

obsidian surface was exposed.

Obsidian hydration dating became a useable archeological dating technique with the publication of Friedman and Smith's classic 1960 paper in American Antiquity. Earlier, Ross and Smith (1955) reported hydration rinds on natural obsidian surfaces. Friedman and Smith (1958) later observed that deuterium levels in hydrated volcanic glass were similar to that of meteoric water, whereas levels in unhydrated glass resembled those of the original magma. This demonstrated that water in hydration rinds came from the local surface environment. In the 1960 paper, Friedman and Smith first determined that dated archeological obsidian samples had hydration rinds and that their rind thicknesses increased with age. They examined variables that potentially controlled rates of hydration and concluded that relative humidity is not important; the strong affinity of glass surfaces for water results in a thin layer of water on glass surfaces even at low humidity levels. Temperature is important because hydration is a diffusion process, and rates of diffusion are temperature dependent. Importantly, Friedman and Smith recognized it was necessary to know the soil temperature regime, and not simply air temperature. The chemical composition of obsidian also proved to be an important variable, with obsidian from different source areas hydrating at different rates.

There are two basic approaches to the creation of an obsidian

hydration chronology. One approach is to measure hydration rinds on a number of obsidian artifacts that have associated radiocarbon dates, and create calibration curves that can be used to date other obsidian artifacts. Another approach is to measure the physical variables that control hydration rates, and to directly calculate rates of hydration from these variables. The second approach has the obvious advantage of being independent of the radiocarbon dating method. This project has used both approaches in the development of a chronology, with the ultimate goal of using only the second approach when sufficient soil temperature data becomes available.

Because the chemical composition of obsidian influences the rate at which the glass hydrates, measurements of the physical constants controlling hydration rates must be done for each obsidian source. Most of the obsidian encountered by this project is from the Batza Tena source in the Koyukuk River Valley (Patton and Miller 1970). Michels and Miller (1983) have experimentally determined hydration rate constants for a number of obsidian sources worldwide, including the Batza Tena source (Michels 1981), by means of induced hydration. In this technique samples of obsidian are hydrated at elevated temperatures in the laboratory for varying periods of time, the induced hydration rinds are measured, and the hydration rate constants are calculated from these data.

Since the hydration of obsidian is a diffusion process (Friedman and Smith 1960) it follows a second order reaction equation:

$$x^2 = kt \qquad (1)$$

where x is the depth to which hydration has progressed in time t, and k is the rate of hydration. Solving for time produces the means of determining the age of an artifact:

$$t = \frac{x^2}{k} \qquad (2)$$

The rate of hydration, k, is given by the Arrhenius equation:

$$k = Ae^{-E/RT} \qquad (3)$$

where A is a hydration constant, E is the activation energy, R is the universal gas constant, and T is the absolute temperature. From the induced hydration experiments of Michels (1981) we know that Batza Tena obsidian hydrates at 7.99 μm^2/day at 473.16 K (200 C) and the activation energy of this obsidian is 79,024 J/mol. However, we need some way to determine the hydration constant, k, at lower environmental temperatures actually experienced by the obsidian. Let k' equal the hydration rate at the lower temperature T':

$$k' = Ae^{-E/RT'} \quad (4)$$

dividing equation (4) by equation (3) and cancelling:

$$\begin{aligned} \frac{k'}{k} &= \frac{e^{-E/RT'}}{e^{-E/RT}} \\ \frac{k'}{k} &= e^{-E/RT'}\, e^{-E/RT} \\ \frac{k'}{k} &= e^{E/RT - (E/RT')} \\ \frac{k'}{k} &= e^{E/R\,(1/T - 1/T')} \\ k' &= ke^{E/R\,(1/T - 1/T')} \end{aligned} \quad (5)$$

Knowing the experimental rate of hydration at a given temperature, the activation energy, and the environmental temperature at which the obsidian artifact has hydrated, we can use equation 5 to determine the rate of hydration of the artifact. Using the experimental Batza Tena data of Michels (1981) where:

$k = 7.99\ \mu m^2\ day^{-1}$

k' = unknown hydration rate of artifact

$E = 79{,}024$ J/mol

$R = 8.317$ J/mol^{-1} C^{-1}

$T = 473.16$ K

T' = temperature at which the artifact hydrated, K

and substituting into equation (5), we have:

$$k' = 7.99\, e^{\frac{79024}{8.317}\left[\frac{1}{473.16} - \frac{1}{T'}\right]} \quad (6)$$

It is conventional to express hydration rates in μm^2 per thousand years, k":

$$k'' = k' \ (365.26 \times 10^3) \qquad (7)$$

Equations (6) and (7) are the means of calculating hydrations rates from temperature data in this report.

Using these equations it is possible to examine the relationship between hydration rate and temperature. Figure 12 shows the exponential nature of this relationship, with hydration rate increasing more rapidly than temperature as temperature rises. There are several implications from this relationship. It is clearly necessary to know temperature precisely, especially at higher temperatures. Errors in temperature estimation will produce a much larger resultant error in hydration rate at high temperatures than at low temperatures. Figure 13 shows the relationship between hydration rind thickness and age for three different effective hydration temperatures. Here again we see that the nonlinear relationship implies that errors in measurement of the hydration rind will cause much greater resultant error in the date, especially at lower temperatures where the slope of the curve increases. The effect of inaccurate temperature estimates is emphasized in this figure; a 2 μm thick rind indicates an age of about 1800 years at 5 C and 6300 years at -5 C.

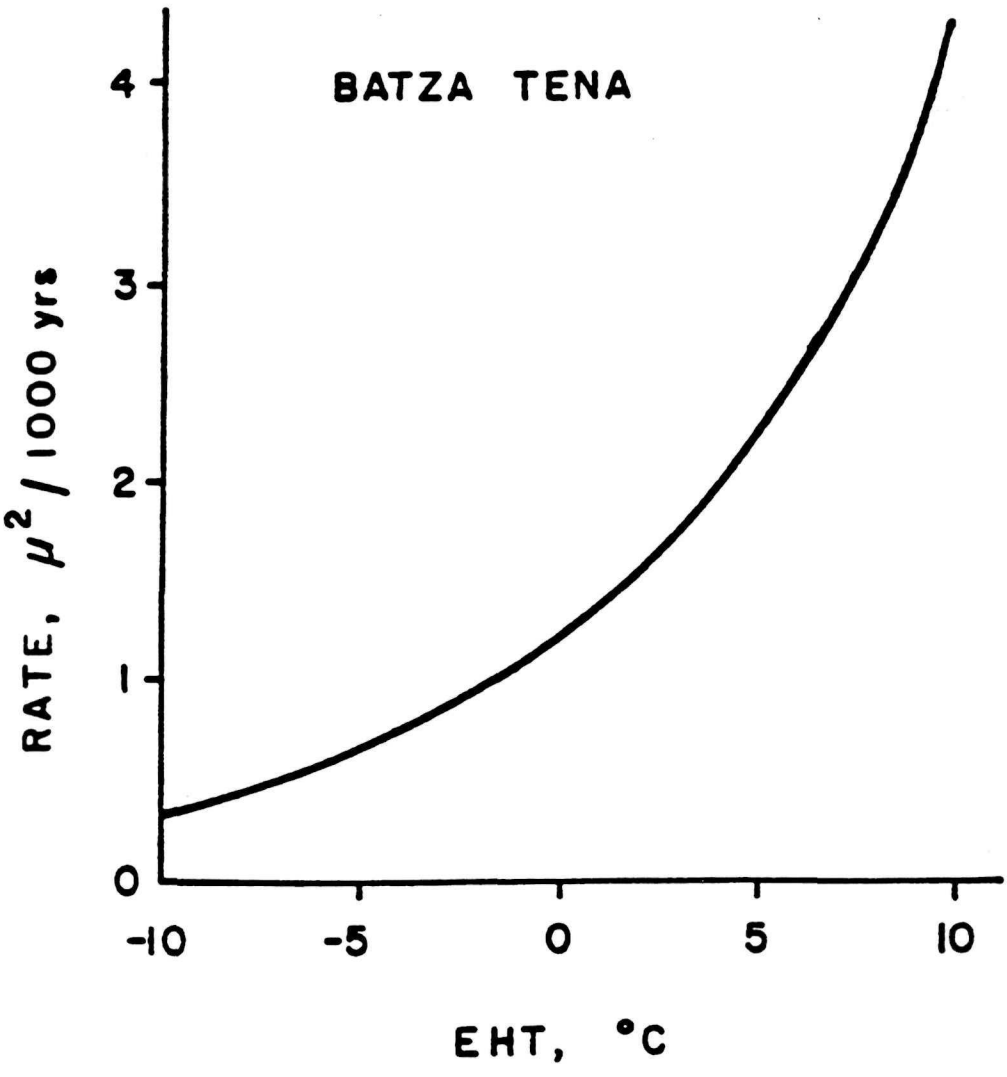

Figure 12. Relationship of EHT and hydration rate.

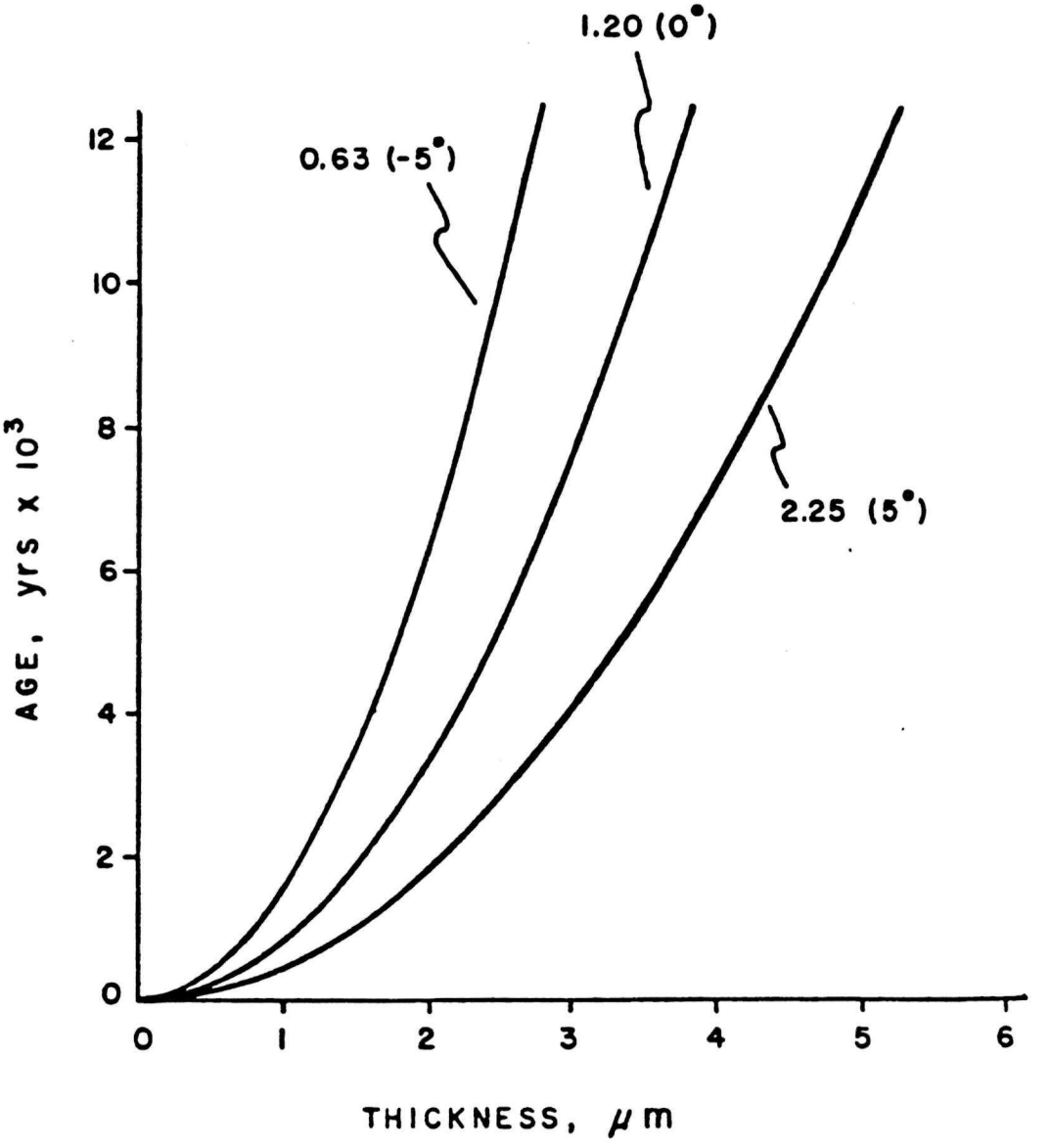

Figure 13. Relationship of hydration rind thickness to age at various temperatures.

The temperature at which an obsidian artifact hydrates is a particularly difficult variable to control. Seasonal temperatures vary, and so the artifact experiences not one temperature but both annual and diurnal fluctuations. The relationship between temperature and hydration rate is nonlinear, so that simple averages of temperature cannot be used. The temperature value required is often referred to as the effective hydration temperature, or EHT. This is an hypothetical constant temperature that would have produced the same amount of hydration as was produced by the varying temperature regime actually experienced by the artifact. EHT can be obtained by integrating annual temperature records, but often temperature records are unavailable for remote site locations.

Simple sensors that can be placed in remote locations are available to measure EHT, and will be discussed later in this report. Where annual temperature records are available an equation derived by Lee (1969) that relates effective temperatures to average temperatures can be used to estimate EHT. This equation is based on effective temperature measurements made by the Pallman technique which uses the temperature dependent sucrose hydrolysis reaction. This reaction has a different activation energy than the obsidian hydration reaction, but the resulting error is negligible (Michels 1983). The equation as reported by Lee (1969) uses effective temperature (T_e) and temperature range (R_T) to predict average temperature (T_a):

$$T_a = -1.2316 + 1.0645T_e - 0.1607R_T \qquad (8)$$

Lee reported the estimate to have a standard error of 1.00 C. Solving the equation for T_e allows us a means to estimate effective hydration temperature given T_a and R_T:

$$T_e = \frac{(T_a + 1.2316) + (0.1607R_T}{1.0645} \qquad (9)$$

Friedman and Smith (1960) observed that soil temperature rather than air temperature data are necessary for use in obsidian hydration dating. Temperature data from Bettles, Alaska, just south of the Park, show the reason for this rather clearly. Table 19 shows the long-term, average air temperatures from Bettles and soil temperatures from various depths for the period 1947 to 1959 collected by the U.S. Army Engineering Office. One striking observation is that because of the insulating effect of snowcover, soil temperatures never reach the extreme cold of air temperatures in winter. In cold northern latitudes temperature estimates for obsidian hydration based on air temperature will be far too cold. This is illustrated by the mean and EHT values. Mean annual air temperature at Bettles is -6.0 C but the EHT calculated with equation 9 is 1.6 C. The mean temperature at the surface of the ground at Bettles is 1.7 C, while the EHT is 5.4 C. EHT is consistently warmer than the mean because of the logarithmic relationship of temperature to rate of hydration. These same data portrayed graphically in Figure 14 show the

BETTLES TEMPERATURE DATA

DEPTH, cm	AIR	0	15	30	60
JAN	-25.8	-4.0	-2.4	-1.6	-0.5
FEB	-23.2	-4.5	-2.9	-2.2	-1.0
MAR	-17.3	-4.2	-3.1	-2.4	-1.6
APR	-6.5	-3.3	-3.3	-2.3	-1.6
MAY	6.0	-0.2	-0.2	-1.2	-1.0
JUN	13.8	7.7	3.6	2.3	0.8
JUL	14.8	12.1	9.7	9.6	7.9
AUG	11.8	13.0	10.7	11.4	10.1
SEP	4.7	7.2	7.9	8.2	8.2
OCT	-7.3	0.5	2.1	2.0	3.3
NOV	-18.3	-1.3	-0.6	0.4	1.0
DEC	-24.7	-2.6	-0.6	-0.9	-0.2
MEAN	-6.0	1.7	1.7	1.9	2.1
EHT	1.6	5.4	4.9	5.1	4.9

Table 19. Temperature Data for Bettles, Alaska. Air temperature data from National Weather Service records. Soil temperature data from U.S. Army Engineering Office records. Values in C.

drastic insulating effect of snow and the characteristic lag of soil temperature annual fluctuations behind those of air temperature. It seems apparent from these data that obsidian artifacts in or on the ground simply never experience the extremes of winter temperature recorded by air temperatures.

The most direct way to measure EHT is by means of thermal cells installed directly in the ground where a given obsidian artifact was discovered. Appropriate thermal cells manufactured by Ambrose in Austraila are commercially available in this country from MOHLAB. Each cell consists of a small plastic container filled with a dessicant. In the field, the cell is immersed in water in a slightly larger glass vial, and the vial is placed in the ground for one year. In operation, water diffuses through the plastic container and is trapped by the desiccant. The cell is weighed before installation and after recovery, and the weight gain together with laboratory calibration of the cell is used to determine EHT.

We installed thermal cells in three archeological sites during the 1984 season (Table 20). The temperature recorded at Lake Selby (HUG-059), 2.04 C, is slightly higher than that calculated by equation (8) from air temperature data at Indian Mountain. At WIS-076, on the Koyukuk River, there is excellent agreement between the two methods probably due to the thin show cover on

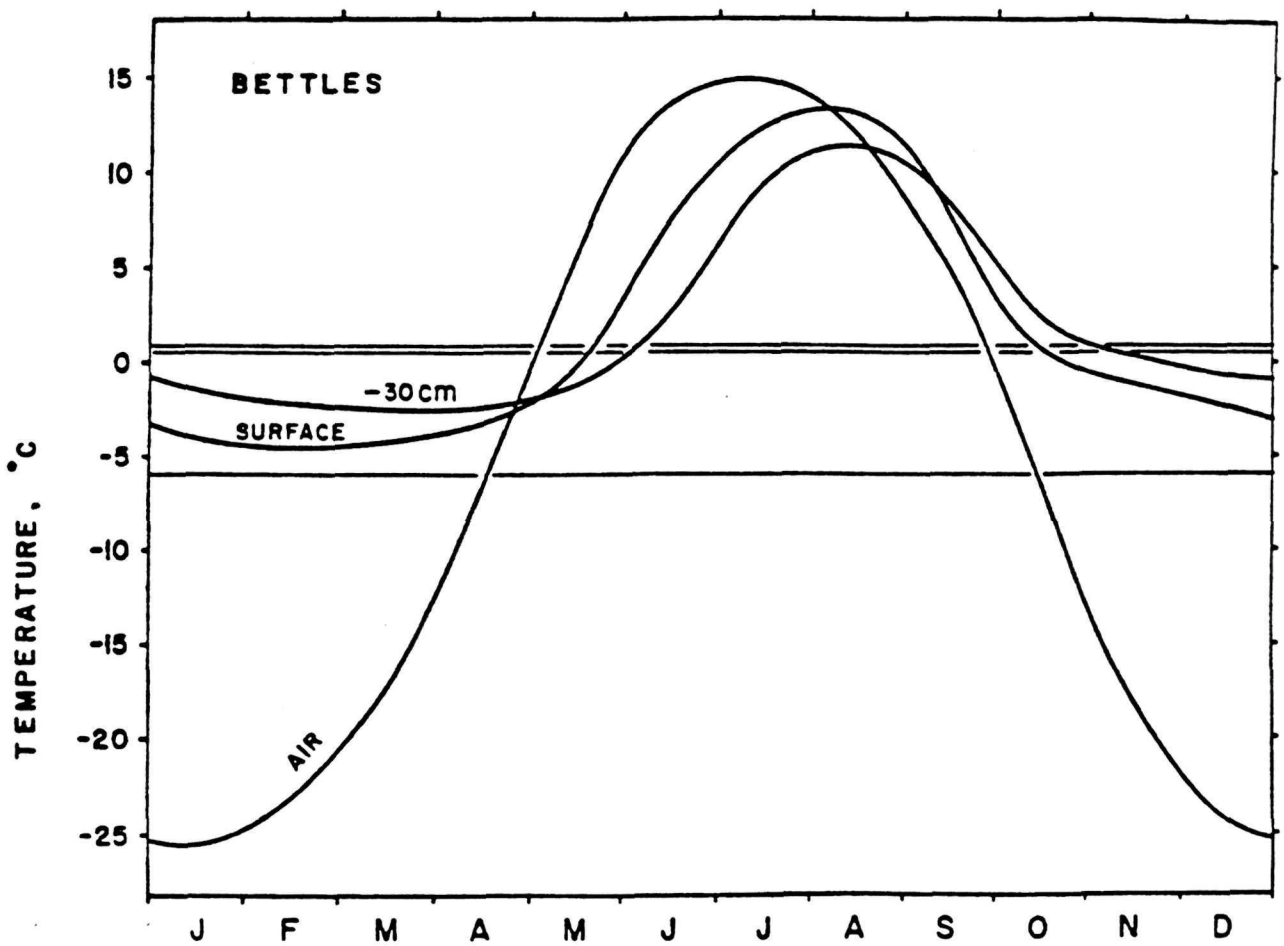

Figure 14. Bettles Air and Soil Temperature Data.

the exposed knob where WIS-076 is situated. The thermal cells show a slightly colder EHT of -0.33 C than does the air temperature record from Chandalar shelf. At Itkillik Lake, thermal sensors installed in the Bateman Site (PSM-138) recorded a much colder EHT of -4.01 C than that calculated from the air temperature record at Galbraith Lake. Discrepancies between in situ EHT measurements and those calculated from air temperature records probably result from such factors as the effect of snow cover that insulates against winter temperatures or the presence of ice-cemented permafrost that may delay summer warming. These results emphasize the need for in situ EHT measurements for accurate hydration dates.

