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TERRESTRIAL ADAPTATIONS OF NEO-ESKIMO COASTAL-MARINE HUNTERS ON SOUTHERN BAFFIN ISLAND, N.W.T.

BY

DOUGLAS RICHARD STENTON

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NAME OF AUTHOR: DOUGLAS RICHARD STENTON

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....
(Signed)

10431 - 52 Avenue
Edmonton, Alberta
T6H 0N7

Date:

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled TERRESTRIAL ADAPTATIONS OF NEO-ESKIMO COASTAL-MARINE HUNTERS ON SOUTHERN BAFFIN ISLAND, N.W.T. submitted by DOUGLAS RICHARD STENTON in partial fulfilment of the requirements for the degree of DOCTOR OF PHILOSOPHY.

(Supervisor)

(External Examiner)

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ABSTRACT

A central theme of the study of hunter-gatherer settlement and subsistence systems is the relationship between the character of the natural resource base and the organization of human subsistence behaviour. Investigations regarding the interplay between natural and cultural components that structure Arctic hunter-gatherer socio-economic systems traditionally focus on the stabilizing influence of the coastal-marine resource base. The role of terrestrial resources in the adaptive strategies of Arctic cultures, specifically the important contribution made by caribou skin clothing to human survival in Arctic winter conditions has received comparatively little attention and thus is not well understood.

Terrestrial adaptations of Late Prehistoric (Thule) Arctic hunter-gatherers are considered in terms of the population dynamics of a critical terrestrial resource, the Barrenground caribou. A 'system-state' model is presented which links population cycles of caribou with the organization of hunter-gatherer procurement strategies. Two contrasting patterns of terrestrial settlement and subsistence, each having specific mobility requirements in terms of caribou population dynamics, are derived from ethnographic and oral historical sources. It is hypothesized that during periods of high caribou numbers a coastal-oriented strategy, with low residential and high logistical mobility will be favoured. In response to episodes of significant decline in caribou population size, an inland-oriented strategy incorporating both low residential and low logistical mobility will be adopted. Based on historical precedents, it is further suggested that during periods of declining availability of caribou, procurement patterns will become less discriminating and that this will be reflected in the age and sex composition of the faunal assemblages from inland sites.

These hypotheses are tested using biological, ethnographic and archaeological data from the interior region of southern Baffin Island, N.W.T. Archaeological surveys and excavations were conducted in the Nettilling Lake district, an area identified in oral historical and

ethnographic accounts as being of special importance to caribou hunting during periods of reduced availability.

The results of the study indicate a long history of human occupation in the interior region of southern Baffin Island, extending back at least 3,000 millennia. Analysis of information recovered from Thule period sites suggests that in the inland-oriented procurement strategy was characterized by low residential and logistical mobility, and that reduced availability of caribou did exert an important influence on the mobility pattern. Selective procurement of caribou according to age and sex (i.e., subadults or younger and females) was also indicated. It is suggested, however, that this bias may relate to normal patterns of herd segregation prior to the autumn rut, rather than to selective predation. Interesting information concerning ideological constraints on patterns of refuse discard was also obtained. This suggests that interpretations of the organization of Thule settlement and subsistence behaviour based on the presence of certain feature may be inaccurate.

It is concluded that Arctic terrestrial environments played more creative roles in the development of Arctic hunter-gatherer adaptations than is usually recognized, and that they can serve as productive settings for the testing of models of human adjustment to changing resources.

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CHAPTER ONE

INTRODUCTION

Archaeological and ethnographic studies in Arctic North America and Greenland over the past sixty years have clearly established that long-term survival in most regions was founded on an adaptation to a coastal-maritime resource base. The technology, economy, social organization and ideology of most truly Arctic societies from Siberia to Greenland have been shown to be linked closely to the productivity, species diversity and predictability of the arctic marine ecosystem. Although the significance of the terrestrial environment to Arctic adaptive strategies in general has also been acknowledged, its importance has been undervalued in many investigations designed to understand the form and development of Arctic cultural systems during the last millennium.