	EHT	
	AIR TEMPERATURE	THERMAL CELLS
SELBY LAKE (HUG-059)	1.6 C	2.04 C
N.F. KOYUKUK (WIS-076)	-0.14 C	-0.33 C
ITKILLIK (PSM-138	-2.2 C	-4.01 C

Table 20. Effective hydration temperatures at three archeological sites.

Application of the Dating Method

With the use of equations 2 and 6, and the in situ EHT measurements we are now able to calculate obsidian hydration dates for several sites in the Brooks Range. At HUG-059, located at Selby Lake in the south Central Brooks Range, we recovered obsidian flakes associated with charcoal during our 1983 fieldwork (Kunz 1984) (Table 21). Hydration rind thickness measured 1.56 ± 0.05 μm and measured EHT at the site is 2.04 C. Using equations (6) and (7), the hydration rate at the site is (coincidentally) 1.56 μm^2/1000 years. Equation (2) produces an age of 1560 ± 100 B.P. Two associated radiocarbon dates average 1730 ± 120 B.P. Applying the dendrochronological correction of Stuiver (1982) the resulting age, 1655 ± 130, is in very close agreement to the hydration age.

At the Bateman Site (PSM-138) on the west shore of Itkillik Lake located at the northern range front of the Brooks Range (Kunz 1976) additional testing was undertaken in 1984 to recover associated obsidian and charcoal samples (Table 22). An average of 23 hydration rind measurements from several obsidian flakes is 1.01 ± 0.14 μm. Measured EHT at the site is -4.01 C. Equations (6) and (7) produce a hydration rate in this cold environment of only 0.72 μm^2/1000 years. Equation (2) produces an obsidian hydration age of 1415 ± 400 B.P. Two associated radiocarbon dates, 1510 ± 90 and 1290 ± 80 become 1440 ± 95 and 1260 ± 90

LAKE SELBY HUG-059

Obsidian flakes 20-30 cm. below surface	
Rind Thickness:	1.56 ± 0.05 μm
EHT:	2.04°C
Hydration rate:	1.56 μm^2/1000 years
Age:	1560 ± 100 B.P.
Radiocarbon dates:	1720 ± 70 1740 ± 100
Corrected dates:	1655 ± 130

Table 21. Obsidian hydration date, Lake Selby, HUG-059.

BATEMAN SITE PSM-138

Obsidian Flakes 40-50 cm. below surface	
Rind Thickness:	1.01 ± 0.17 μm
EHT:	-4.01°C
Hydration rate:	0.72 μm^2/1000 years
Age:	1415 ± 400 B.P.
Radiocarbon dates:	1590 ± 90 1290 ± 80
Corrected dates:	1440 ± 95 1260 ± 90

Table 22. Obsidian hydration date, Bateman Site, PSM-138.

when dendro-corrected according to Stuiver (1982), and are in close agreement with the obsidian age.

Site AMR-041, at Lake Kipmik in the Nigu/Noatak drainages, produced an obsidian microblade and an associated small charcoal sample during the 1985 season (Kunz 1986) (Table 23). The measured hydration rind thickness was 1.68 ± 0.06 μm. Measured EHT at the site is -4.53 C. Again, the use of equations (6) and (7) produce a hydration rate of 0.67 μm^2/1000 years. Equation (2) produces an obsidian hydration age of 4186 ± 300 B.P. An accellerator mass spectrometry radiocarbon date on a small charcoal sample was 3655 ± 85, which becomes 4045 ± 150 when

KIPMIK LAKE AMR-041

Obsidian Microblade	
Rind thickness:	1.68 ± 0.06 μm
EHT:	-4.53°C
Hydration rate:	0.67 μm^2/1000 years
Age:	4186 ± 300 B.P.
Radiocarbon date:	3655 ± 85
Corrected date:	4045 ± 150

Table 23. Obsidian hydration date, Kipmik Lake, AMR-041.

dendrochronologically corrected (Klein et al 1982). Again, the two dates demonstrate excellent agreement.

The Avingak Site, Campbell's type site for the Liva Liva Complex, located at Tulugak Lake north of Anaktuvuk Pass, yielded obsidian flakes from the house fill excavated by Campbell (1962). Hydration rinds from two flakes recovered from the site in 1985 measured 0.95 ± 0.07 μm and 1.18 ± 0.08 μm (Table 24). Since we lack an <u>in situ</u> EHT measurement from this site, we have used the value from Itkillik Lake, -4.01 C, as an estimate, as the areas appear to be climatologically similar. The use of equation (2) produces obsidian hydration ages of 1250 ± 185 B.P. and 1930 ±

AVINGAK XCL-010

Obsidian flakes	
Rind thicknesses:	0.95 ± 0.07 μm
	1.18 ± 0.08 μm
EHT: (Itkillik)	-4.01°C
Hydration rate:	0.72 μm^2/1000 years
Ages:	1250 ± 185 B.P.
	1930 ± 260 B.P.
Radiocarbon date:	1470 ± 80
Corrected date:	1375 ± 100

Table 24. Obsidian hydration dates, Avingak, XCL-010.

260 B.P. A radiocarbon date some 20 meters distant from the flake location was reported by Stanford (Gal 1982) as 1470 ± 80 B.P. This date is 1375 ± 100 B.P. when dendrochronologically corrected. If the date reported by Stanford relates to the same occupation represented by the flakes, and there is little reason to doubt such a relationship, the two dating methods are in good general agreement.

An isolated surface find of an obsidian Tuktu Point from the Tuktu-Naiyuk site (XCL-003) located just north of Anaktuvuk Pass (Campbell 1962) exhibited a hydration rind of 1.85 ± 0.05 μm. Using the EHT from Itkillik Lake results in an obsidian hydration age of 4750 ± 260 B.P. for the projectile point. The dates from Tuktu-Naiyuk localities with side-notched points range from 3000 to 6500 B.P. (Gal 1982) (Table 25), showing general agreement between the dating methods and giving some additional evidence for the antiquity of these side-notched point forms.

Finally, an example from the North Fork Koyukuk River that lacks radiocarbon dating corroboration. At WIS-076, we recovered two obsidian projectile point bases from the surface of the ground. One is from a fluted projectile point and the other is from a nicely collaterally flaked projectile point (Kunz 1986) (Table 26). EHT measured at the site with thermal cells is -0.33 C, resulting in a hydration rate of 1.15 μm^2/1000 years. The hydration rind on the fluted projectile point measured 3.75 ±

TUKTU-NAIYUK XCL-002

Tuktu point on surface		
Rind thickness:		1.85 ± 0.05 μm
EHT: (Itkillik)		-4.01°C
Hydration rate:		0.72 μm^2/1000 years
Age:		4750 ± 260 B.P.
Radiocarbon dates:		
N1	3042 ± 188	3615 ± 217
N2	2576 ± 157	3292 ± 445
N4	5688 ± 183	
T2, T3, T5		6510 ± 610

Table 25. Obsidian hydration date, Tuktu-Naiyuk XCL-002.

0.26 μm, which equates to an age of 12,230 ± 1695 B.P. The collaterally flaked projectile point rind measured 2.38 ± 0.07 μm resulting in an age of 4925 ± 290 B.P. These ages argue strongly for the antiquity of at least some fluted points in the Arctic, and for early occupations by humans of this part of the Brooks Range.

Measurement Error

As pointed out earlier, measurement error, especially where EHT's are low, can lead to large errors in resulting hydration dates. Early in this project we began experiencing difficulties in replicating hydration rind thickness measurements made by a commercial laboratory. This problem led us to split samples between three separate laboratories and compare the results. Initially we requested that the original laboratory (laboratory 1) remeasure slides that seemed to be in error. This resulted in the remeasurement of 39 specimens. Of these, only two agreed to within two standard deviations of the initial measurement, with

NORTH FORK KOYUKUK RIVER WIS-076

Surface finds	
EHT:	-0.33°C
Hydration rate:	1.15 μm^2/1000 years
<u>Fluted point base</u>	
Rind thickness:	3.75 ± 0.26 μm
Age:	12,230 ± 1695 B.P.
<u>Projectile point base</u>	
Rind thickness:	2.38 ± 0.07 μm
Age:	4925 ± 290 B.P.

Table 26. Obsidian hydration dates, North Fork Koyukuk River, WIS-076.

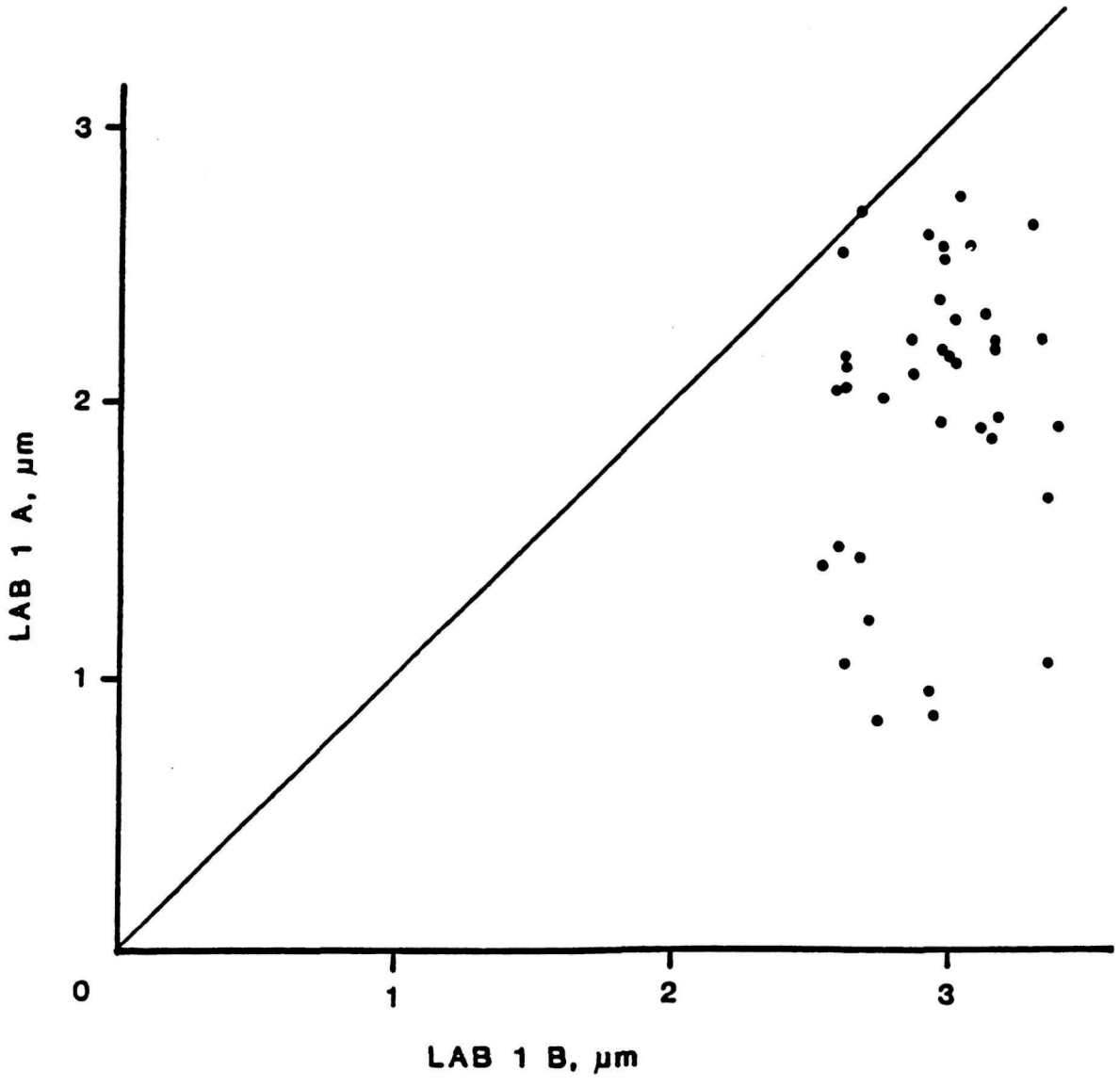

Figure 15. Comparison of remeasurements of hydration rind thickness, laboratory 1.

the mean difference between the two measurement sets equaling 1 μm (Figure 15). The cause for the discrepancy was not given. A comparison of measurements from laboratory 1 with those measured by this project (laboratory 2) produced a similar scatter plot, suggesting a similar cause for the discrepancy (Figure 16).

Comparisons between results from the first laboratory and a third laboratory also show a similar pattern (Figure 17). Finally, a comparison of measurements made by laboratory 2 (this project) and laboratory 3 show, at last, the expected linear relationship with a slope of 1 (Figure 18). However, an unacceptable level of variability remains in the data even in this case. The causes of the measurement error are still unresolved, but appear to be technical in nature. Work is in progress to determine and eliminate the sources of error. For this reason, the examples given in this chapter rely solely on measurements made directly by this project.

Conclusion

The process of developing a regional obsidian hydration chronology for Gates of the Arctic National Park and Preserve pointed out to us several serious problems and shortcomings of the dating method. Errors in measurement of the hydration rind

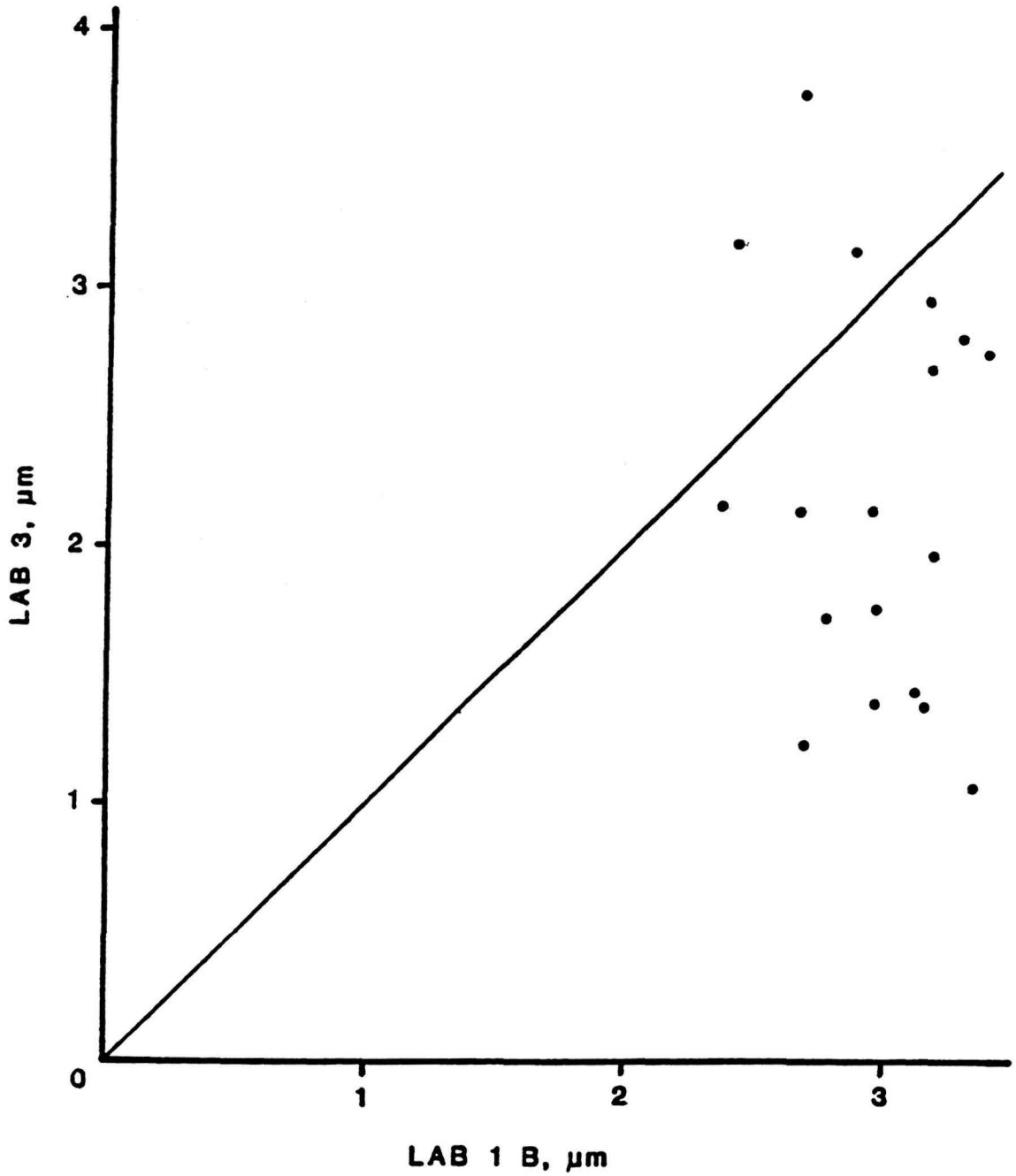

Figure 16. Comparison of laboratory 1 and laboratory 2 rind thickness measurements.

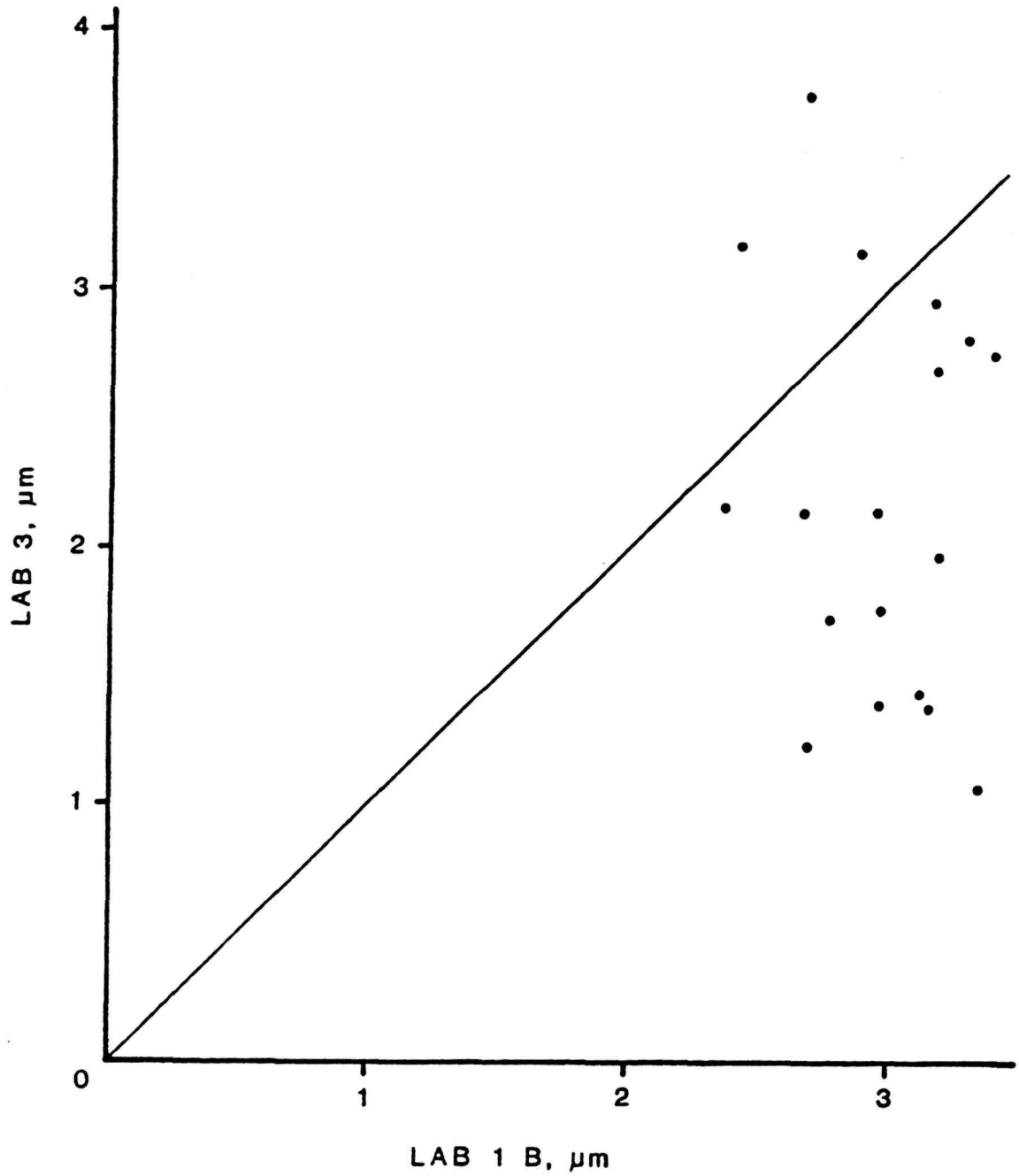

Figure 17. Comparison of laboratory 1 and laboratory 3 rind thickness measurements.

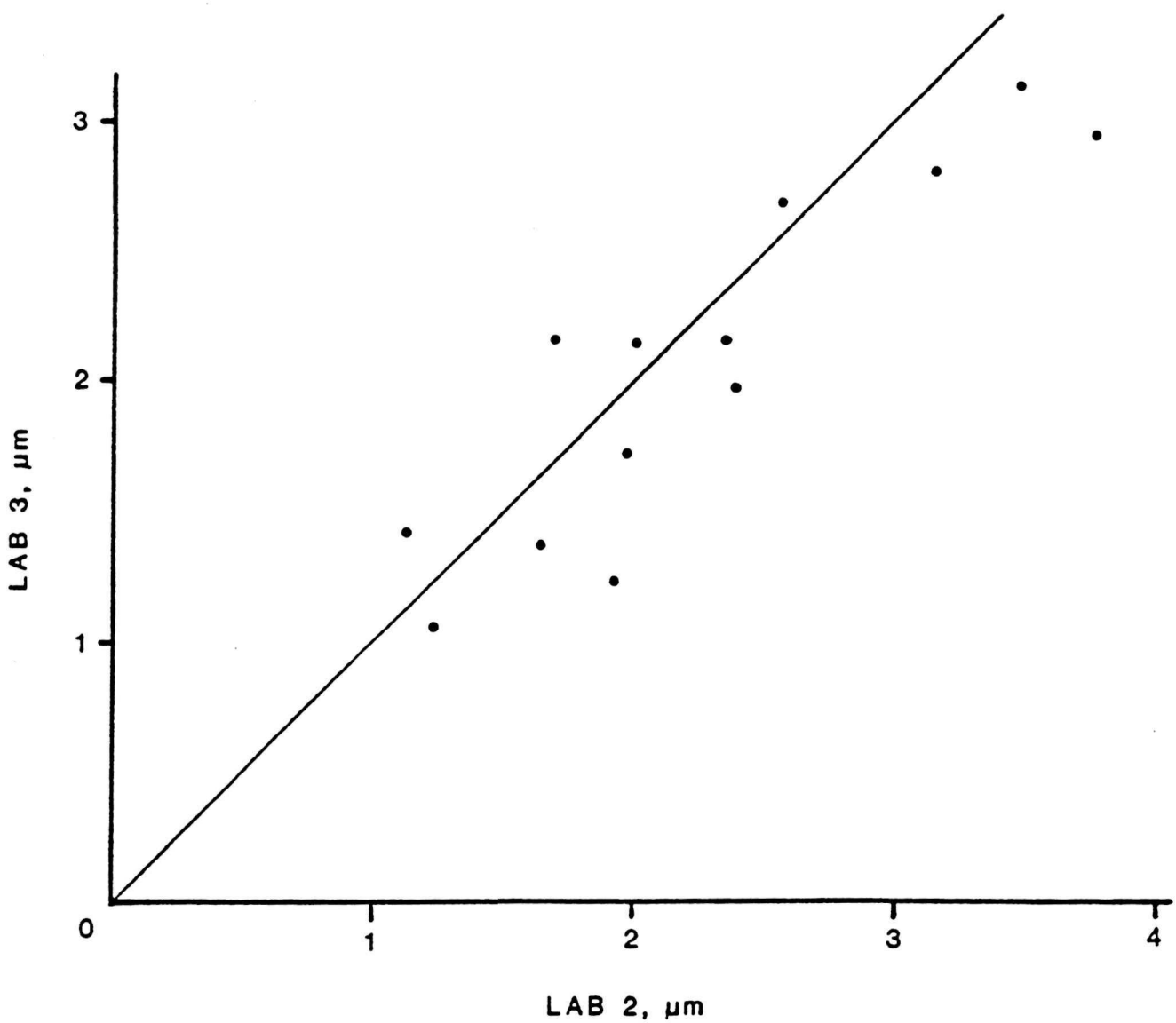

Figure 18. Comparison of laboratory 2 and laboratory 3 rind thickness measurements.

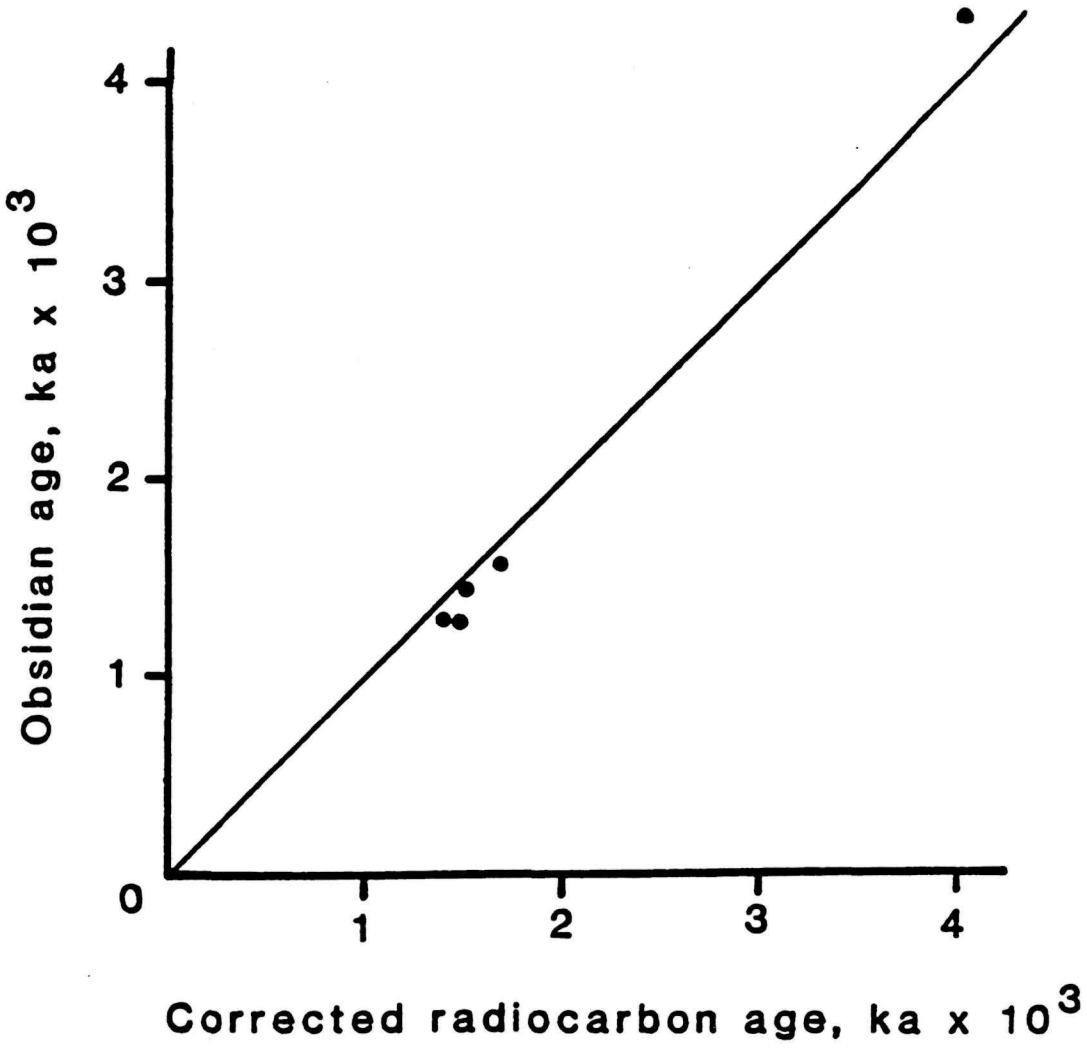

Figure 19. Comparison of obsidian hydration and radiocarbon dates.

thickness evidently occur more frequently than most investigators have suspected, making verification and remeasurement of suspect values a necessary part of the process. Sources of error and discrepancies among laboratories remain unresolved.

The temperature of the hydration process has proven to be a critical variable, and the use of in situ EHT measurement has proven both feasible and necessary for accurate hydration dates This is particularly necessary because of the lack of weather records in the Brooks Range, and the unpredictable effect of snow cover and permafrost on ground temperatures in the environment. Despite these limitations, a comparison of obsidian hydration dates in sites where radiocarbon control is also available shows good correspondence between the methods (Figure 19).

Thus, we can conclude that obsidian hydration dating will be a useful routine dating method in Arctic environments once the problem of hydration rind measurement error is resolved.

APPENDIX III

A Bathymetric Study of Nine Lakes in the South-Central Brooks Range

By Richard E. Reanier[9]

The lakes included in this report are Chandler Lake and Amiloyak Lake located in the Chandler River drainage on the north side of the continental divide, and Agiak Lake, a few kilometers south of Amiloyak Lake, on the south side of the Divide near the headwaters of the Hunt Fork of the John River. Included in the Kobuk River drainage are Lake Selby, Narvak Lake, Lake Minakokosa, Nutuvukti Lake, and Walker Lake. Iniakuk Lake lies about 50 km east of Walker Lake in the drainage of the Alatna River.

In order to record bathymetric data from these lakes in an efficient manner an easily transportable system was required. The system consisted of a small, inflatable Zodiac boat 3.1 m in length powered by a 4 horsepower outboard motor. The transducer of a Coastal Navigator DR-500 fathometer was attached to the transom of the Zodiac boat. A 12 V lead-acid marine battery powered the fathometer which produced permanent records on 10 cm

[9]A map showing the location of the lakes in the bathymetric study was drafted for this report.

strip chart paper. This instrument records a maximum depth of about 150 m. It was possible to fit this equipment, camping gear, and two crew members into a Cessna 185 float plane equipped with float compartments or a Bell 206B helicopter equipped with external baskets.

In operation, the inflatable boat was steered along a series of transects across a lake providing a continuous record of depth along each transect. Transects were selected to insure complete coverage of each lake, and additional transects were added when the strip charts indicated complex bottom morphology. One crew member steered the boat, sighting on natural landmarks along the shore while the other crew member operated the fathometer, starting and stopping the instrument and changing depth scales and recording intensity as necessary to insure a good recording. Each transect was recorded in a log and marked on a base map as it was traversed. This system worked efficiently except in foul weather when wind and rain made holding a true course and operating the fathometer impossible.

Production of bathymetric maps from the fathometer transects began with the creation of accurate base maps. Since none of the lakes had been mapped by the USGS at a scale greater than 1:250,000, base maps were prepared from aerial photographs and then enlarged to an appropriate size. The aerial photographs provided details of shoreline morphology and landforms that were

useful for locating the transects. Transect locations were laid out on these base maps. Contour intervals were selected, and depths were read from the strip chart recordings and transferred to the transects on the maps. After all transects were transcribed in this fashion, contour lines were drawn on the map connecting points of equal depth on the various transects. The interpolated shapes of contour lines between these control points are based on the judgement of the cartographer and are highly subjective. Often they mirror the shape of a nearby shoreline; sometimes they are but one of several possible shapes allowed by control points on nearby transects. For this reason a small inset map showing transect locations has been included on each bathymetric map. This inset map shows where the bathymetry is tightly controlled and where it is interpolated and may not be reliable.

Bathymetric Maps

Chandler Lake

Chandler Lake (67°14'N 152°43'W) lies at an altitude of 880 m in the upper part of the Chandler River valley. Mountainous terrain rises steeply from its eastern and western shores to altitudes of 2000 m and more. The long axis of the lake is oriented NNE-SSW in the center of the glaciated valley. The lake is 7.5 km long

and is 2.5 km wide near its northern end. Moraines of the late Itkillik II glaciation lie some 15 km to the north of the lake. The present lake was formed during the retreat of this glaciation which reached its maximum extent between 13,000 and 11,500 years ago (Hamilton 1986). The north end of the lake is formed by bedrock capped by glacial drift and alluvium, with the outlet stream immediately entering Little Chandler Lake within a few hundred meters. Several inlet streams enter the south end of the lake, traversing the low, poorly-drained terrain south of the lake. The main inlet, the Chandler River, flows from its source at Amiloyak Lake 10 km to the south. Despite the steep valley walls on either side of Chandler Lake, the lake itself is relatively shallow, reaching a depth of only 22 m in its northern basin. The southern basin, cut off from the northern basin by sediment from the growth of the alluvial fan deposits on both the eastern and western shores, is only slightly shallower. The southern end of the lake deepens fairly steeply to a depth of 20 m, indicating that the inlet streams have transported relatively little sediment into the lake and have not built extensive deltas. Livingstone, who took core samples from the lake in 1952, did report deltaic sediments near the Chandler River inlet (Livingstone 1955). He also reported a maximum depth of 34 m (110 feet) during limited sounding of the lake (Wiggins and MacVicar 1958). It is possible that such a deeper basin exists in the lake in an area not traversed by our transects.

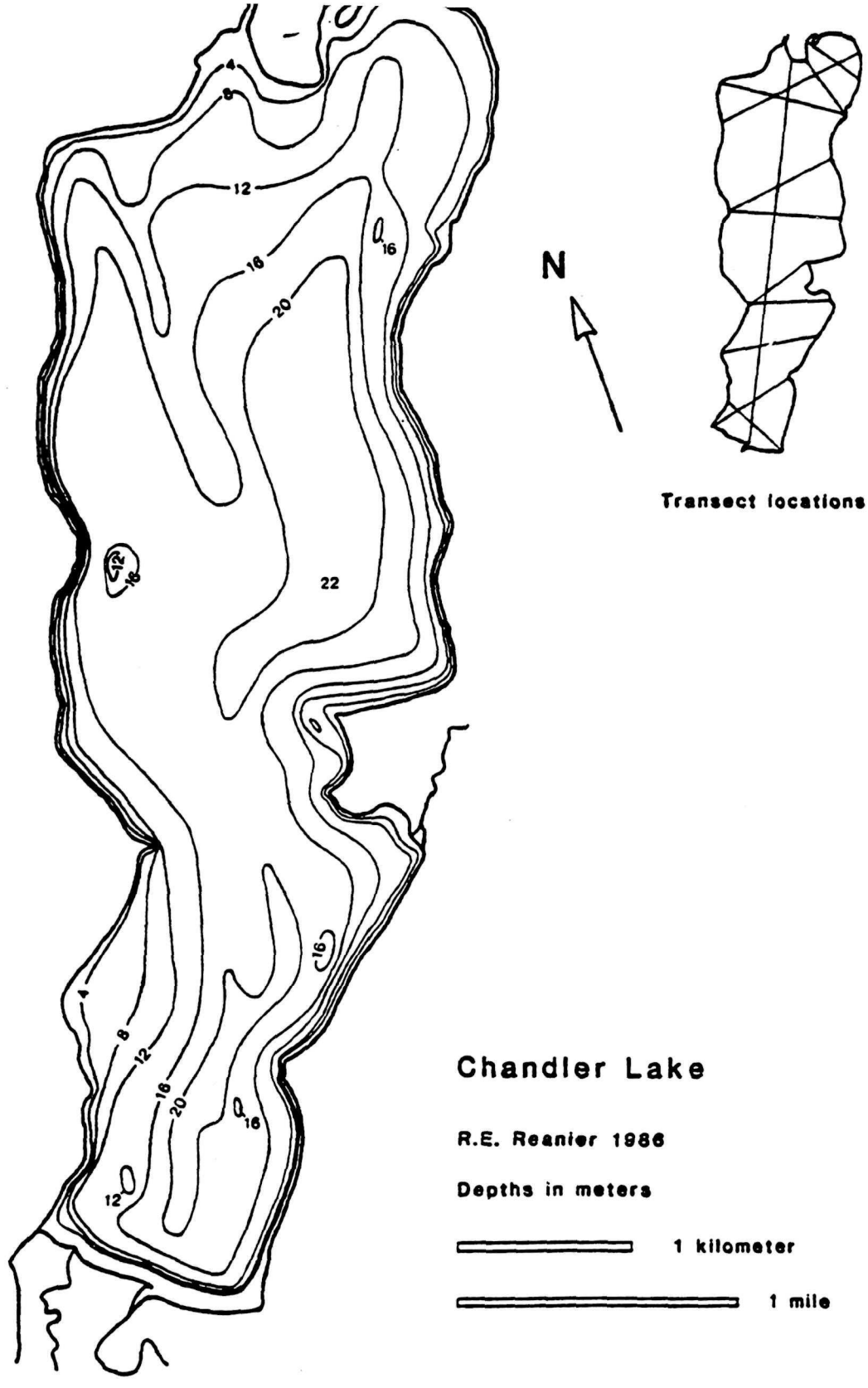

Figure 21. Bathymetric Map: Chandler Lake.

Amiloyak Lake

Amiloyak Lake (68°06'N 152°52'W), which lies at the upper end of the Chandler River Valley at an altitude of 950 m, is one of the sources of the Chandler River. It is oriented NE-SW and lies in the center of the valley only 2.5 km north of the continental divide. Amiloyak Lake is long and narrow; 2.7 km in length and only 0.5 km in width. Like Chandler Lake, Amiloyak was formed by the retreat of the Itkillik II glaciers which reached their maximum extent between 13,000 and 11,500 years ago. The lake appears to be impounded behind stagnant ice deposits left as ice retreated eastward up a tributary valley toward Mount MacVicar. The Chandler River cuts through these deposits as it leaves the lake. A small inlet stream approaches the lake from the south, skirting around the south shore to enter the lake from the west near a small peninsula. Other small streams enter the lake on its eastern shore. The slopes above the eastern shore consist of ancient alluvial fan deposits that appear to have been overrun by glacial ice. The lake is deeper along its eastern shore where these fan deposits form the shoreline, reaching 10 m at its deepest point. The western side of the lake is much shallower, as is the northern quarter of the lake which seems to have received considerable sediment from an active alluvial fan deposit. The lake bottom is complex, with several basins. Probably there are other such small basins not encountered by the transects.