Despite its lower productivity, the terrestrial environment is a key ingredient of human adaptations to coastal Arctic conditions. In terms of basic prerequisites for human survival, there is no single resource, marine or terrestrial, capable of providing all essential food and non-food materials. However, as Burch (1972) has argued for the Nunamiut Eskimos of interior Alaska, and as the Caribou Inuit of the Canadian Barrengrounds demonstrate, caribou can meet most, if not all of these requirements. Caribou made important contributions to the diet of coastal groups whose economy was based on the harvesting of maritime resources, but it was also highly valued for its skin which furnished excellent protection from cold winter temperatures and thus allowed the effective exploitation of marine resources during the critical winter period. The Arctic caribou, however, is an "unreliable" resource whose distribution and density are subject to extreme variation through time, events which have had disastrous effects on some human populations. This suggests an interesting paradox for the study of prehistoric coastal-marine arctic cultures: long-term survival based on maritime socio-economic strategies also required the adaptation of cultural systems to an unstable terrestrial resource.

Arctic environments are characterized by marked seasonality to an extent unparalled in other regions of the world. Although seasonal changes are extreme, they are regular and normally have predictable consequences for the resource base. In recent years, a variety of models employing both ecological (e. g., Smith 1981; Savelle 1985) and social (e. g., Amsden 1979; Minc 1986) concepts have been developed to test hypotheses concerning the means through which Arctic cultural systems maintain adjustments to these conditions through time. A central theme of these studies is the interplay between hunter-gatherer settlement and subsistence systems and the regularly varying character of the resources upon which they rely. While human adaptation to the consequences of environmental rhythms is a prominent area of Arctic ethnography and archaeology, there have been comparatively few archaeological studies that address the importance of periods of unpredictable but inevitable environmental stress.

Because the form of any specific human adaptation can be viewed as being partially contingent upon the characteristics of the selective pressures, and the manner in which their effects are perceived, attention to periodical environmental pressures can increase our understanding of the range of human adaptive strategies. This approach is particularly relevant to the problem of cyclical periods of dramatic reductions in resource availability. Unlike the marine ecosystem, populations of many terrestrial species, including caribou, appear to fluctuate in a cyclical fashion. Biological research suggests that caribou population dynamics are controlled by several factors including changes in climate, forage conditions and predation. An important dimension of caribou herd dynamics are episodes of significant quantitative decline which recur every few human generations. Unlike short-term reductions, which are also characteristic of the species, longer term periods of scarcity require that human groups that rely on caribou develop systematized mechanisms to deal with protracted shortages since the appearance of a deprivative phase of a cycle will normally be outside the direct experience of many members of a social group. In view of these characteristics, Arctic terrestrial ecosystems can also be considered an important setting for research directed toward understanding the development of Arctic cultural systems.

The present study explores the implications of recurring fluctuations in a key terrestrial resource during the late prehistoric (Thule) period on south-central Baffin Island in eastern Arctic Canada. The study area is an insular one in which the traditional economy has a distinct maritime orientation. The distribution of both aboriginal and modern native populations has been in coastal settlements with marine mammals, especially small seals (e.g., Phoca hispida), forming the bulk of the traditional diet. The nature and complexity of the interaction between Arctic hunter-gatherers and northern marine ecosystems has been a subject of anthropological research for decades and its significance to human survival is well established. The existence of an important terrestrial-inland component to most Arctic social and economic systems is also well documented in ethnographic accounts; however, due to a lack of empirical studies the nature of this relationship in most cases is poorly understood both in terms of its intrinsic properties as well as the manner in which it was integrated with the maritime component to produce a complex and dynamic human adaptive strategy.

Historic and ethnographic accounts pertaining to southern Baffin Island (e.g., Hall 1865; Boas 1888) as well as the testimony of Inuit informants, indicate clearly that caribou hunting took place in coastal-upland districts (especially at river and lake crossings), and in the distant interior region of the island. In the latter context, the vicinity of Nettilling and Amadjuak Lake figured prominently at times in the traditional annual cycle of settlement and subsistence. Movements to the interior were prompted by both social and economic factors, but evidently a principal objective was to hunt caribou for several weeks during the period of their annual migration and feeding in the territory bordering the large inland lakes. Inland excursions were typically of short duration and occurred during the summer and fall months, although occasional reports of extended occupancy (i.e., overwintering) also exist.