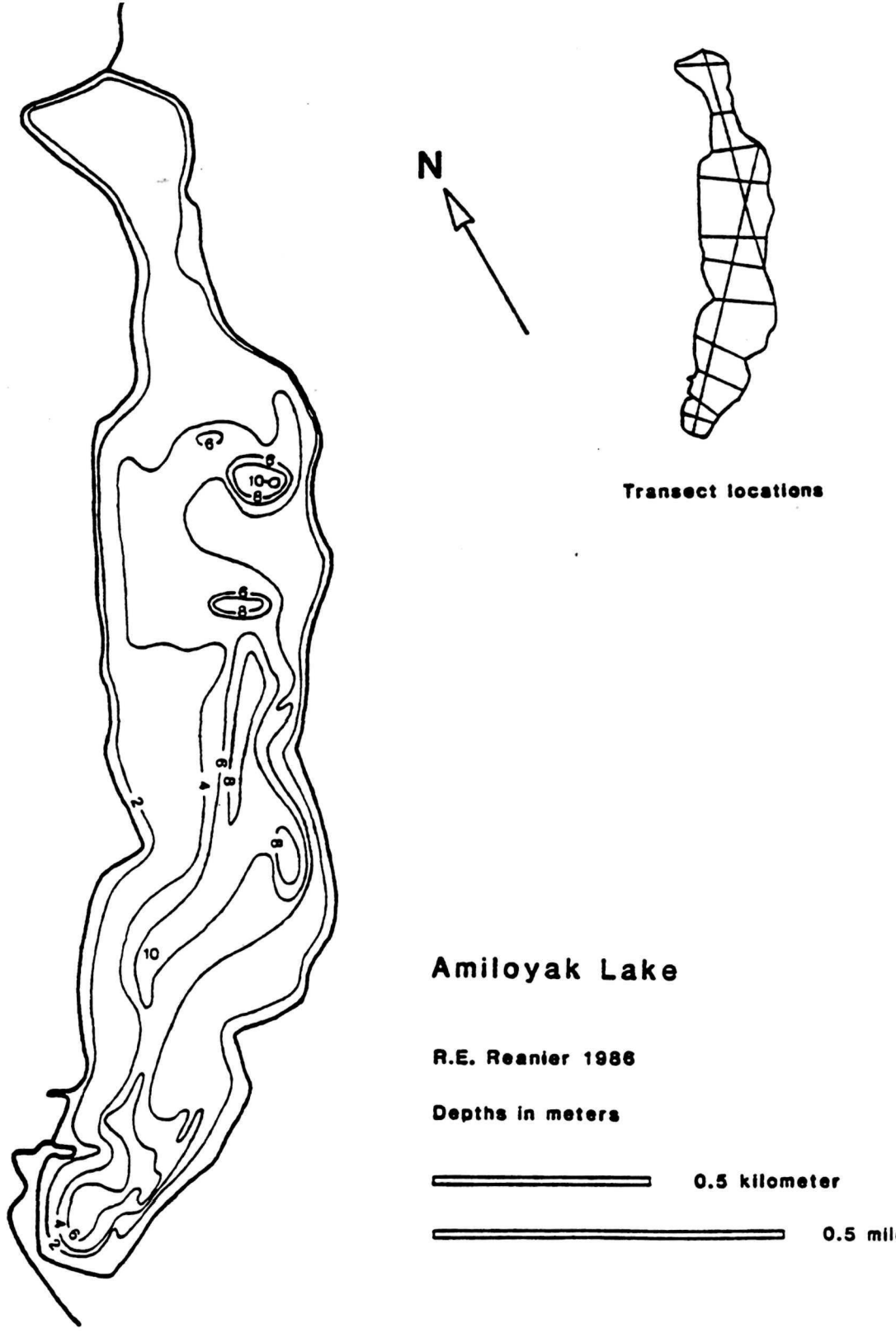

Figure 22. Bathymetric Map: Amiloyak Lake.

Agiak Lake

Agiak Lake (68°04'N 152°57'W) lies immediately south of the continental divide at an altitude of 950 m, only 3 km south of Amiloyak Lake. The lake is 2.4 km long, slightly less than a kilometer in width, and is oriented NE-SW. The lake was formed during retreat of late Itkillik II glaciers which reached their maximum extent between 13,000 and 11,500 years ago. Its outlet stream is Agiak Creek which cuts through stagnant ice deposits that impound the lake and drains into the Hunt Fork of the John River. An inlet stream enters the lake on its northern side, and a second, larger stream enters the lake on its eastern shore. This eastern inlet has built a large delta out from the eastern shore. Like Amiloyak Lake, the slopes above the eastern shore of Agiak Lake are formed in part by large, stable, alluvial fan deposits, and the eastern half of the lake is much deeper than then west, reaching a maximum depth of slightly greater than 16 m. The bottom morphology of the lake is complex, with several separate basins and individual ridges. Mapping of the shallow western half of the lake was aided by the fact that the shallower areas were visible in aerial photographs, allowing more accurate interpolation between transects.

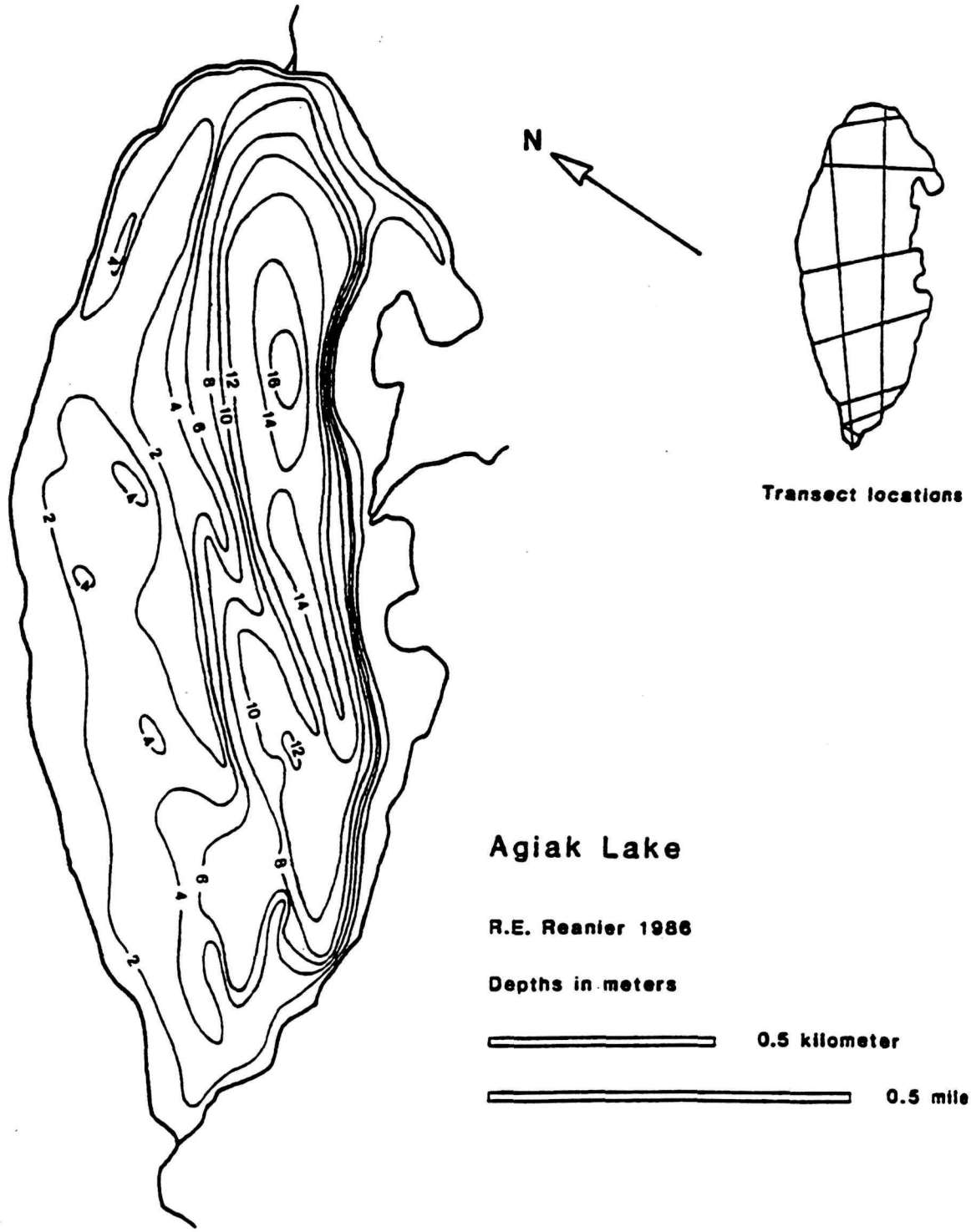

Figure 23. Bathymetric Map: Agiak Lake.

Narvak Lake

Narvak Lake (66°56'N 155°37'W) lies at an altitude of 145 m in the upper Kobuk River drainage immediately north of Lake Selby. Narvak Lake is long and narrow, oriented N-S, measuring 8 km by about 1.25 km. The lake was formed by the retreat of Itkillik I age glaciers at some time prior to 65,000 years ago and remained unglaciated during the subsequent Walker Lake glaciation (equivalent to Itkillik II age glaciation). Narvak Lake fills a deeply entrenched valley that cuts through the Angayucham Mountains rising above the lake to altitudes of 1500 m. The steep valley walls plunge beneath the lake surface to form the eastern and western sides of the deep central basin with a 114 m depth. The lake shallows slightly at its northern end probably due to an influx of outwash sediments from end moraines of Walker Lake (Itkillik II) age which lie about 4 km north in the Mauneluk River Valley. The south end of the lake also shallows as it nears the bedrock peninsula that separates Narvak Lake from Lake Selby. The bottom of the central basin is broad and flat probably due to sediment infilling. At several points along the shore alluvial fan deposits have built out into the lake.

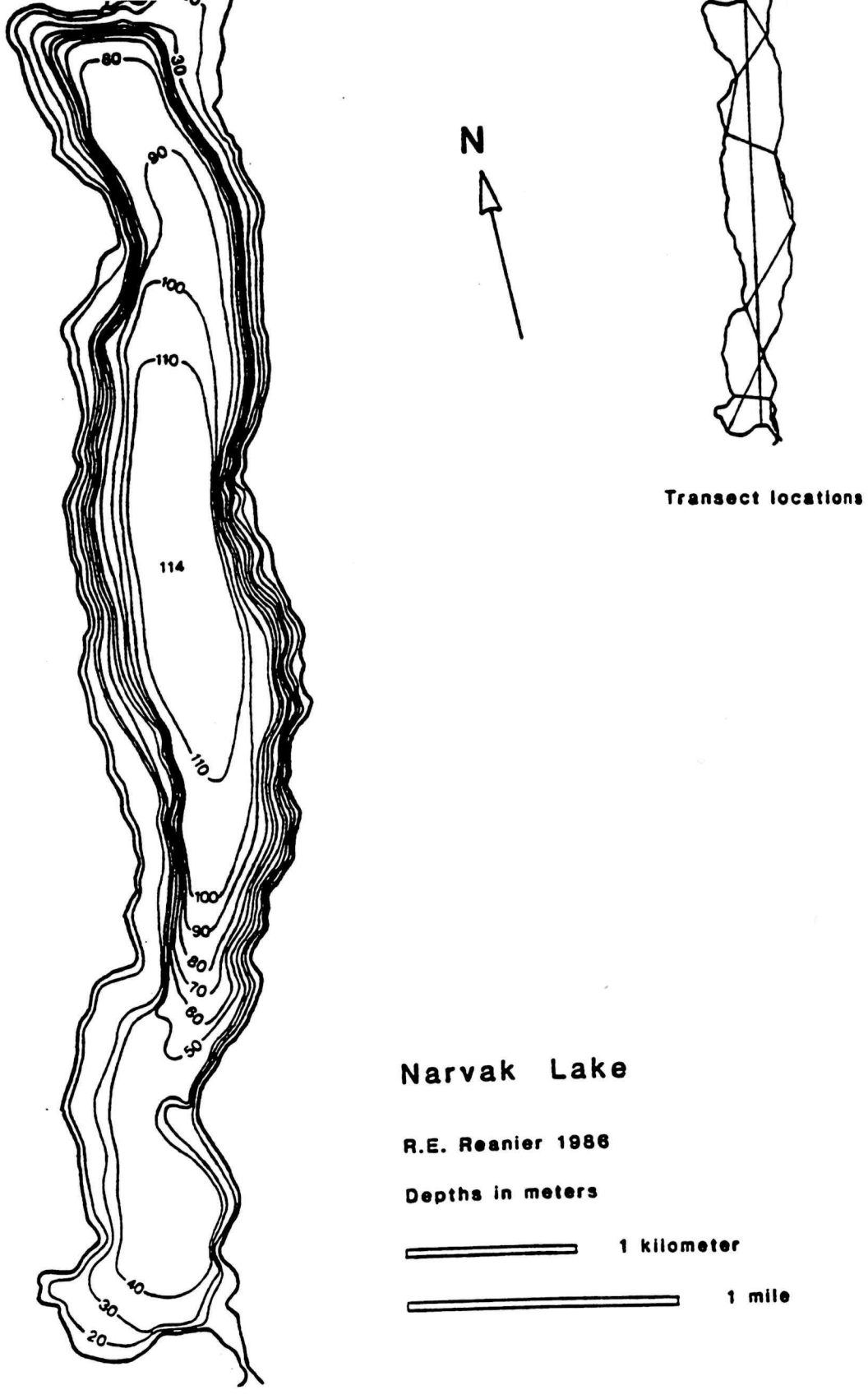

Figure 24. Bathymetric Map: Narvak Lake.

Lake Selby

Lake Selby (66°52'N 155°40'W) lies in the upper Kobuk River drainage at an altitude of 145 m, immediately south of Narvak Lake. Lake Selby measures 6.5 km in length and is about 2.4 km wide at its widest point. It is oriented NNW-SSE. The lake was formed by the retreat of the Itkillik I glaciation some time prior to 65,000 years ago, end moraines of which impound the southern end of the lake. The outlet stream, the Selby River, which has cut down through these end moraines, joins the Kobuk River 9 km south of the lake. The lake has a central basin that reaches 33 m in depth. The northern end of the lake drops off rather steeply due to the influence of the Angayucham Mountains, whereas the southern end which extends out beyond the mountain front is shallower and drops off less steeply. The southern end of the lake forms a very shallow embayment within the terminal moraine system.

Lake Minakokosa

Lake Minakokosa (66°55'N 155°01'W) is situated in the upper Kobuk River drainage at an altitude of 115 m. The lake is about 4 km in length and is about 0.75 km wide at its northern end. It is oriented N-S and fills a small valley cut through the eastern end of the Angayucham Mountains. The lake was formed by the retreat

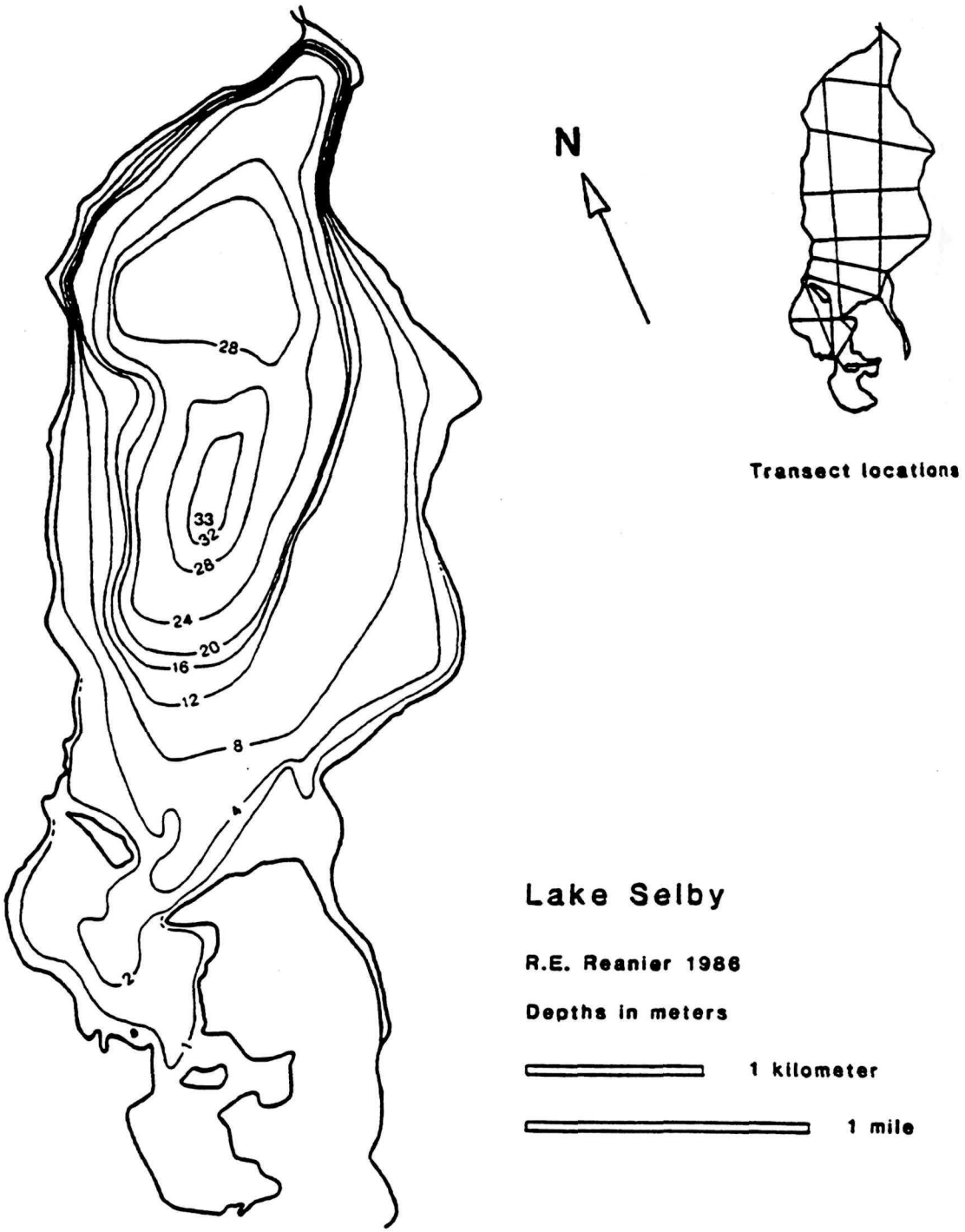

Figure 25. Bathymetric Map: Lake Selby.

of Itkillik I age glaciers more than 65,000 years ago, and remained unglaciated during the subsequent Walker Lake (Itkillik II) glaciation. The inlet stream enters the lake at its northern end, while the outlet stream drains from the south end of the lake into Beaver Creek. The mountains to the east and west of the lake rise to 600 m and cause the respective shores of the lake to drop off rapidly to a maximum depth of 54 m. The northern, and, especially, the southern ends of the lake drop off more gradually. The bottom of the central basin is relatively flat probably due to sediment infilling. At the extreme southern end of the lake is a very shallow embayment less than 1 m deep.

Nutuvukti Lake

Nutuvuktu Lake (66°58'N 154°41'W) lies in the upper Kobuk River drainage at an altitude of about 150 m. The lake is 8.7 km long and about 1.5 km wide for most of its length, and is oriented NW-SE. Nutuvukti Lake was formed by the retreat of Itkillik I age glaciers more than 65,000 years ago, but remained unglaciated during the subsequent Walker Lake (Itkillik II) glaciation. Several small inlet streams enter the lake at its northern end and another enters from the western shore, having built a small delta out into the lake. The outlet stream leads from the southeastern end of the lake into the Kobuk River 6 km to the

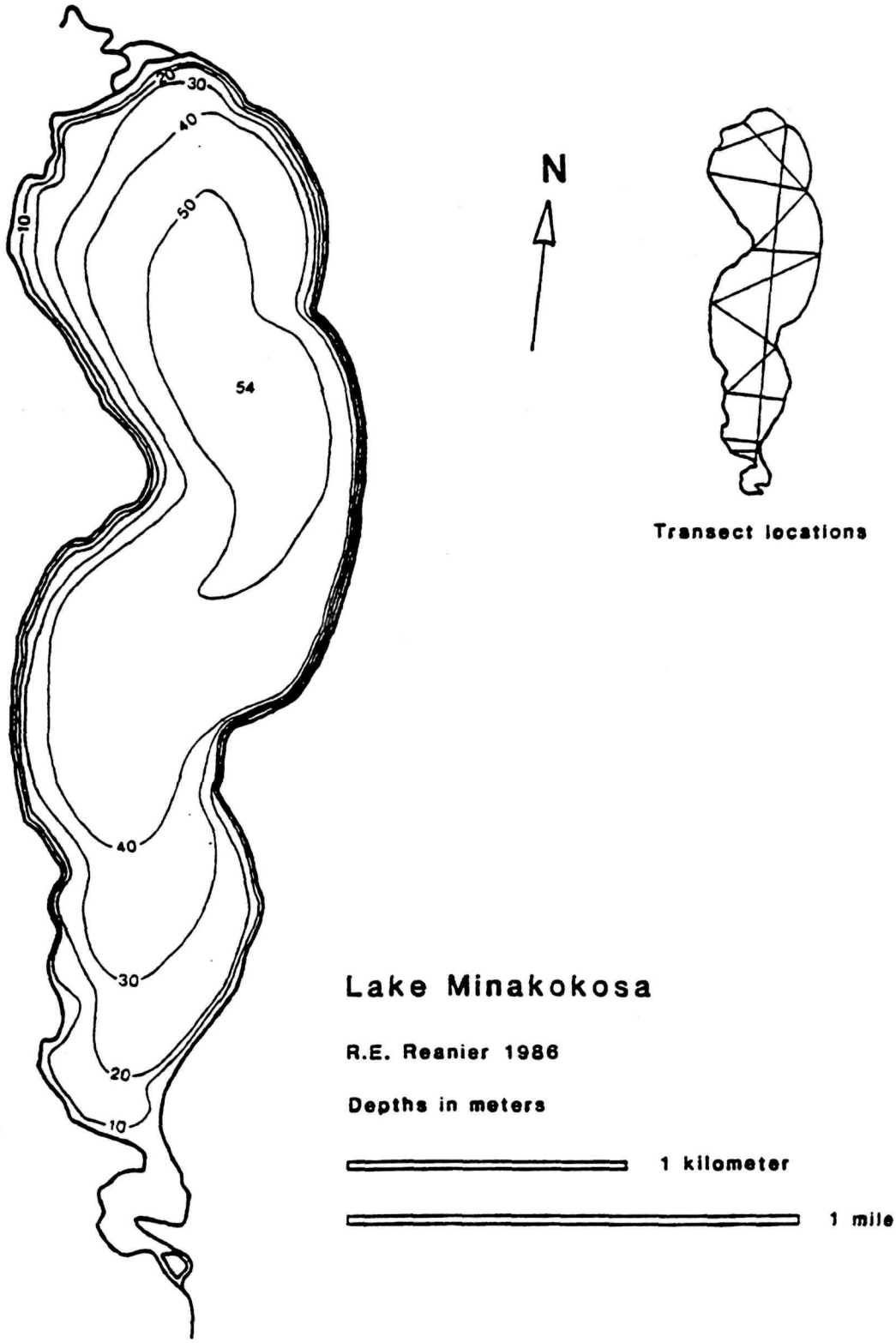

Figure 26. Bathymetric Map: Lake Minakakosa.

southeast. Mountains rise east and west of the lake to altitudes of 850 m, and their slopes continue beneath the lake surface to form the relatively steep drop-offs seen midway up the two shores. The lake reaches a maximum depth of 49 meters in the main basin and shallows rapidly in the southern third of its length. Shallowing in the northern end of the lake may be a result of an influx of outwash sediments from Walker Lake (Itkillik II) age end moraines in the Reed River valley which lies only 2km north of the lake. A large embayment at the northeastern corner of the lake has a separate basin 10 m deep.

Walker Lake

Walker Lake (67°08'N 154°21'W) lies near the headwaters of the Kobuk River at an altitude of 194 m. It is the largest lake mapped by this project, 21 km long and 4 km wide at its broad southern end. The lake fills a NW-SE trending valley leading from the Mount Igikpak area. Walker Lake was formed by glaciers of the Walker Lake (Itkillik II) glaciation which reached its maximum extent between 24,000 and 11,500 years ago. The lake is impounded by terminal moraines of this glaciation, which, as the name implies, have become the type locality for moraines of the most recent glaciation in the south-central Brooks Range (Fernald 1964). A large inlet stream, Kaluluktok Creek, enters the lake at its north end and has built a large delta system out of the

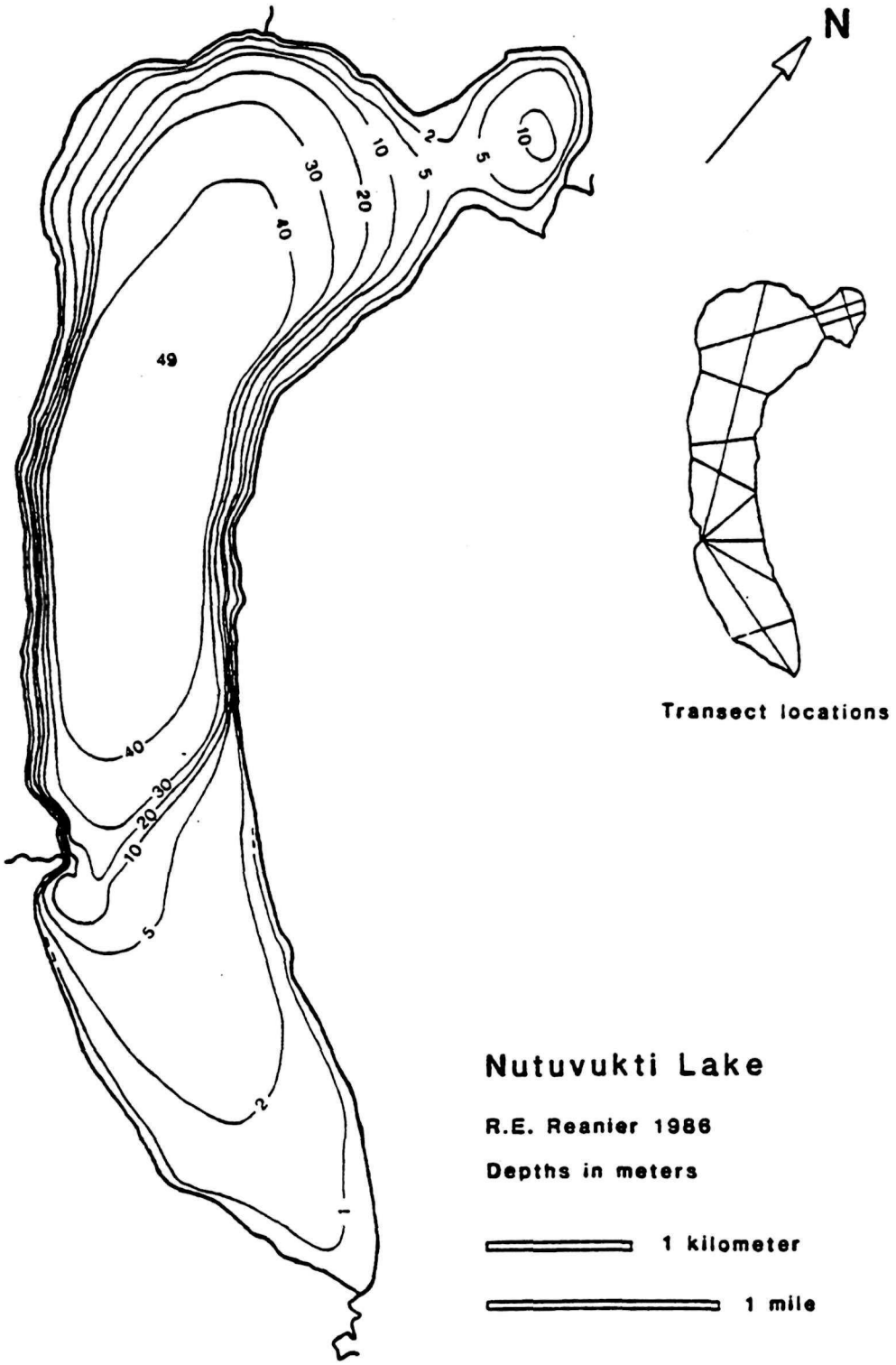

Figure 27. Bathymetric Map: Nutuvukti Lake.

lake. Recently, a change in the course of the creek has cut off part of the delta, creating a new island. Smaller inlet streams enter the lake at points along the eastern and western shores. The outlet stream leaves the south end of the lake to traverse the moraine complex before entering the Kobuk River 4 km south of the lake. At one point the stream forms white water rapids where it cuts down through part of the moraine. Except for the southern end of the lake that extends out beyond the range front, the slopes above the eastern and western shores are steep, raising to as much as 1400 m. These slopes are reflected in the steep-sided shapes of the two major lake basins. The northern basin, separated from the southern basin by a shallow area north of Swan Island, is deep and symmetrical, plunging to a depth of 120 m. The southern basin is more complex, with its deepest part on the eastern side of the lake reaching 122 m. The bottoms of both these basins, carved into bedrock, are remarkably flat and smooth, probably reflecting the infilling of sediment. Complex ridges and troughs that separate this basin from one 88 m deep to the west probably represent a submerged moraine system left as the Walker Lake glacier began its retreat. A shallow sill less than 30 m deep crosses the lake just south of the northern basin, greatly affecting the exchange of the water between the two basins. Northwest of Swan Island is a 50 m deep basin isolated from the rest of the lake by sills less than 20 m deep between the islands. Two very shallow areas are located in the vicinity of the island chain. One, between Swan Island and the peninsula

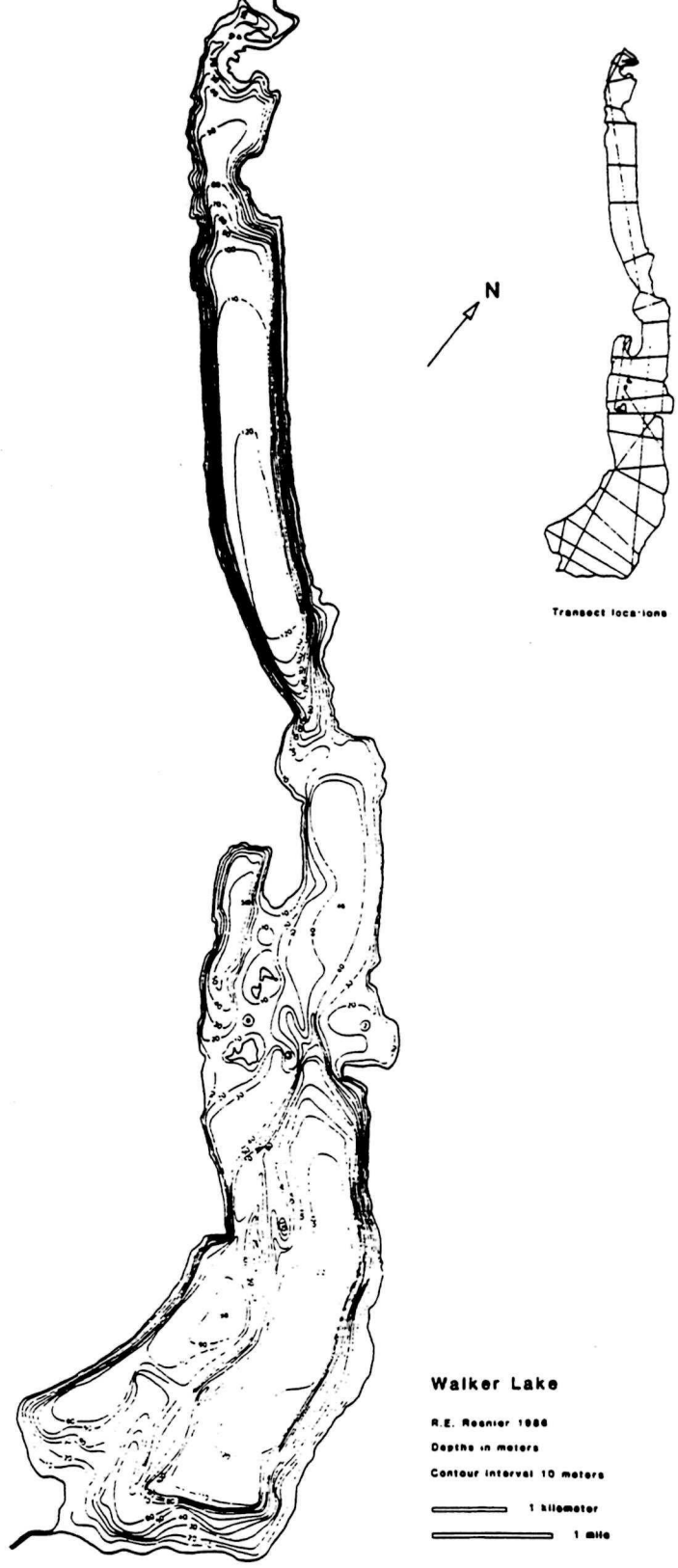

Figure 28. Walker Lake bathymetric map.

to the east, rises to within 3 m of the surface. The second, to the north of the penninsula, comes within 2 m of becoming an island. Both of these shallows are visible on aerial photographs of the lake.

Iniakuk Lake

Iniakuk Lake (67°08'N 153°13'W) is situated in the Alatna River drainage at an altitude of 214 m. The lake is oriented NNW-SSE in the valley of Tobuk Creek, 8 km east of the main valley of Alatna. Iniakuk Lake is 8.2 km long and reaches a width of 2 km near its southern end. The lake was formed by the retreat of Walker Lake (Itkillik II) age glaciers that had reached their maximum extent between 24,000 and 11,500 years ago. Arcuate terminal moraines of this glaciation impound the southern end of the lake. Tobuk Creek, the lake's inlet and outlet stream, has built a small delta out from the south end of the lake into the Malamute Fork of the Alatna River about 4 km to the south. The shape of the lake's central basin reflects the asymmetrical shape of the valley, with steeper walls on the east and more gradual slopes on the west. The basin reaches a maximum depth of 63 m on its center, shallowing gradually to the north and south. An embayment on the southeastern side of the lake has a separate, shallow basin 10 m deep. The extreme southeastern part of the lake is quite shallow.

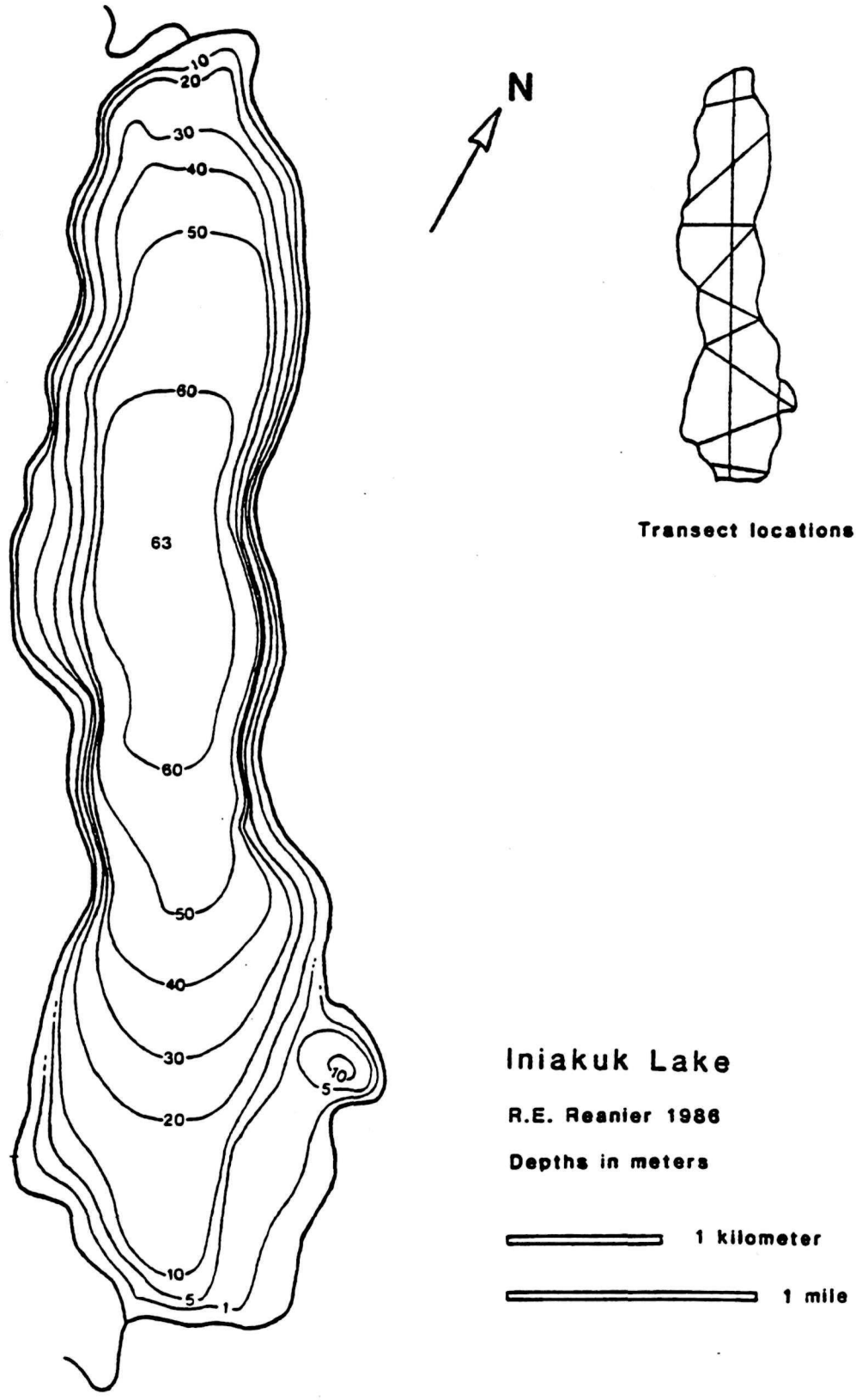

Figure 29. Bathymetric Map: Iniakuk Lake.

Discussion

The lakes mapped by this project owe their basin shapes to the cumulative action of a number of successive Pleistocene glaciations. Although these lakes have probably existed repeatedly during interglacial periods, their present form is due largely to the action of the last glaciers to scour out their basins. The lakes form two age groups; those formed after the most recent glaciation (Itkillik II), Chandler Lake, Amiloyak Lake, Agiak Lake, Walker Lake, and Iniakuk Lake; and those formed after the penultimate glaciation (Itkillik I), Narvak Lake, Lake Selby, Lake Minakokosa, and Nutuvukti Lake. Walker Lake and the combined Narvak Lake and Lake Selby provide an interesting comparison between the two groups. Both sit at the range front and are impounded at their southern ends by terminal moraines through which their outlet streams have cut. Both have deep, steep-walled, narrow northern basins (Narvak), with shallow sills dividing these from wider, more complex southern basins (Selby). However, Walker Lake is perhaps 45,000 years younger than Selby and Narvak Lakes, a fact reflected in the more subdued moraine topography and poorly drained landscapes at Lake Selby due to the effects of mass wasting and permafrost aggradation through time.

This bathymetric data has been extremely useful in attempting to understand the methods and locations of lake exploitation by the prehistoric inhabitants of the park. Additionally, besides being

necessary to paleoenvironmental studies, the bathymetric information has been of great value to the fisheries studies presently being conducted by the National Park Service in Walker and Chandler Lakes. This is an excellent example of a project specific endeavor which has broad applications in park research and management.

APPENDIX IV

Nunamiut Ethnographic Recollections from 1934 to the Present[10]

The Return to the Brooks Range

By the beginning of the third decade of this century, the economic pursuits outside of the Brooks Range that the Nunamiuts had come to rely on were gone. The whaling industry declined because most of the whales had been killed, and the petroleum industry with its production of fuels and plastics had supplanted whale oil and baleen. The great depression ruined the fur market and impaired the Alaskan gold mining industry. On the other hand, the Arctic caribou herd had reestablished itself numerically in the fifteen years the Nunamiuts had been absent from the Brooks Range, which gave the people an opportunity to return to the mountains and to survive as a cultural entity.

However, the Nunamiuts that returned to the mountains were not the same people that had left the mountains to take up residence

[10]Some editing has been done to this appendix. The section concerning the caribou hunt, in particular, was originally written by Grant Spearman. Editor.

on the coast 15-45 years earlier. During their absence from the mountains, they had lived a different lifestyle, become influenced by the materials and excesses of Euro-American culture (including religion), and had generally adopted and become partially dependent upon that technology and economic system. In short, they had learned to want the luxuries that made life easier and more enjoyable. Indeed, although the small, remaining nucleus of Nunamiut families longed to return to the mountains, they hesitated to abandon the variety of technological luxuries and supplies that were more readily available on the coast. (In a 1974 interview, Simon Paneak said that in the thirteen years he lived in the Foggy Island area, Sagavanirktok River Delta, he never liked or got used to eating "sea animals". He said that he frequently made 3 or 4 day sled trips in winter, and pack dog trips in summer into the mountains to get caribou and sheep meat (Kunz field notes 1974)).

In 1934, fourteen years after the last Nunamiuts had left the Brooks Range, a few families returned. They did not immediately go back to the mountains but established a small settlement at the mouth of the Anaktuvuk River which served as their base of operations. After spending the fall, winter, and part of the spring in the mountains hunting and trapping, they would return to their base camp in late spring while there was still enough snow for sled travel. The summers were spent on the Colville River hunting, fishing, and trading. In autumn, once there was

enough snow for sled travel, they would return to the mountains. In 1939 the original group of families were joined by several others, and this group returned permanently to the mountains and their semi-nomadic way of life (Spearman 1980).

Initially, there were three groups or bands formed by the returning Nunamiuts: one inhabited the Killik River drainage; another, the area around Chandler Lake; and the third, Itkillik Lake and the Ulu Valley. After several years, the Itkillik Lake group was assimilated by the other two groups (Spearman 1980). These small bands of Eskimos, residing in isolated family groups (winter), or in larger consolidated groups (summer), lived mainly off the natural resources of the region by moving seasonally from place to place in an annual cycle of subsistence. True, these 1930s Nunamiuts were utilizing implements of modern technology and goods such as firearms, steel traps, metal pots and pans, flour, sugar, tea, and coffee, but they were still living the semi-nomadic lifestyle they and their progenitors had led before moving away from the Brooks Range. However, their return to the mountains was not without problems.