The conditions according to which the orientation (and intensity) of land use alternated between coastal and inland strategies on southern Baffin Island are not well understood. Historic accounts provide information relevent to the post-contact period, during which time certain inland terrestrial resources were exploited with greater intensity. The expansion of the fur trade to Baffin Island in the early years of the twentieth century had a considerable impact on traditional patterns of land use, with trap lines established over many coastal and interior parts of the island. Patterns of caribou hunting were also modified as a consequence of improved technology (i.e., firearms) and the pressure to provision crews of Euro-American whalers who overwintered in ship and shore stations. The extent of this activity on Baffin Island and thus its potential effect on traditional procurement systems nevertheless remains unclear. Although historic and ethnographic records are important sources of information concerning the sources, rates and types of cultural change, it is evident that contextual problems limit their ability to clarify the form of indigenous land use patterns.

From a "traditional" perspective, however, caribou can be visualized as a critical resource for which there is a constant (i.e., annual) need and a limited number of substitutes. As such, human behaviour associated with caribou procurement can be expected to be closely governed by the changing nature of herd density and distribution. Based on the propensity of these herd attributes to fluctuate in a dramatic fashion, a logical model is developed in this study which focusses on a limited set of relationships between Arctic cultural and natural systems, in the latter of which caribou is regarded as a key oscillating variable triggering environmental stress. This stress is viewed as having potentially important consequences for the organization of human behaviour among Arctic hunter-gatherers. Two mutually exclusive patterns of human response to variations in the productivity of the terrestrial ecosystem, developed using ethnographic, historic and biological information, are then introduced. These patterns are considered in terms of the collector/forager model developed by Binford (1980), and from which two hypotheses related to changes in residential and logistical mobility are generated. These concern the manner in which the organization of interior land use during the Thule era was modified under conditions of resource scarcity. These hypotheses are then tested using Thule archaeological data from Nettilling Lake region in south-central Baffin Island.

The core of the argument to be developed here is that there are limits to the adaptive capabilities of any society. In the context of prehistoric hunter-gatherers, the position taken is that certain forms of variability documented in the archaeological record can be understood not simply through reference to modern characterizations of hunter-gatherer societies as infinitely flexible in their social and economic organization, but in some cases as systems experiencing one or more forms of stress. In the present example, stress is seen to be environmentally rather than culturally induced, but it should be noted that system stress of environmental origin is considered simply to be one approach among many that might be chosen to explore this issue.

The objectives of this study are: (1) to contribute to an understanding of the complexity and variety of processes through which human groups adapt to periods of resource scarcity; and (2) to broaden existing perspectives concerning the role of terrestrial ecosystems in the development of human adaptations to Arctic conditions. The ultimate goal is to reduce the imbalance in models proposed for the interaction of Arctic hunter-gatherer societies and their natural environments.

Theoretical Approach

In the past two decades, many of the theoretical perspectives associated with investigations of prehistoric hunter-gatherer economics have been influenced by research involving contemporary hunter-gatherer societies (e.g., Lee 1968; Jochim 1976; Binford 1978, 1980, 1982; Yellen 1977; Gould 1978, 1980). To a certain degree, these developments relate to the fundamental reappraisal of hunting and gathering as a way of life that emerged from the 1968 symposium on "Man the Hunter" (Lee and Devore 1968; Sahlins 1972). This conference emancipated hunter-gatherers from Victorian characterizations as: (i) "survivals" of an evolutionary stage through which western society had passed, and who could therefore serve as direct analogues for archaeological interpretation; and (ii) peoples who obtained an uncertain existence through constant hard work in harsh and biologically marginal environments. Replacing these views were perspectives which balanced ecological and socio-cultural factors and which stressed the concept of adaptation to the natural and social environment. Thus, while prehistoric cultural developments could not be interpreted strictly within ethnographic contexts, adaptation could be used as a fundamental premise to derive general cultural models that could be projected onto specific archaeological data.