From 1934-1938 the Nunamiuts who had returned to the mountains spent the open water months at their base camp at the confluence of the Anaktuvuk and Colville Rivers. During that season, when water travel between the coast and the northern foothills was possible, the Nunamiut traded their winter catch of fur and

caribou hides for the supplies such as guns, ammunition, axes, knives, cloth, flour, sugar, tea, tobacco, pots, and pans that were now important in their daily lives. However, in 1939 when the Nunamiuts elected to live in the mountains on a year-round basis, the acquisition of the commercially manufactured supplies they had come to rely on became more difficult. A partial solution to this problem was the utilization of another product of Euro-American culture, the airplane.

The Nunamiuts who had lived on the coast during the late 1920s and early 1930s and/or visited Barrow to trade must have been aware of or seen and realized the capabilities of the airplane. The Nunamiut in the mountains living at Chandler Lake had contact with their first airplane during the summer of 1943 when Sig Wien landed his float plane near their camp. This initiated the opportunity for the Nunamiut to again be directly linked to the white man's economy. Indeed, it was largely at Sig Wien's suggestion roughly four years later that the Nunamiuts moved their main camp to Tulugak Lake in the Anaktuvuk Valley because they could receive more reliable air service. From this infrequent and irregular air contact, a system of exchange was developed, and the Nunamiuts were once again able to trade directly for manufactured goods.

This basically covers what is the author's perception of the culture history of the Nunamiut Eskimo up to the point that they

became a sedentary people. Therefore, for the purposes of the cultural resources inventory project, Nunamiut Eskimo sites that date to the early 1950s are considered to be archaeological sites representative of a fairly traditional culture since these people were still seasonally mobile, dependent upon the caribou for sustenance and on the dog for transportation. However, since additional information concerning the evolution of the Nunamiut Eskimo from a semi-nomadic hunter to a sedentary village dweller was collected ancillary to the cultural resources project, some of the more pertinent and interesting information regarding this genesis will be presented here.

The Caribou Hunt, 1943-44

By the early 1940s the Nunamiut had been using a variety of commercially manufactured goods for several generations. The use of one such implement, the rifle, had greatly altered their methods of hunting. However, an incident which happened in 1944 proved that the Nunamiut were not irredeemably dependent upon firearms for most of their subsistence needs. Additionally, of great value to the researcher is the eyewitness data concerning this event as it provides a template which should have practical application at prehistoric sites where similar events occurred.

During the fall of 1943 a small group of related Nunamiut

families were camped along the mid-portion of the Anaktuvuk River. The men were concerned about the difficulty of obtaining ammunition for their rifles due to the war, and the effect such a shortage might have on obtaining a sufficient number of caribou to get them through the following winter. Ideas on how to cope with this problem began to take shape under the influence of several elders. These were men in their 70s, who as young men in the 1880s had participated in large communal hunts where herds of caribou had been driven into lakes and lanced from kayaks. After some discussion, the broad outlines of a plan to attempt such a hunt for the coming fall were agreed upon. Each family would be responsible for obtaining the necessary materials with which to build a kayak. By the next spring all the participating families were to gather in the Chandler Valley where they would decide upon a camp location, and make more definite plans concerning the hunt. The family groups then separated to spend the summer hunting and trapping throughout the mountains.

The camp was established in May of 1944 on an alluvial fan on the south side of Ikagiak Creek, the only creek to enter Little Chandler Lake from the east. Metzger, who spent some time in the area in 1945, remarked that the location of the camp,

> ". . . was imminently shrewd. It was close to spring and summer water supply. It was exposed enough to the wind so that in early spring drifting snow would not settle around it and bury it. It was high enough so that its residents could look down on the Chandler Lake Valley from just a few yards outside their doors and spot migrating or wandering caribou, and it was masked from the view of either caribou or man looking up at it

from the valley floor." (Metzger, 1983:52.)

Additionally, the dense growth of willows bordering the creek provided a windbreak against the brutal north winds, construction materials, and wood for heating and cooking.

This camp was occupied from mid-May through late September, a period of five months, an exceptionally long time for Nunamiuts to remain at a single location. One of the reasons that such a long stay could be made at this camp was that sledloads of firewood were brought in from distant sources before the snow melted so that the local willow patch would not be exhausted. Additionally, the area had reliable food resources, sheep in the mountains and fish in the lake. However, the single most important reason the Nunamiut could remain at this camp so long was aircraft support which provided them with a direct supply of commercially manufactured goods. Accounts from the few surviving Nunamiuts that were involved in this venture say that a pre-arranged cache of supplies had been flown into the Chandler Valley before they had arrived and set up camp. After the camp had been established, additional deliveries of goods were made by aircraft in the late spring and early summer while the lake ice was sufficiently strong to be used as a landing strip.

As the lake ice began to break up, the building of three kayaks began. The gun-whales, keel,and cockpit were built of spruce

while the rest of the single ribbed hull was made of willow and covered by the dehaired skin of three bull caribou. The craft were not large, eight feet long and thirty inches wide at the cockpit. They were completed by late spring and used throughout the summer in a variety of subsistence activities, as well as for the training of the hunters who would use them in the fall.

By early August, in anticipation of the approaching seasonal migration of caribou, construction of an inuksuk line or drift fence was planned taking into consideration both the local topography and the probable direction of caribou movement. The building of the three-mile long inuksuk line required the efforts of the entire group for a period of at least two weeks. Each inuksuk was made by driving sharpened willow stalks into the ground, tying the upper branchy portions together with willow roots, topping the whole with a tussock that from a distance was designed to look like a human head, and binding the entire bundle to an anchor made of a small pile of large stream cobbles. Pack dogs were used to haul the cobbles from the creek. When completed, the inuksuk was between four and a half and five feet tall and, for added effect, might have willow sticks inserted for arms with bits of cloth or hide attached.

Once the inuksuk line was finished, a constant watch was kept for the approaching caribou herds. Because game had been plentiful over the course of the summer, the people could afford the luxury

of biding their time, waiting for just the right caribou herd to drive into the lake. A herd of fat bulls was selected and the people reacted quickly, each tending to their assigned tasks: some were to keep the younger children quiet, others to keep the dogs quiet, others were stationed along the length of the drive line to agitate the animals by waving pieces of skin or cloth and shouting. This latter job had to be done carefully to prevent spooking the animals yet keep them moving parallel to the drive line and toward the lake.

When the last of the herd had been driven into the lake, the hunters, alerted by the shouts of the people on the shore, launched their kayaks and swiftly paddled around the concealing point of land that had hidden them from the caribou. The people on shore had driven the caribou into a small bay just south of the point and the hunters circled the outer (western) edge of the swimming, milling animals to induce them to begin swimming in a circular pattern which would keep the animals from scattering. Once this was achieved, the hunters began lancing the caribou, the best location for a killing thrust being near the back of the rib cage where the lung or heart might be penetrated. When it was determined that enough animals had been taken, the hunt ended and the surviving animals were allowed to swim to safety. The dead caibou, which floated, were roped together and towed ashore for butchering.

The lances used in this hunt were of traditional size (slightly over seven feet long) and manufacture except that the eight inch-long points were made of saw blade metal rather than chipped stone. The butchering tools, knives, axes and saws, also made of metal rather than stone, were utilized to cut the caribou into traditional units: head, neck, ribs, backbone, pelvis, and front and rear legs. After the butchering was completed, the meat was left on the ground to cool for awhile and the people cleaned the area, drank tea, and ate fresh roasted caribou ribs. When cooled, the meat was taken back to camp by the pack dogs. Distribution of the caribou was done on the basis of the number of tents in the camp.

This scenario was repeated many times over the following days as the Eskimos gradually built up their supplies of meat, fat, and skins. Informants say that the hunt ended on a note of near tragedy when a young man capsized his kayak and almost drowned. Rather than risk another accident, and because most of the necessary meat had been obtained, the people turned to hunting on land. The camp was occupied until freeze-up when snow cover made sled travel possible and the encampment broke up into family groups which set off in various directions to spend the winter hunting and trapping.

The use of the inuksuit, kayaks, and lances allowed the Chandler Lake Nunamiut to supply themselves with the necessary winter

supply of caribou meat, fat, and hides without firing a shot. It was possible for them to accomplish this feat for several reasons, all perhaps of equal importance. There were elders among the group who remembered the methods and practices required to accomplish a caribou drive. By Nunamiut standards, the family groups were able to maintain themselves in a single camp for an extremely long period of time because they were periodically supplied by aircraft with commercially manufactured supplies. Lastly, the fact that the killing and butchering implements were made of metal greatly eased the burden of work.

In this instance the Nunamiut successfully melded a traditional practice with modern technology and benefitted as a result. However, it is interesting to note to what degree the body of knowledge required for a traditional caribou hunt was available to these people in 1944. Only the two oldest men among the group had ever participated in a hunt of this nature because, due to the wholesale adoption of firearms, obtaining caribou through the drive technique had not been necessary for over fifty years. The knowledge of flint knapping, the making of stone tools, was known to some of the middle-aged men, but very probably only the two oldest men in the group had ever had much actual, practical experience with stone tool manufacture. In a 1974 interview Simon Paneak, then 74 years of age, stated that he had learned/or knew how to make stone tools but that in his life it had only rarely been necessary to do so (Kunz 1974). In fact, metal was

replacing stone as the medium of tool manufacture before the rifle began to supplant bow and arrow, lances, snares, and spears in the acquisition of big game. The knowledge required to build and use a kayak was known to most of the adult males of the group since, up to that time, the kayak had been regularly used for seasonal transportation. The use of pack dogs was as common and necessary in 1944 as it had been for centuries. One of the most critical and important bodies of knowledge required for the hunt had been knowing and understanding the moods, behavior and movements of the caribou. That knowledge was sharp and clear because, despite their ever increasing dependence on the commercially manufactured goods of the modern world, the Nunamiuts were still totally bound to the caribou for survival.

Metzger 1945

In May of 1945, the spring following the great caribou hunt, a USGS party involved in the exploration of Naval Petroleum Reserve #4 set up a base camp on Chandler Lake and became acquainted with the few families of Nunamiut living there. These Eskimos were some of the group who had staged the kayak hunt. The cook for the USGS expedition, a college student named Charles Metzger, kept a diary of the party's activities that summer and published the diary in book form in 1983. Metzger, who was little more than a casual observer and unlike most professional researchers

or scholars, had no hypothesis to prove or point to make concerning these Eskiumos, made some interesting and candid observations about the Chandler Lake Nunamiut.

By and large, Metzger saw the Nunamiut as people that were getting along but wished for a more reliable supply of manufactured goods. He also mentioned that only two of the men had any command of English and that one was "quite worldly," having once gone all the way to Anchorage, presumably in an airplane. During the summer of 1987, at a chance meeting with George Gryc, who had been in charge of the expedition, I was told that the two Eskimo men at Chandler Lake who spoke English did so only brokenly, and that the rest spoke only Inupiat. Part of the worldliness that Metzger mentions may stem from the fact that one of the two English-speaking men owned a radio to which he listened regularly. As Metzger reports, the radio listening, as well as the trip to Anchorage, may have been responsible for such seemingly out of place occurrences as this Eskimo man naming his lead dog "Horsey" and another one of his sled dogs "Jackie".

Many of Metzger's observations point out just how selectively the Nunamiut had adopted elements of western culture and technology. For example, any adult Eskimo male totally understood firearms, in many cases so well as to be able to improvise parts in cases of mechanical failure. On the other hand, because they seldom bathed, the Eskimos knew nothing of soap and as Metzger relates,

"Soap, indeed, was at that time a rare enough item to Eskimos that some of them uninstructed in its use and finding some bars in a long abandoned cache and hoping it was food had actually tried eating some of it" (Metzger 1983). Additionally, Metzger states that the man that owned the radio also smoked a willow stem pipe with a Dr. Grabow briar bowl, wore GI style wire rim glasses, and owned a pair of manually operated hair clippers, a Brownie box camera, an alarm clock, and a calendar for that year.

As described by Metzger, the method by which the Nunamiut were able to directly receive commercially manufactured goods was somewhat haphazard.

> "The next time we looked up from our work we saw that the man was wearing snowshoes and swinging a sack of something, apparently not very heavy, since the weight of it was insufficient to distort his gait. By the time we had gotten the last box and the last bag out of the plane and had finished loading our toboggan for the first time, he was close enough that the pilot started walking out to meet him. As the two figures met, they both stopped, shook hands, and then started walking together, strolling leisurely now and apparently continuing to chat as they came over toward the plane. The stranger -- he really wasn't the stranger, Stef and I were the strangers, he lived here -- proved to be an Eskimo, and a rather winded one at that, after his mile or so trot across the snow covered tundra. He had a sack of fox skins in his hand which he wanted the pilot to send into the Northern Commercial Company the next time a plane left Umiat for Fairbanks. He had two red fox skins and four cross fox skins (of mottled red and black fur) which he wanted to turn in for credit before the weather warmed up and the skins spoiled on him. He was in effect, making a deposit to his account with the N. C. Company back in Fairbanks, on which he could draw for tea, or ammunition, or traps, or whatever else it was he wanted to buy. A pound of tea, he told us later, delivered informally by air, i.e. whenever a pilot coming his way remembered to bring it along, cost him $1.45, over three times the current stateside cost.

> The Northern Commercial Company was, in effect, his mail order house and bank and conducted business with him by way of credit on furs (some call it barter) with exchange both ways on a catch-as-catch-can basis by air" (Metzger 1983:10).

From Metzger's description of the village in 1945, it appears that it was in the same location that had been used during the summer of 1944, when the kayak caribou hunt occurred, although there seemed to be fewer families present. Given the time of year (late spring), the Eskimo families must have arrived at Chandler Lake only a short time before the USGS party did. Again, Metzger's description of the Eskimo houses is indicative of the degree of mixing of aboriginal and modern technology occurring at the time.

> "Eskimo houses were very good houses. ...about ten feet in diameter. Its floor, about a foot thick, was composed of willow twigs, which provided not only insulation from the permafrost underneath, but a ready supply of firewood. This twig floor when carpeted with caribou skins was resilient, soft, and warm. The overhead frame of the house was formed by about twelve willow poles stuck in the frosted ground at more or less regular intervals around the perimeter of the house. These poles from long usage had become permanently bent, each pole joining its opposite to form a low arch. To the under side of the skeletal dome formed by these poles, the Eskimos fastened caribou skins, fur side down. Outside and over the skins and the frame, the Eskimos draped a large piece of canvas, analagous to the flies over our own tents and to the poplin outer parkas that the Eskimos wore in cold weather over their inner fur ones. The insulation against cold provided by such a structure was impeccable.
>
> ..... heat retention was not so much the problem as heat escapement. That problem as well as a good many other problems of survival and comfort had long since been solved by the Eskimos. When overwarm in his house the Eskimo takes care of the matter simply by opening

> the door, namely by lifting the canvas and removing one of the skins to form, between the willow pole supports, an opening chosen for the usual good reasons of location relating to wind and view.
>
> ..... brewed us up a quick pot of tea over her Yukon stove. It appeared to have been made of two of the more or less square five gallon gasoline cans that had been left at the lake by bush pilots who commuted regularly between Fairbanks and Barrow, and as regularly left such empty cans at their refueling cache by the lake. (Author's Note: In 1945 this "regular traffic" between Barrow and Fairbanks had probably been going on only for about a year due to the pending exploration of National Petroleum Reserve #4.) Two cans had been opened, each at its punctured end, and brazed or otherwise fastened together to form a fire box about three feet long and twelve to fourteen inches wide and high. With a stove pipe fixed to the top surface at one end and running up through a hole in the roof, and with an opening for the admission of twig fuel and air at the opposite end, the lady of the house had at her disposal a usuable and efficient stove. They also use these stoves when need be to provide heat. For caribou Eskimos at least, such stoves are a good deal more efficient, economical, and clean than the seal or whale oil lamps used by the coast Eskimos" (Metzger 1983:54-55).

Metzger also mentions that the Eskimos camped at Chandler Lake had to make regular forays to the Castle Mountain area fifteen miles north of the lake to obtain firewood, because few willows remained near the lake, possibly due to repetitive use. An effort was made to make as many trips as possible with dog sleds before the river ice broke up, putting an end to easy overland transport of bulky/large/heavy items.

In 1945, as had been the case over the preceding 2000 years, the dog was a necessity for survival in the mountains, being the only means of transport, whether harnessed to a sled or draped with a

pack, other than a person walking and carrying the burden on his/her own back. However, there was a price to pay for the benefit; the dogs had to be fed, and keeping enough meat on hand to feed an Eskimo family and its dogs could be a very time consuming project. Metzger relates that the man in the village who had the largest dogs told him that it required three caribou a week to feed him, his wife, one child, and seven sled dogs. If that information is correct, that equates to a minimum of 300 pounds of meat per week, or slightly more than four pounds of meat per day for every person and dog in the family. On a yearly basis it amounts to over 15,000 pounds of caribou meat. (Author's Note: Based on other data, this rate of caribou consumption seems high.)

> "Simon's sled and large dogs were roughly equivalent in Eskimo terms of prestige and usefulness to a custom built Cadillac station wagon... The sled and dogs were unusual, powerfully useful, and honorifically pretentious. The sled, about eight feet long and slightly more than two feet wide, was made principally of large weathered slabs of what appeared to be cedar driftwood"... (Author's Note: It is quite doubtful that the sled was made of cedar driftwood; it was most likely made of spruce obtained from the forests 30 miles to the south.)
>
> "Simon's dogs, weighing on the average 80 pounds apiece, were tremendously strong and obviously ate a lot. Only a very rich, i.e., successful, Eskimo could afford to support them in order to use them to draw such a large sled... The other Eskimos such as Elijah used smaller, lighter, willow sleds drawn by fewer and smaller dogs.
>
> "Some of the best dogs used by Simon or any other of the Eskimos we encountered looked like the textbook "Husky." The rest appeared to be part terrier or part wolf or for that matter part anything, except possibly part Chihuahua. As long as a dog whether willing or unwilling was strong, had large feet, and lived in the

Arctic he was likely to live out his life as a sled dog." (Metzger 1983:38-40.)

Approaching Sedentism

Using Metzger's 1945 information as well as Hanson's 1978 Anaktuvuk Pass census plus the updated version of that census (Lincoln and Kunz 1987), it appears that there were five families camped at Chandler Lake during the summer of 1945. Metzger recalls that there were seven or eight houses, and census and other information suggests that there were at least 20 people present.

In 1947 the Chandler Lake group of Nunamiut moved their main summer camp to Tulugak Lake in the Anaktuvuk Valley, about sixteen miles north-northeast of present-day Anaktuvuk Pass Village. As previously mentioned, Sig Wien had suggested that they move to the Anaktuvuk Valley due to its easier accessibility by air than Chandler Lake. To aid the exploration of Naval Petroleum Reserve #4, a large airstrip had been built on the east bank of the Koyukuk River about five miles upstream of the old village of Bettles which was located at the confluence of the John and Koyukuk Rivers. Even in poor weather conditions, pilots could literally fly fifty feet off the deck from Bettles north through the Brooks Range to Umiat, simply by following the John

River to Anaktuvuk Pass, where they could pick up the Anaktuvuk River and follow that to its confluence with the Colville River twenty miles below Umiat. This meant that there would be regular air traffic flying through Anaktuvuk Pass, creating the possibility for the Eskimos to be regularly supplied with commercially manufactured goods shipped out of Fairbanks. Float equipped aircraft could land on several nearby lakes during the open water season, usually early July through mid-September, and, if equipped with wheels/skis during the cold months, when covered with ice and snow.

By the winter of 1948-49, the Tulugak Lake Eskimos had become dependent enough upon the goods and services now available to them through air service that, although they still split up into family groups during the winter, they were remaining in or close to the Anaktuvuk Valley. For the above reasons, the five families of Tulugak Lake Nunamiut were joined by the eight families of the Killik River Nunamiut in the summer of 1949. In the fall of 1949 the Eskimos living in the vicinity of Tulugak Lake numbered 65, comprising thirteen families living in twelve tents (Ingstad 1954).

Between the summer of 1943, when Sig Wien "accidently" discovered Nunamiut families camped at Chandler Lake in an area where no people were thought to live, and 1949 when the Anaktuvuk Valley became the more or less permanent residence of the Nunamiut, a

number of changes in their lifestyle had occurred. Some of the changes were obvious, such as a defined area of year-round residence, while others were much more subtle, such as changes engendered by a reliable backup food supply which could partially offset the privation resulting from the unavailability of sufficient numbers of caribou.

One of the more subtle changes is reflected in Rausch's description of the sled dogs he observed in the Tulugak Lake region between 1949 and 1951. "The present-day Nunamiut have fine teams of unusually large and powerful dogs, some of which weigh more than 100 pounds" (Rausch 1951). Rausch goes on to say that the Nunamiut need these extremely large and powerful dogs to pull the sleds through the rugged terrain. However, he also says the Nunamiut have been criticized for maintaining large numbers of these dogs which requires the killing of many caribou for dog food. Rausch's description of the typical Nunamiut sled also indicates a change from only a few years before.

> "The Nunamiut sled has runners made of spruce, from trees obtained in the timbered regions to the south and east. A tree which has a pronounced curve just beneath the ground surface is felled and sawn lengthwise into boards. An entire section, after some shaping, is used for a runner, the bent end making the curved front." (1951:162)

Ingstad's comments concerning dogs and sleds further illustrates the change that had taken place since Metzger visited the Nunamiut in 1945 at Chandler Lake.

> "The largest sledges are about 11 feet long by 1 foot 9 inches wide, are made of fir-wood (Author's Note:

> Ingstad means spruce.) and have high solid runners, uprights at the rear, and a handle for steering, and a roughly constructed iron brake. There are only two of the typical Alaska sledges (basket sledges) here. They have thin runners and a slanting lattice-work from the uprights back to the point of the sledge, so the cargo lies as it were in a basket.
>
> "The Nunamiut sledges were formerly of a different type, rather small. In those days people had few dogs, and it was customary for women and men to help draw the sledges. Dogs' food was a much greater problem in those somewhat primitive times." (1954:119)

Ingstad goes on to say that there were 200 dogs in the Tulugak Lake camp, and that his friend Paniaq (Metzger's Simon) owned about twenty dogs. This is a considerable increase from Metzger's observations in 1945 at Chandler Lake, when he states that Simon, being extremely well off, owned seven large dogs and a large sled, although, Simon's "big" sled was smaller than the most numerous variety of sled described by Ingstad. Additionally, Metzger observed five or six dog teams at Chandler Lake, suggesting that each family camped there had a team of about five dogs, each weighing 60 pounds or less, and that the total number of sled dogs was between 25 and 30 (Metzger 1983; Ingstad 1954). Although the number of families camped at Tulugak Lake in 1949 was only slightly more than twice the number camped at Chandler Lake in 1945, the number of sled dogs at the Tulugak Camp had increased by more than sixfold. The numbers and sizes of the sled dogs at Tulugak Lake in 1949 suggests that the resident Nunamiuts had either more resources, or more free time, either of which enabled them to maintain more and larger dogs,

pulling larger and heavier sleds, which was the direct result of their now rapidly changing lifetstyle.

At this point a cautionary word about Helge Ingstad may be in order. Helge Ingstad, a Norwegian adventurer/anthropologist, spent the winter of 1945-50 with the Nunamiut at Tulugak Lake. In 1951 Ingstad published a book about his stay with the Nunamiut which was translated into English and published in London in 1954. It is interesting to compare Ingstad's portrayal of the Nunamiut with that of Metzger and that of the Nunamiut themselves as presented in the diary of Homer Mekiana, a Tulugak Lake/Anaktuvuk Pass resident since at least 1949. Although there are many good observations and descriptions of the Nunamiut's lifestyle in Ingstad's book, it should be apparent to anyone familiar with the present day Nunamiut and/or the literature dealing with the Nunamiut of the last fifty years that he wanted the Nunamiut to be truly primitive people, separated from the contemporary Euro-American culture and society to as great an extent as possible. It was not so much what Ingstad said in his portrayal, but rather the way he said it as well as what he did not say. For example, he always refers to the Tulugak Lake people only by their singular Eskimo names. This is definitely studied, an effort to divest the Nunamiut of any cultural trappings other than their own. This style is in contrast to Ingstad's contemporaries such as Charles Metzger at Chandler Lake, 1945, and Dr. Robert Rausch at Anaktuvuk Valley, 1949-51,

who usually referred to the local residents by their given name, most often a Christian name, or by their given name and Eskimo surname. Indeed, Homer Mekiana, an Eskimo resident of the Anaktuvuk area from the late 1940s until his death in 1967, in his own diary, which spans the years 1950-63, uses the local given or Christian names. Another example of Ingstad's effort was in reference to the names of sled dogs. As would be expected, many of the dogs had Eskimo names. Recall, however, that Metzger referred to a dog Simon Paneak had in 1945 as Jackie. The dog was very distinctive because it was quite large and pure white. Four years later, Ingstad refers to Simon's best lead dog saying it is called, "Inugwik; he is chalk white and an unusually beautiful animal" (1954:1209). Another aspect of daily life in the Anaktuvuk Valley that was of vast importance to the Nunamiut was air traffic. It was common, with planes passing overhead regularly, if not landing. Ingstad chooses to ignore this, making it seem that his flights in and out of the area plus a few others, that are so involved in the fabric of his story that they cannot be left out, were the only occurrences of aircraft in the area during the nine months he spent with the Nunamiut. This implies that the Eskimos received only a few prearranged flights that year and that they were much more isolated than they actually were.

Having had the feeling for some years that Ingstad was guilty of some biased reporting and that one needed to be careful when

using his work as a reference, during the summer of 1987 we questioned some of the Anaktuvuk Pass residents who had been young men and women at the time of Ingstad's stay to see what the general opinion regarding Ingstad was. All of the people we talked to had known Ingstad well and had read his book. In their opinion, "He was a nice man, but he made up some things about the Nunamiut in his book." However, it was hard to get anyone to explain what Ingstad had fabricated. One of the men said that some of the things Ingstad had said about the hunting were not true, "like about the herd migration routes for example," but aside from that would speak no more on the subject. Two of the men thought that Ingstad had depicted the Nunamiut as living a more primitive lifestyle than they actually did. All of the interviewees seemed to like Ingstad personally, but believed that "because he's Norweigian he wrote some things that aren't true." Generally speaking, Ingstad appears to have described Nunamiut life selectively, as he conceived it, not as it actually was. In this, he may have done the Nunamiut a disservice since his book was the original vehicle of discovery for most of the outside world concerning these Eskimos. The picture he portrayed in his book had a strong bearing on decisions directly affecting the lives of the Anaktuvik Pass Nunamiut for many years to come.

Aside from the previously mentioned changes occurring between 1945 and 1951, such as the Nunamiut becoming more or less sedentary in the Anaktuvuk Valley, an increase in the size and

number of sled dogs, and sleds becoming larger and heavier, Nunamiut life was little changed. An example of this can be seen in Rausch's description of the Nunamiut houses which is basically the same as that given by Metzger six years earlier (Metzger 1983; Rausch 1951). In 1951 the Nunamiut were basically conducting their daily lives/activities as they always had except that the area that they were now utilizing for subsistence and habitation was greatly circumscribed from what it had been only a few years earlier. However, according to Amsden (1977:Table 19) the trend of reduction in the area used for habitation by the Nunamiut had been occurring since shortly before the turn of the century. Although Amsden's figures relate to what he refers to as habitation area, by usage, these habitation areas are their areas of resource exploitation. The almost daily need for the men to go hunting suggests that the Nunamiut were as dependent on the caribou as they had ever been. At this time, however, since both hunting and trapping, which were the Nunamiut's only "cash economy", were being conducted over a much smaller geographic area, there was increased pressure on the local subsistence resources.

The Economy: Food, Caribou, Wolves and Dogs

As has been mentioned by all writers documenting Nunamiut history since the onset of commercial whaling on the Arctic Coast, a

Nunamiut Habitation

Period	Area (Sq. Miles)	Comment
1898 - 1909	24,500	Covered eastern half of North Slope and adjacent northern face of mountains.
1910 - 1919	7,900	Area shifted west and south to encompass Colville, Killik, Chandler, Anaktuvuk, and upper John River Valleys. Most of the area between mountains and coast abandoned.
1920 - 1934	0	All of former area abandoned, several families living near Wiseman, rest on Beaufort Sea Coast in Alaska and Canada.
1934 - 1939	7,500	Area almost the same as period 1910-1919; however, contacts and camps were seasonally maintained on the coast.
1940 - 1950	5,500	Area identical to previous six years except that coastal and northernmost inland areas were abandoned.
1951 - 1959	2,200	Encompassed only upper Anaktuvuk and John River Valley. Area of exploitation was similar to period 1940-1950 (After Amsden 1977:73-75).

Table 27. Changes in Nunamiut territory size over a period of sixty years.

"cash economy" or at least the ability of the Nunamiut to barter fur and/or services for commercially manufactured items had a tremendous bearing on making their lives easier. When the whaling ships were seasonally plying Arctic waters, and more so when they began laying over for the winter, Euro-American commercially manufactured goods were readily available to the Nunamiut, either directly or through adjacent Eskimo groups. The supply of these goods was almost inexhaustible due to the tonnage that could be carried in the ships. When the whaling stopped, the available supply of commercially manufactured goods was significantly reduced. After the Nunamiut returned to the mountains, the geographical distance which separated them from the sources of Euro-American technology further limited the availability of these supplies. Once the Nunamiut were discovered to be inhabiting the central Brooks Range and the direct supply of commercially manufactured goods became possible, obtaining cash and/or items of barter again became extremely important to them. Additionally, the fact that supplies were being transported by air meant they were available at any time of the year rather than seasonally as had often been the case earlier. Indeed, when Wien pointed out how much more accessible the Anaktuvuk Valley was to aircraft, the Nunamiut moved there even though it created problems and altered the make-up of their culture and society.

From 1950 on, the availability of Euro-American food items and

commercially manufactured goods in the Anaktuvuk Pass area steadily increased as aircraft traffic became more and more regular. Gubser (1965) states that:

> "..... it was not until a steady supply became available from the whaling ships operating along the north Arctic coast that these foods became a regular part of the Nunamiut diet. Several Nunamiut first encountered onions in a stew at Point Barrow, possibly in the 1880s, but thought they smelled like dog urine. In spite of the initial dislike for many of the new foods, they were soon accepted and then desired for the novelty and variety they offered" (Gubser 1965:51-52).

Gubser goes on to say that through the late 1950s the most popular food items and those in greatest demand were things offering variety, not survival, such as tea, coffee, flour, salt, sugar, baking soda, butter, syrup, and rice. He has also observed that aside from tools and firearms:

> "The main innovations are wool socks, rubber boots for summer use, pants, long underwear, shirts, and a variety of jackets, hats and gloves. Many articles of white man's clothing, properly used, supplement skin clothing very well" (Gubser 1965:85-86).

Also, some earlier innovations, as Rausch relates, continued to affect Nunamiut life.

> "Cooking which has become a more common practice in later years, is done on small sheet metal stoves. Maptigak, now an old man of about seventy years, stated that he was "old enough to hunt ptarmigan" before his family had any stove other than the old fireplace outlined by a few stones on the floor. Cooking was done in wooden vessels by adding heated stones" (Rausch 1951:162).

Ingstad (1954) noted that imported food items, while greatly enjoyed, were usually found only in small amounts, were usually used up quite quickly, and were in no way significant to the

survival of the Nunamiut. Rausch's observations concerning imported food items and their significance in the Nunamiut diet essentially mirror those of Metzger, Ingstad, and Gubser:

> "Although certain food items, such as tea, flour, and sugar are now obtained from the white man, the Nunamiut diet is essentially unchanged from that of many years ago. Frozen fish are frequently eaten in the fall and when they can be obtained, in the spring. Meat forms the great bulk of the diet and the caribou is the main food animal upon which the Nunamiut depend for survival" (Rausch 1951:161).

Throughout their history, caribou have been the critical resource for the Nunamiut. As Amsden says:

> "It is axiomatic that caribou are the most important single food resource to the Nunamiut. In fact it is commonly accepted that without adequate numbers of this animal, no human society could inhabit interior north Alaska for any substantial period of time" (1977:42-43).

By the same token, to be so totally dependent upon one animal for survival can be, and is, as exemplified by the Nunamiut' abandoning the mountains between 1920 and 1934, a double-edged sword. Skoog (1968) suggests that caribou populations can fluctuate quickly, drastically, and independently of human predation. This appears to be true in light of the drastic reduction in the population of the Western Arctic Caribou herd in the early 1970s. Therefore, as Burch (1976) has suggested, any human population that relies completely upon caribou for food, as well as clothing and housing, will be periodically faced with a major survival crisis.

According to Ingstad, the absence of caribou for at least short periods of time (seasonally?) was not uncommon as far as the Nunamiut were concerned. He relates that one evening following several days of unsuccessful hunting, Simon Paneak remarked, "If the caribou disappear altogether, we've got plenty of skins. They taste good when they are boiled" (1954). Ingstad also states that: "It is such a common thing for the Nunamiut to be on starvation diet that they have a name for this dish" (1954). Ingstad may have exaggerated a bit since there were other resources such as sheep and moose when caribou were unavailable for extended periods of time. However, if the caribou were unavailable continually during the seasons when they were expected to be abundant, serious privation would occur. In fact, if Amsden's data is correct, the Nunamiut became more dependent upon caribou through time from 1898 to 1959. Amsden arrives at this conclusion based on the percentage of animals caught at the various camps for which he has data.

1898 - 1909 caribou were taken at 25% of the camps.
1910 - 1919 caribou were taken at 50% of the camps.
1934 - 1950 caribou were taken at 66% of the camps.
1951 - 1959 caribou were taken at all of the camps.
(Amsden 1977:177)

Actually there was another "cash economy" available to the Nunamiuts which was associated with trapping and had been going on for a number of years: the Federal bounty paid on wolves. As Metzger relates, an Eskimo was double dipping when he shot or trapped a wolf, because he was paid the bounty by the government,

and then could sell the hide for its fur value. As can be seen in the following quote, the Nunamiut, were not above a bit of chicanery to make an extra dollar.

> "Wolf skins being worth at the time $25 for the bounty money and another $25 for the pelt, had provided irresistible temptation to the Eskimos to turn in the pelts of "retired" sled dogs for the $50 total profit which they could bring, provided the Eskimos could get away with the deception. Noticing ancient harness marks on some of the "wolf skins" that they had paid bounty on, Fish and Wildlife officers subsequently requested that on all wolf skins turned in for bounty payment the bones of the left foreleg of the original beast should still be securely attached, the bones of sled dogs being thicker and heavier than those of genuine wolves" (Metzger 1983:39).

During his stay with the Nunamiut in 1949-50, Ingstad remarked upon the importance of trapping to the Nunamiut.

> "Wolves, wolverines, and foxes are what they are after. The skins of these animals are their only means of obtaining ammunition and other things, so trapping is of great importance to them. ...It is the wolf that counts; in his case there is a bonus of fifty dollars per head, in addition to the price of the skin. The whitish-grey skins, with their long, close neck hairs, are well paid for by the coast Eskimos, who use them for trimming" (1954:165).

Rausch (1951:159) states: "They are excellent hunters, and the wolf-bounty is their most important source of cash income. Wolf skins are sold also to the coast people, who are unable to obtain sufficient wolves for parkas."

While the wolf and certain other fur-bearing animals may have provided desired goods, both Euro-American and native, one other animal besides the caribou was essential for the survival of the

Nunamiut, at least as we know them to have existed historically and probably pre-historically as well. That animal is the dog. As Gubser states:

> "Without the dog, Nunamiut life could not exist as it does today (1960) or has in the past; households could not stay together in large encampments for more than a few days, if at all. Only caribou occur in large enough numbers to support more than a few isolated families in the Brooks Range, and caribou range over great distances during the year. Since so many caribou have to be killed so far from any one encampment, only the transportation provided by dogs permits the continued existence of Nunamiut society. Without them families would be forced to split up and forage on all the elements of the fauna and flora in order to eke out the barest living; the only alternative would be to move out of the Brooks Range" (1965:293-294).

Before proceeding further, some elucidation of just how important the dog was to the Nunamiut's mobility and survival, prior to the introduction of the snow machine and all terrain vehicle (ATV), should be made. One of the best sources for this appears to be Gubser because during the sixteen-month period he lived with the Nunamiut, between 1959-1961, the dog was the only available source of terrestial transportation.

> "When a dog is one year old it is put to work, but it does not reach its prime until its third year. A dog is usually good for eight to ten years...when it becomes a burden on the household it is shot.
>
> "Dogs are highly valued as economic assets. A man is often judged by the number, power, endurance, and size of his dogs.
>
> "In winter a man and his dogs can cover amazing distances with heavy loads. The longest trip I ever took was with a 65-year-old man. He drove one sled with eight dogs loaded with 300 pounds, and I drove another with six dogs and 250 pounds, 50 miles in one day.... The spring I lived in Anaktuvuk Pass one man with no load and a team of 14 dogs traveled over 100

miles, with no stop longer than a break for tea, in less than 24 hours.... With such mobility, endurance, and power, it can readily be seen how crucial dogs are to the Nunamiut way of life. In winter they contribute over 90 percent of the power used for transportation of goods and about 50 percent of the effort for traveling.

"In summer the Nunamiut use their dogs.... By making a saddlebag or dog pack from bull caribou hide, meat and camping equipment are easily transported over the treeless tundra.... A dog can pack 50 pounds or more for a short distance, say a mile or two, but should not be made to carry 30 pounds or more for a whole day over a 20- or 25- mile trail.... Summer travel by pack dog still permits a great deal of mobility, but a hunter can rarely bring home more than 200 pounds of meat from a long trip.

"In the early 1800s when the Nunamiut used to hunt musk ox, dogs were used to help round them up and force them into a defensive circle. Also in the old days, a few good dogs were trained to help drive mountain sheep over cliffs.

"One rarely sees the petting and fondling of dogs that occur among the white men, but I often saw Nunamiut men in their sixties tap dogs on the top of their muzzle out of affection...

"On the other hand, many Numamiut men and women alike, take out their feelings of frustration and aggression on dogs by speaking harshly to them and beating them, sometimes for little reason. Some Nunamiut are quite aware that dogs function as a limited psychological escape valve. (Author's Note: Ingstad states that the Nunamiut never mistreat their dogs while Metzger, Gubser, and others say they do.)

"In some years, the Nunamiut have great difficulty with rabies and distemper. The year I lived in Anaktuvuk Pass, over a fourth of the dogs died, either from severe distemper, some nonviolent form of rabies, or both. Most of the dogs that survived were greatly weakened. Life became difficult with reduced and weakened dog teams. Hauling heavy loads of meat and firewood turned into arduous tasks. In the memory of the older Nunamiut, every now and then fatal epidemics among the dogs have occurred. A few always seemed to survive, and in a year or two a man could build his team up again; but meanwhile mobility was reduced, and people had to pull and push their sleds themselves until new dogs were born and trained" (Gubser 1965:289-

293).

It is interesting to note that as late as 1961, Gubser, a trained anthropologist, had no hint or idea that the Eskimo's dependence upon dogs for transportation would ever come to an end or that the dog could or would ever be replaced by any other form of motive power. This is evidenced by the following quote: "... by 1980 between 55 and 60 hunters will have to provide for 200 or more mouths, and presumably 300 or more dogs" (1965:320).

Homer Mekiana's Diaries

In May of 1950 Homer Mekiana began keeping a diary of daily life at Anaktuvuk Pass. Rausch describes Mekiana as "a Point Barrow man who married a Nunamiut woman, and who has lived for many years among the Nunamiut..." (1951). Rausch goes on to say that Mekiana was an educated, bilingual Eskimo who had been trained at the Point Barrow Native School. With these qualifications, Mekiana became one of Anaktuvuk Pass' first historians.

Although Mekiana's diary covers a span of thirteen years, the bulk of the in-depth information cover only the first couple of years. For example, the first 70 pages (40%) of the 178-page typewritten document covers the first year, May 18, 1950-May 18, 1951. During that first year Mekiana made an entry in his diary 335 days out of a possible 366 days, so the overall coverage can

be considered very good. As previously mentioned, this period is probably one of the most critical to the Nunamiut in terms of dramatic changes in their daily lives resulting from a variety of outside influences. For the first time air service began to occur on a relatively regular basis which meant a dependable source for supplies and mail. There was now an almost continuous presence of Euro-Americans, mostly scientists, and their technology among these Eskimos including one man who set up a trading post, resided in the area, and made a supply of goods readily available to the local residents. Schools began and, for the first time, the Numamiut were the recipients of more than cursory medical and dental examination and care. In short, this period saw many firsts that were soon to become a regular part of the new pattern of Nunamiut culture and society and it is therefore worthy of summary review.