An important result of this change in perspective for archaeological research has been the proliferation of increasingly complex models of past human adaptive behaviour. Much of the current literature on prehistoric hunter-gatherer societies concerns the application of formal models that stress either the role of rationality, and which rely extensively in development on analogy and concepts borrowed from biology and evolutionary ecology (Hardesty 1975, 1980; Jochim 1976; Winterhalder and Smith 1981; Bettinger 1980, 1987; Kirch 1980), or a various social anthropological theories (Barnard 1983; Hodder 1982, 1987; Kent 1987). The central assumption of the former group of models is that human economic behaviour is based on rational decision making processes. Faced with a set of economic (i.e., subsistence) options, hunter-gatherer subsistence strategies are considered to be the result of knowledge-based and deliberate decisions between alternative choices. These strategies are inherently flexible and those which optimize chances for survival through time become basic elements of subsistence strategies and lead to the adaptation of the system to its environment.

Several of these models are operationalized through the use of sets of dichotomous variables (*e.g.*, foraging/collecting (Binford 1980); immediate return/delayed return (Woodburn 1980); storage/non-storage (Testart 1982); minimizing/maximizing (Smith 1983)), thought to reveal behavioural patterns with recognizable archaeological correlates, and thus useful in the investigation of the complexities of hunter-gatherer societies in both historic and prehistoric archaeological contexts.

Although all of these models are comparatively new to archaeology, they have been applied to areas of traditional interest, typically issues related to the organization of subsistence and settlement. Many of them are also unified in their adoption of an explicitly ecological theoretical orientation. Ecological studies are those that focus on the relationships between living organisms, or communities of organisms, and their environment, the term environment being broadly defined to include not only the physical components (e.g., land, water) but other living organisms (Helm 1962; Vayda 1969; Rappaport 1971).

Two concepts form the foundation of an ecological approach. The first is the analytical framework provided by systems theory (von Bertalanffy 1968; Buckley 1968). Miller (1965:200) defines a system as:

> "...a set of units with relationships between them. The word 'set' implies that the units have common properties. The state of each unit is constrained by, conditioned by, or dependent on the state of other units."

The utility of the systems approach as an organizing device for the study of individual and group interaction is thus derived from the structure provided by the units of the system and the processual relationships that coordinate them (Clarke 1968; Gibbon 1985). The ecosystem concept originally focussed on the exchanges of matter and energy, and more recently, of information.

> "An ecosystem - an ecological system - then becomes a relatively stable set of relationships in which energy, material and information are in continuous circulation, and in which all processes are seen in terms of their systems-wide repercussions." (Ellen 1982:84)

An important property of cultural systems is that they are internally and externally open, and in which feedback loops permit "not only self-regulation, but self-direction or at least adaptation to a changing environment" (Buckley 1968:490; cf. von Bertalanffy 1968; Miller 1965).

The second concept basic to ecosystemic approaches in anthropological research is the principle of adaptation. As commonly used, adaptation refers to the complex genetic and/or behavioural processes through which an organism or population modifies its relation to its environment (Cohen 1974). It also refers to the outcome of these processes, for example, in the sense of being in a state of "adaptedness" to a specific environment. In cultural contexts, however, there is little explicit agreement regarding how the term should be defined and where its use is appropriate. Very different meanings have been applied in the context of its general application (genetic versus non-genetic), as well as the manner in which specific cases are operationalized (active versus passive) and the nature of the resulting modifications (short-term versus evolutionary) (Bennett 1976a, 1976b; Bargatzky 1984). In the study of cultural systems, the general value of the concept of adaptation lies in the organizational framework it provides for identifying and evaluating the integration of specific ecological and behavioural variables. According to Kirch (1980:102), the concept of adaptation "lies at the intersection point between evolutionary and ecological theory", and thus offers a potentially unique perspective on change given the logical interdependence between these approaches.

A key component of adaptation, in any context, is variation. Variation is the cornerstone of both genetic and non-genetic concepts of adaptation, and of the general theory of evolution. The adaptive significance of variation is reflected in the features summarized by Kirch (1980) as basic to the paradigm of culture as an adaptive system. These are:

> "1. The importance of a source of variability within the cultural system in order to respond to the adaptive challenges posed by the changeable environment. Sources of cultural variability include innovation on the individual level, and diffusion of ideas from outside the immediate cultural system.

2. A set of selective criteria for sorting out those behavioural variations that are most successful in a particular environment, or in Buckley's terms, "most closely maps the environment" (1968:491). The ultimate criterion, presumably, is that selective behaviour must enhance the population's adaptedness in the sense of reproductive fitness.

3. A mechanism for the retention, propagation and transmission of those behavioural strategies that confer a selective advantage on the population." (Kirch 1980:109).

Adaptation is thus well-suited to many of the interests of contemporary archaeology which has as one of its primary objectives the identification, analysis and explanation of variability within and between specific cultural systems (e.g., Plog 1974; Schiffer 1976; Binford 1978, 1980). Nevertheless, one of the primary obstacles encountered in attempts to explain certain forms of cultural variation by employing ecosystemic models has been the difficulty in relating observed variation to selective pressures of the environment (Reid 1978; Kirch 1980; Gibbon 1985). This difficulty is made more pronounced by the large number and complexity of the interactions encompassed by such models, features which have combined to force investigators to define and focus only upon subsets of activities (Bayliss-Smith 1977; Jochim 1979; Bettinger 1980).

The development of an ecological perspective in anthropology has been shaped by several trends (cf. Helm 1962; Bennett 1976; Bettinger 1980; Kirch 1980; Ellen 1982). The early deterministic models saw direct and mechanistic correlations between human behaviour and climate. In the 1930's, this simplistic model of geographical control over cultural development was supplanted by what has been termed "possibilism". This view holds that specific environmental characteristics do not predetermine cultural attributes, but rather act as factors limiting or constraining the development of cultural phenomena, which can nevertheless display a wide range of variability (Boas 1888; Birket-Smith 1929; Kroeber 1939; Meggars 1954). The most influential development within ecological anthropology was

Steward's (1955) introduction of the method of cultural ecology. This approach emphasized the relationship between various components of a cultural system, with an explicit concern for the adaptive interaction between these components. To accomplish this, Steward focussed on those variables (e.g., technology, socio-economic organization) most closely associated with the utilization of the environment, referring to this group as the "culture-core" (1979:37). Steward had originally proposed the term cultural ecology to distinguish it from its biological counterpart; however, there is clear evidence for a reversal in this thinking, with several authors arguing that anthropology should adopt units of analysis similar to those used by biologists (e.g., organism, community, population)(Vayda and Rappaport 1968; Vayda 1969; Vayda and McCay 1975). This undoubtedly has some historical basis (i.e., suggested in part to emulate these other sciences), but more importantly, (and consistent with biological sciences) by doing so, all cultural behaviours could potentially be explained with reference to their adaptive benefit, including those with little apparent connection to the culture core (e.g., Bettinger 1982:159).

Archaeological Approaches to Hunter-Gatherer Adaptation

Reviews of archaeological applications of systems-ecological approaches have been presented by Jochim (1979), Kirch (1980) and Bettinger (1980, 1987). A basic assumption of this conceptual framework in anthropological research is that man is not a passive receptor of environmental influences, but is a highly interactive organism both physiologically and culturally. As a result, a wide variety of cultural behaviours can be more fully understood by establishing the connections between behaviour and its environmental context (Vayda 1969). It is evident from the summaries above that many archaeological analyses surrounding the interaction between environment and human behaviour give priority to the nature of, and change in, the biophysical environment and derive from this repercussions for the cultural components of the ecosystem.

Bettinger (1980, 1987) has reviewed several models of hunter-gatherer adaptation currently in use, dividing them into two basic groups. The first includes "resource studies" and "adaptive principles", which stress the use of ethnographic data as a means of understanding specific behaviours in particular societies. Resource studies examine the subsistence potential of a particular species or community, following the assumption that any group exploiting the resource will experience similar problems and opportunities. Studies intended to derive adaptive principles build on and are logical extensions of resource ones, in that they attempt to generalize regarding the organization of resource procurement and the manner in which this organization affects the formation of the archaeological record. The second group, consisting of more formal models, has four sub-groups with different topical interests (e.g., models of the environment, subsistence, settlement, and population). Included here are a number of familiar approaches, including linear programming, optimal foraging, goal models and game theory. The ethnographic and formal models are distinguished primarily by the fact that the latter are not tied in development or application to specific cases, and thus theoretically have much broader potential utility.