The information which has been extracted from the diary is basic to the daily lives of the Nunamiut in 1950 and 1951, and contrasts the remaining necessities of the old lifestyle with the acquired tastes, luxuries, and perceived necessities of the contemporary modern American culture/technology. The information is presented on a monthly basis in a short narrative accompanied by a numerical summary. Because the diary is written in the English of the writer, it is, on occasion, somewhat ambiguous. For example, a "wolf tent" is a wolf den and a "white owl" is a weather phenomenon known as a white-out. Due to my familiarity

with the people of Anaktuvuk Pass and their manner of speech, such ambiguities usually do not present a problem in interpretation and I feel that an accurate picture of the 1950-51 Nunamiut is presented. Lastly, the data from the diary concerning the numbers of animals taken are not absolute; they represent only what the writer was aware of. However, they are excellent indicators of subsistence trends and certainly reflect overall percentages (Mekiana, 1972).

May 18-31, 1950: Diary entries made for 6 out of 14 days. During this 14-day period two planes landed on the ice at either Cache Lake or Tulugak Lake where all of the Nunamiut families had gathered for the summer. The aircraft brought in Pat O'Connell who was going to establish a trading post, and Dr. Robert Rausch, a parasitologist with the U.S. Public Health Service (PHS). During this period, a meeting was held to establish a village council. A major source of entertainment was listening to the radio. No caribou or other animals were recorded to have been shot or trapped during this period.

June 1950: Diary entries made for 22 out of 30 days. During the month of June at least ten fixed-wing aircraft landed at Anaktuvuk, most on a short, rough strip that the natives had cleared near the river and at least 14 fixed-wing aircraft and helicopters were visible working in the area almost daily. All of the helicopter traffic and the bulk of the fixed-wing traffic

were the result of USGS exploration activities in and around National Petroleum Reserve #4. During this period the Eskimos got their first look at an ATV in the form of a Weasel, a large tracked vehicle, several of which were being used by the USGS in their exploration activities. A major source of entertainment was listening to the radio. The diary indicates that caribou are not plentiful in the area. At least 18 caribou were shot, 17 marmot were trapped, and three adult wolves and eight pups were killed (more for the bounty than the fur), and that one wolf pup was captured alive (presumably for the researchers at Naval Arctic Research Laboratory in Barrow).

July 1950: Diary entries made for 23 out of 31 days. During the month at least six fixed-wing aircraft landed at the camp, and another ten aircraft overflew the camp. School teachers and zoologist Dr. Laurance Irving arrived. A council meeting regarding the establishment of a post office and store was held. USGS Weasels were occasionally seen working in the area. A few villagers receive supplies by aircraft. A major source of entertainment was listening to the radio. The diary indicates that two caribou, 26 sheep, and six grizzly bears were shot, and that a small amount of fishing was being conducted in the vicinity of the camp.

August 1950: A diary entry was made every day of the month. During the month at least eight fixed-wing aircraft landed near

the camp, half of them on floats, and at least eight aircraft overflew the camp. The trader established his store at the summit of the Pass and received several shipments of goods via aircraft. USGS came into the camp with their Weasels and gave the kids rides in them. Several families traveled to Shanin (Willow) Lake to hunt marmot. Several families moved their tents up to the summit, possibly to be near the store. An infant girl died and a dentist visited the camp. A major source of entertainment was listening to the radio. Some people picked berries and a few people did some fishing near camp. Families were starting to split up; some are camped at Tulugak Lake, others at Cache Lake, and others at the Pass. A few families received supplies via aircraft from Fairbanks and mail order houses. People were out hunting daily. The diary indicates that at least 20 caribou, 13 sheep, two grizzly bears, and one wolf were shot.

September 1950: A diary entry was made for every day of the month. During the month at least ten fixed-wing aircraft landed near the main camp; all of the landings were made on floats on the lake. The trader received several plane loads of supplies, and a few Eskimo families received goods by aircraft directly from Fairbanks or mail order houses. At least one Eskimo family was on relief and receiving checks. Women picked lots of berries and a limited amount of fishing was conducted. There were quite a few caribou around and pack dogs were being used to transport

the meat. Late in the month the families began to move to their winter camp locations; family groups were camped at Tulugak Lake, Cache Lake, Kongumavik, the Pass, and Savioyok Creek. Euro-American hunters using a twin engine amphibious airplane were hunting in the area. Listening to the radio was a major source of entertainment. People were out hunting daily. The diary indicates that at least 60 caribou, 14 sheep, and one grizzly bear were shot, and that 22 marmot were trapped. The trader was offering $6.00 worth of supplies for each excellent marmot, $3.00 for a standard, and $1.50 for a small.

October 1950: A diary entry was made for every day of the month. During the month at least two planes landed with skis/wheels on frozen Eleanor Lake and two planes overflew the camp. Family groups continued to move to their winter camp locations. People began setting out traplines. There was enough snow to use dog sleds for transportation. A number of people were camped and fishing at the Ekopuk Creek fishing hole. Listening to the radio was a major source of entertainment as well as information. KFAR, a Fairbanks radio station, would broadcast messages to bush residents on a program called "Tundra Topics." Through this radio program, the Anaktuvuk area Eskimos would learn when a plane was coming and usually the type of load it would be carrying. There were very few caribou in the area. People were out hunting daily. The diary indicates that at least two caribou, 19 sheep, one wolf, and one grizzly bear (taken by a

scientist) were shot while two wolves and one wolverine were trapped.

November 1950: A diary entry was made for every day of the month. During the month at least 3 planes landed on frozen Eleanor Lake with wheel/skis bringing supplies for the trader, mail, and some goods ordered directly by some of the Eskimos. Many people were engaged in trapping and people were out hunting daily. There were lots of caribou in the area. People listened to the radio for both entertainment and information. Family groups continued to operate out of scattered camps within a 20 mile radius of Anaktuvuk Pass. The diary indicates that at least 89 caribou, eight sheep, two wolves, and one grizzly bear were shot during the month and that two wolves were trapped.

December 1950: A diary entry was made for every day of the month. During the month at least one plane landed on frozen Eleanor Lake on wheel/skis bringing supplies for the trader and goods ordered directly by a few of the Eskimo families. During the first half of the month caribou were very numerous in the area and people were out hunting almost daily. Some families come to the Pass for a few days for the holidays; dancing, dog sled races, etc. People listened to the radio for entertainment and information. The diary indicated that at least 23 caribou were shot (this number seems to reflect mainly the caribou shot by the recorder, at least three times this number were probably

taken) as well as one sheep and one wolf.

January 1951: A diary entry was made for every day of the month. The diary indicates that during the month no planes landed at the Pass but that a C-47 made a low pass over the camp. People were well into winter routine; lots of sled travel between the scattered camps and for the purpose of checking traps and hunting. Other almost daily activities included hauling ice for drinking water and willows for firewood. People were listening to the radio for entertainment and information. Another form of entertainment, at least for the men, was playing poker, usually for tobacco. The diary indicated that at least 57 caribou, one sheep, and one wolf were shot and that nine wolves and four fox (red or cross) were trapped.

February 1951: A diary entry was made for every day of the month. The diary indicated that at least five aircraft landed on frozen Eleanor Lake on wheel/skis bringing in goods and supplies for the trader and some goods ordered directly by a few of the families. A Public Health Service scientist visited the camp for a few days collecting animal carcasses. Caribou were relatively plentiful during most of the month and people were out daily hunting and checking their traps. In mid-month the trader moved his operation 30 miles south to the confluence of John and Hunt Fork Rivers. Daily chores included hauling ice and firewood, and fixing sleds and harnesses. Listening to the radio provided

entertainment as well as information for many of the families. The diary indicated that at least 46 caribou and two sheep were shot and six wolves and one weasel were trapped.

March 1951: A diary entry was made for every day of the month. The diary indicates that at least one plane landed on frozen Eleanor Lake on wheel/skis bringing mail and some supplies to people at the pass. Most of the air traffic was now landing 30 miles south of the pass on Hunt Fork Lake adjacent to the trader's new post location. People were traveling regularly to this location to trade for supplies and the trader was erecting a log building since he was far enough south to be in spruce trees. During this month people began to move camp locations for seasonal change, and because firewood supply was running low at winter camp locations. Daily, people were hauling firewood and ice and were hunting and checking traps. Caribou were present in the area for the majority of the month. Listening to the radio provided entertainment as well as information for many of the families. The diary indicated that at least 61 caribou and one wolf were shot and one wolf and two wolverines were trapped.

April 1951: A diary entry was made for 27 out of 30 days, although six of the 27 recorded days were spent in Fairbanks. The diary indicated that at least six aircraft landed on frozen Eleanor Lake on wheels/skis during the month bringing in some mail, goods and supplies for summer teachers, a doctor and a PHS

biologist. Two aircraft with Euro-Americans hunting wolves operated in the area for awhile. About six Eskimos are taken to Fairbanks by the doctor for in-depth medical examinations. It was the first airplane ride and first trip to a real town for most of them. People were traveling to the Hunt Fork to trade regularly. There were small numbers of caribou around, and people were out hunting almost daily. Snow was getting soft and beginning to melt and people were pulling their traps. People listened to the radio for entertainment and information. People were beginning to move to summer camp locations at Cache or Tulugak Lakes. Diary entries indicate that at least 21 caribou were shot and one wolf was trapped.

May 1-18, 1951: A diary entry was made for each of the 18 days covered in this period. The diary indicates that at least four aircraft landed on the ice on either Cache or Tulugak Lakes bringing in supplies and equipment for scientists as well as a uranium prospector, some mail and supplies for the local residents. People were busy hauling meat and gear with dog sleds to summer camp locations before the snow was gone. The trader abandoned the area and moved to Fairbanks. Caribou appear plentiful in the area and people were out hunting regularly. People listened to the radio for entertainment and information. The diary indicated that at least 30 caribou and one grizzly bear were shot, and eight marmot trapped during this 18 day period. Some of these numbers appear to have more corroboration than

Animals Caught during a Representative Year

Type	Number	Manner
Caribou	429	shot
Sheep	84	shot
Wolf	40	18 shot, 22 trapped
Grizzly Bear	12	shot
Wolverine	3	trapped
Fox	4	trapped
Weasel	1	trapped
Marmot	30	trapped

Table 28. Animals Recorded As Taken in the Anaktuvuk Pass Area Between May 18, 1950 and May 18, 1951, by Homer Mekiana (1972).

others. Homer recorded 429 caribou as being shot during the representative year. This number appears to be about half of what a population of 65-70 people and roughly 200 dogs would require for a regular year (Metzger 1983; Gubser 1965). The necessity of the caribou to the Nunamiut at the time of Mekiana's writing cannot be over stressed. However, it was so common for many caribou to be shot very frequently, by a number of scattered groups of people, that only half the number actually harvested may have been recorded.

Although Mekiana's diary never indicateed extended periods of time when caribou were not present, the number of sheep taken during the summer and fall of 1950 was inordinately high when compared with previous data concerning the harvest of sheep by the Nunamiut. Since sheep kills were highest when caribou kills were lowest, there may have been fewer caribou than normal taken that year. Rausch (1951) stated that the Nunamiut rarely hunted sheep except during times of caribou shortages, because the activity required too much effort when compared with the rewards. Ingstad (1954) said the Nunamiut only hunt sheep in time of dire need, or in an almost recreational sense for a change of pace in their daily fare. Gubser (1965) repeated basically the same thing, suggesting the Nunamiut viewed sheep hunting as hardly worth the effort, especially in the summer and fall when there were other, more easily obtained subsistence resources, such as marmots and fish, that could make up for the low caribou numbers

during that time of the year.

Rausch (1951) reported that usually between 20 and 30 wolves were taken each winter, but that the winter immediately previous to the one recorded above, 48 wolves were taken. However, Rausch goes on to say that some years wolves are more plentiful than others and that a record 150 wolves were taken by the Nunamiut during the winter of 1942-43. Therefore, Mekiana's total of 40 wolves for the winter of 1950-51 would appear quite accurate.

The number of bears, 12, recorded in Mekiana's diary as being taken in one year also appears to be quite accurate. Rausch (1951) stated that during the year 1948 eight grizzly bears were taken by the Nunamiut and that in 1949 the number was five. Gubser (1965) stated that the Nunamiut kill between four and ten grizzlies per year, mainly for meat, fat, and hides. The grizzly bear hide was the preferred material for tent doors.

Mekiana recorded the trapping of three wolverine during the 1950-51 winter, and according to other sources that number appears to be normal. Rausch (1951) stated that the Nunamiut normally caught three and six wolverine a year, and in a good year as many as twelve. Ten years later Gubser (1965) said that those numbers were still accurate. The Nunamiut trapped the wolverine primarily for their own use since it was the most highly valued fur. A wolverine skin is incredibly durable and lasts for years,

fading and loosing hair very slowly. Additionally, they were easily traded for a value of at least $50.00 at any time.

In Homer's diary only four fox are reported to have been trapped during the 1950-51 seasons. Fox in this case refers to red, cross, and silver. The area exploited by the Nunamiut lies on the extreme southern boundary of the arctic fox range and it is only a rare visitor to the Anaktuvuk Pass area. The numbers of foxes trapped, as recorded in Mekiana's diary, appears low, although neither Rausch (1951) or Gubser (1965) mention the yearly numbers usually taken by Nunamiut trappers. However, Gubser does mention that the Nunamiut had little or no use for fox skins themselves, so the purpose of trapping fox was obviously for trade or cash, suggesting that the market value would have influenced the number taken.

Mekiana's diary records one weasel as being trapped during the 1950-51 winter. Rausch (1951) stated, though, that in those years the Nunamiut were trapping between 30-40 a year, which may be more accurate. According to Gubser (1965), the Nunamiut had little use for weasel skins themselves, but could trade them to the coastal Eskimos, or they could get between $0.25 and $1.25 for them in the cash market, a price they thought exceedingly good for such a small skin. However in the ten years that elapsed between Rausch's and Gubser's reporting Gubser states that the Nunamiut rarely bothered trapping weasels as there were

easier methods of making money.

Mekiana's diary records the number of marmot taken during the spring, summer, and fall of 1950 as 30, which may be somewhat low. The Nunamiut prized marmot skins because they were both windproof and waterproof, and made excellent parkas and blankets. Additionally, marmot skins could easily be traded for a cash value of up to $8.00 in 1960, and their meat and fat were highly prized. Marmot were available during the time of the year when the caribou were most likely to be scarce and, therefore, were an important food source to the Nunamiut. Through the 1950's marmot were usually trapped in rock deadfalls or shot.

Based on Gubser's figures for resource consumption by a population the size of that in the Anaktuvuk area in 1950, eighty-four sheep constitute nearly 10% of the total Nunamiut diet, an amount far greater than here-to-for had been considered, at least as reported by Gubser, Ingstad, and Rausch. However, Amsden (1977) presents information, based on species hunted out of the known camps between 1898 and 1959, which suggests that sheep were always an important subsistence animal for the Nunamiut, particularly during the winter months. Binford (1978) presents data for five selected years between 1950 and 1971 indicating that sheep resources were regulary utilized, and that the majority of sheep procurement occurred between the months of July and November.

This recent high level of sheep utilization during a time of year apparently different from that demonstrated in the historic record, and its effect on the local sheep resources, may have been one of the initial reactions of an historically transient, subsistence-oriented, human population becoming sedentary and utilizing a much reduced resource area when reacting to changes in the availability of their primary subsistence resource. As Binford stated:

> "During the early years of the settlement at Anaktuvuk Pass (1950-1956) the Nunamiut practiced a direct procurement strategy during the summer months, hunting sheep, bear, and caribou. This strategy resulted in the near absence of local sheep by 1955. The situation was so critical that in 1956 deep storage cellars were dug into the permafrost for the storage through the summer of caribou meat obtained during the spring migration. Since 1956 summer hunting has decreased and sheep have become a delicacy rather than a subsistence necessity, which was the role they played between 1950 and 1955" (1978:278-279).

Changes in lifestyle

The decade of the 1950's was probably the one of greatest change and acculturation for the Brooks Range Nunamiut. In the early fifties, Anaktuvuk Pass was still more of a base camp or supply depot than a village. During much of the year, families were out at their seasonal camps, coming back to the village for resupply and then going out again. The more permanent residents of the village still went out on an almost daily basis to hunt, fish or

check traps. This pattern slowly became the norm as more people became sedentary because of the school and other social or economic ties. However, when school was not in session and/or village affairs slakened seasonally, even the "village families" moved back out to the camps. Men without family responsibilities or families without school age children still continued to range the country for extended periods on hunting expeditions when necessary, providing meat for those who were, for various reasons, tied more closely to the village.

A very visible sign of change and acculturation was the construction of a log church in the late 1950's. This building occasionally served as a school when a teacher was available, until 1960 when the first permanent school was built. With the construction of the school and the presence of full-time teachers, school attendance became mandatory. This caused the few remaining families who had not become permanent residents to abandon their seasonal camps and take up residence in what was now a full-fledged village. At about the same time an airline company walked a bulldozer to Anaktuvuk from Umiat and bladed out a permanent, all-weather airstrip at the village, and in April of 1964, a cat train on its way north from Fairbanks reached Anaktuvuk Pass. Five year later other cat trains would pass through the village on their way to the oil field at Prudhoe Bay.

The old ways and means of living were changing because there was

no choice. To a resident of Anaktuvuk Pass, much of the old lifestyle had to be given up and much of the Euro-American culture used to fill the gap. The semi-nomadic methods of utilization of the natural resources could not be applied to a growing sedentary population. During the 1960s, the village residents began to burn fuel oil exclusively to heat their homes because the willow patches surrounding the village grew more slowly than they were harvested for use as fuel, and had been completely depleted. There was even talk of moving the village to Umiat, on the Colville River, where the willow resources were considered inexhaustible even for the needs of a permanent village.

Methods of travel were also revamped. Overland transportation had consisted of walking accompanied by pack dogs, or occasionally floating the rivers by boat or raft during the summer, and snowshoeing and/or dog sledding in the winter. In 1960 the first snowmachines appeared in the village, and throughout the next ten to fifteen years these machines, as they became more powerful and reliable, replaced the dog as the main transportation medium. A sedentary population of hunters and gatherers has to depend on food resources close at hand and suddenly the dogs were in direct competition with people for these resources, which began to decline. Snowmachines, on the other hand, used gasoline, and only when they were working, unlike the dogs who needed to be fed regularly. Additionally,

new game regulations made it illegal to use game animal parts for dog food.

These innovations, though, were not without problems. Snowmachines cost money to purchase as well as operate, and fuel and heating oil were expensive. Fortunately the decade of the 1070s offered many opportunities for the transition from a hunting/bartering economy to one that was based primarily on cash. Construction of the Trans-Alaska Pipeline provided many jobs for the residents of Anaktuvuk Pass, if they were willing to leave the village. At the same time, the Alaska Native Claims Settlement Act of 1971 provided Alaska's Natives with 44 million acres of land and almost 1 billion dollars. The Act also provided for the establishment of regional and village corporations. Establishment of the North Slope Borough in 1972 encompassed all lands north of 68° latitude. The Regional Corporation, Village Corporation, and the Borough all provided local jobs through a variety of community improvement construction projects.

The decade of the 1979s brought a new form of mechanization to Anaktuvuk Pass, the ATV. The ATV basically replaced the pack dog which had been, other than one's own back, the only method of moving gear or meat overland during the summer months. Snowmachines and sleds had been used to move gear and meat overland in times of necessity during the summer, but such use

was hard on the machines, especially the older models. The ATVs were designed for overland travel and even the early ones could easily carry the load of ten or more pack dogs. Around 1970 the first ATV was imported into the village. Coots, Rangers, and Tracksters were some of the earliest ATV models, followed in the mid-70's by Maxes and by 6- and 8-wheeled Argos in the late 1970's. Although ATV technology over the last 15 years has not changed much, it has been refined and today's vehicles are more efficient and reliable than those of the past. The last documented use of pack dogs occurred in the summer of 1978.

To live in Anaktuvuk Pass today requires cash. Certain aspects of modern living now found in Anaktuvuk Pass, such as electricity, telephone, heating oil, cable TV, even water, cost money. While ATVs may serve a useful purpose, they are very expensive to purchase. An 8-wheel argo is at least $8500 delivered to Anaktuvuk Pass, not to mention the operating and maintenance costs. Most of the people in the village who have an ATV also have a steady job, in most cases working for the Village Corporation, North Slope Borough, or School District. By the same token, the people who have the steady jobs are, by their own assertion, those who need ATVs the most and also are the ones who can most afford them.

The people of Anaktuvuk Pass do not want to abandon what they consider to be their cultural heritage. In 135 years the Natives

of Arctic Alaska underwent the types of technological changes that had taken most other cultures myriad centuries to develop and accept. Indeed, all of the residents of Anaktuvuk Pass society, who are 37 years of age or older, and are descendants of the original founding families, were born into a lifestyle more dependent on the land and its resources, and less on technology than most other contemporary societies. It is little wonder that even today these people feel that they are very closely associated with the land, and that they are a natural part of the ecosystem.

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