One of the more innovative models of hunter-gatherer adaptation, in terms of its range of application, is that proposed by Binford (1978, 1980), in which two contrasting organizational forms of hunter-gatherer settlement and subsistence systems are identified. Foraging systems are those in which resources are procured on a daily basis by individuals or groups of various sizes, through what Binford terms an "encounter" strategy. These systems tend to correlate with relatively stable and/or undifferentiated environmental contexts, and the underlying assumption is that all necessary food and other resources are available in adequate supplies within a more or less restricted range or "foraging radius". When such necessary or preferred resources are depleted the entire group relocates. In situations where highly valued resources are localized, procurement activities may be "tethered" around a series of restricted locations. In addition, since foragers gather fresh food on almost a daily basis, they normally do not accrue and store food surplus for future needs.

Foraging strategies are seen to generate two basic types of archaeological sites: residential bases and locations. Residential sites are the base of operations and the center of subsistence activities (manufacturing, processing and maintenance). The concept of a central place or "hub" of activity implies the existence of other peripheral loci having more specific functions. Binford (1980:9) refers to these as locations, or places where procurement tasks are carried out. In foraging systems, locations are designated as "low-bulk" sites, since in the absence of a need for storage, only limited quantities of a given resource are harvested at any one time. Locations typically have low archaeological visibility due to their normally brief usage and associated low rate of artifact discard. The archaeological visibility of forager residential sites, while higher than locations, will vary as a function of the frequency of relocation (i.e., mobility) and size of the social group, and the extent to which the site may be periodically re-used.

Collecting systems, by contrast, do not "map on" to resources through a series of residential moves, but instead move goods to consumers by logistical strategies operationalized through special task groups (i.e., typically male hunting parties of variable size). Like the foraging system, logistically organized strategies are problem solving devices. Whereas foragers solve provisioning problems through a series of residential moves and fluctuations in group size within relatively undifferentiated environments, collectors are typically found in heterogeneous environments, where they face both spatial and temporal incongruities in the distribution of critical resources. This introduces scheduling and procurement problems to the system in that peak availability of several resources may seasonally overlap. To solve this problem, collectors locate themselves as close as possible to one or more key resources, and from this point, hunting parties move out to procure specific target resources which are field processed and transported to the residential site.

This logistical situation results in lower residential mobility, (and thus higher archaeological visibility) and the formation of three site types in addition to the residential bases and locations recognized for foragers. These are: field camps, stations and caches.

Field camps are established and used by task groups during their absence from the residential base, and may have resource-specific attributes (e.g., fishing camp). Stations are sites related to the activities of special-purpose task groups, for example, meeting at a particular place in order to monitor game conditions or plan an intercept strategy. Caches are important and common features of collector systems since: (i) task groups are provisioning for larger social units, and thus are involved with greater (i.e., "high-bulk") volumes of food, not all of which will be desired or possible to immediately transport to consumers. Thus the need for at least temporary storage, and (ii) caches represent one of the principal means of extending the "time utility"of resource beyond their limited period of availability (Binford 1980:10).

The potential for variability in the archaeological record is increased considerably by a logistical production strategy and its various permutations. However, despite their differences, these strategies share a number of common properties. Both types of organization are adaptive in that they represent responses to problems/opportunities posed by the environment. More specifically, these are reactive strategies that reflect cultural systems in dependent relationships with their natural environments. In these models, the abundance, variety, distribution and density of resources exert considerable influence on decision making processes, and accordingly, settlement and subsistence behaviour. Resource structure does not exclusively influence all decisions, however. Other factors, such as labour and transportation costs and availability, consumer demand (including preference) for particular resources, as well as economic and social costs/benefits will also influence the form of these behaviours.

It is also evident that neither strategy is likely to occur in a "pure" form. Although the Nunamiut Eskimo, whom Binford (1978) used as a model of a collecting system, were almost totally dependent on a single animal species for food (Binford 1978:12, 458), he is emphatic on the point that foraging and collecting systems do not constitute mutually exclusive strategies.

> "It should be clear... that we are not talking about two polar types of settlement-subsistence systems; instead we are discussing a graded series from simple to complex. Logistically organized systems have all the properties of a foraging system and then some." (Binford 1980:12).

In other words, mobility, considered to be a fundamental expression of both organizational strategies, is a continuous variable, and not a threshold property that can be used to classify rigidly any particular society. Accordingly, many hunter-gatherer adaptive systems can be expected to resist any sharp dichotomy in the characterization of their settlement-subsistence systems, and variability observed in the archaeological record cannot, therefore, be interpreted as the "transformation" of a given system from one type into another. It is instead a reflection of emphasis, in which the role of one or more components of a strategy changes to accommodate new conditions or circumstances in the environment. This further increases the potential for intersite variability both within and between cultural systems:

> "Given basically two strategies, "mapping on" and "logistics", systems that employ both are more complex than those employing only one and accordingly have more implications for variability in the archaeological record." (Binford 1980:12).

It is axiomatic that flexibility in socio-economic behaviour is a vital component of hunter-gatherer cultural systems, and that the ability to maintain this property has important consequences for long-term survival. It should be remembered, however, that flexibility refers to the ability to reverse any given behaviour easily . Thus, we should expect to find hunter-gatherer settlement and subsistence systems maintaining elements of both types of organization, which will differentially express themselves as properties of both short and long-term adaptive strategies. However, accepting this proposition raises important questions regarding the nature of the circumstances under which a particular strategy might be favoured. As a means of identifying criteria according to which a given strategy might be emphasized, Binford examined the relationship between environmental variability (using a derivative measure of temperature) and the degree of residential mobility recorded for a large sample of hunting and gathering societies. It was argued that the more unstable the thermal environment (i.e., the greater the seasonality), the greater will be the number of critical resources (due to reduced productivity) whose distributions will be spatially and temporally incompatible. To compensate, human groups existing under such conditions are expected to employ some form of storage as an integral part of their overall adaptive strategy. On this assumption, Binford suggested the following proposition:

> "...the greater the seasonal variability in temperature, the greater the expected role of logistical mobility in the settlement or positioning strategy." (Binford 1980:15).

Surprisingly, this postulate did not hold for ten of the ethnographic groups sampled, many of whom (i.e., the Copper, Iglulik, Netsilik and Polar Inuit) inhabited environments with extreme seasonal fluctuations in temperature, but did not substantially provision themselves during the winter from food surpluses accumulated during other seasons. Binford suggested that these groups represented a different type of forager, called "serial specialists", who differed from their temperate and equatorial counterparts by employing residential mobility in order to position consumers not with regard to food-yielding habitats in general, but to particular species available only during certain seasons.

Binford did not further investigate these groups, but overlooked in his suggestion an obvious, yet fundamental, point. With rare exceptions (i.e., the Nunamiut of Alaska and Caribou Eskimo of the Canadian Barrengrounds), Inuit from Alaska to Greenland traditionally exploited three distinct ecosystems (marine, riverine and terrestrial), each having different levels of biological production, and which are affected unequally by environmental variables (Freeman 1976, 1984; Cooke 1984). Moreover, species diversity, growth and reproduction rates, as well as ethology all contribute to the productive potential of each system in terms of human utilization (Freeman 1984:36-42). Thus, the fact that the foraging strategy adopted by the Inuit during the winter period is not explained by a simple extrapolation from temperature is not surprising. In terms of subsistence economics, their behaviour can be more directly related to the productivity of the marine ecosystem, which is the focus of subsistence activity at this season. The Arctic maritime environment is not only generally more productive than the terrestrial, but remains so through the annual cycle by providing several different procurement "contexts"(e.g., breathing-holes, leads, floe-edge, surface basking, etc.) for a number of resources, but particularly small seals, which were the staple item of most traditional Inuit diets. By contrast, the terrestrial and riverine environments are characterized by much lower annual rates of production, in which the role of temperature as a limiting factor is more apparent (Freeman 1984; Bliss et al. 1973). These systems support a small number of important, but highly seasonal and mobile resources (e.g., caribou, musk ox, also fish) which, as might be predicted, can be harvested effectively using logistical tactics.

This point is illustrated in Table 1, constructed using data presented by Sabo and Jacobs (1980:495-496) for the traditional seasonal cycle for Inuit occupying the south coast of Baffin Island. The table does not consider all potentially available foods, nor does it include non-food resources (e.g., fuel, raw materials). It nevertheless illustrates the potential influence of seasonal environmental productivity. Although a total contrast between ecosystems and mobility strategies is not apparent, it is interesting to note that several procurement systems (Flannery 1968) associated with the exploitation of marine resources during critical seasons associate with foraging (F) strategies, while the harvesting of terrestrial and riverine resources appears to be accomplished primarily through collecting (C) strategies. For certain resources both strategies are indicated, which is consistent with the general concept of a forager/collector continuum but also reflects differences in perspective. For example, open water seal hunting (i.e., by boat) could, from the hunter's perspective, be classified as a foraging strategy since the target resource is usually widely distributed, and hunting takes place through an encounter strategy. If this activity is considered in terms of its

Table 1. Summary of Seasonal Subsistence Cycle for Southern Baffin Island Inuit.

Season	Habitat	Resources	Techniques	Strategy
Winter	Marine:			
	Sea Ice	Ringed Seal	Breathing Hole[1]	F
	Floe Edge	Ringed Seal Bearded Seal Walrus Beluga Whale	Open Water[2]	C/F
	Open Lead, Polynya	Ringed Seal Bearded Seal Walrus Beluga Whale	Open Water	C/F
	Lacustrine: Lake Ice Cod	Char	Nets, Jigging	F
	Terrestrial: Coastal-Inland	Caribou	Stalking, Trapping	C
		Wolf	Trapping	C
		Fox*	Trapping	C
		Hare	Snares	C
Spring	Marine:			
	Sea Ice	Ringed Seal (Basking)	Stalking	F
	Open lead	Ringed Seal Bearded Seal Walrus Beluga	Open water	C/F
Summer/Fall		Marine:		
	Open Water	Ringed Seal Harp Seal Bearded Seal Walrus Beluga Whale Narwhal Waterfowl	Open water	C/F
	Coastal-Inland	Caribou	Lance, bow/arrow	C
	Intertidal**	Shellfish Seaweed	Digging Collecting	F
	Lacustrine: Coastal Lakes	Char Cod	Leisters Nets, lures	C

Table 1. Continued.

Season	Habitat	Resources	Techniques	Strategy
	Riverine:			
	Coastal Rivers	Char	Weirs, leisters	C
	Terrestrial:			
	Interior	Caribou	Lance, bow, kayak	C
	Coastal-Inland	Caribou	Lance, bow, kayak	C
		Wolf	Traps, snares	
		Fox	Traps	
		Hare	Snares	
		Waterfowl	Snares, traps	
	Coastal Islands	Eggs	Collecting	C
		Berries	Collecting	

[1]Includes use of winter ice hunting harpoon and associated paraphernalia.
[2]Includes use of harpoons, lances, floats, kayaks, and associated paraphernalia.
*Minor activity during pre-contact period.
**Minor contribution to traditional diet.

basic organization, however, and included only young male hunters who provide for other members of one or more households, it would in terms of the archaeological model be classified as a collecting strategy.

Binford's proposition relating environmental variability and degree of logistical mobility is a useful starting point for investigating the organizational context of prehistoric subsistence and settlement. Other ecological factors, however, will need to be considered when evaluating specific cases, including environmental productivity within and between exploited habitats, seasonal rhythms in resource abundance and changing procurement contexts. It should also be noted at this point that (although they are not the focus of the present study) the importance of social and/or ideological motivations in the economic behaviour of subsistence-level societies generally, as well as in the collector/forager context, is recognized. Where appropriate, the potential influences of these factors are briefly discussed.

Adaptation and Environmental Stress

As originally formulated, the collector/forager model was concerned primarily with seasonal (i.e., short-term) mobility and the resulting variation it produced in the patterning of archaeological remains. In recognition of its importance to the development of more comprehensive models of hunter-gatherer settlement and subsistence behaviour, Binford (1983) has elsewhere considered the social and ecological dimensions of long-term land-use patterning. This was based on a model of economic zonation which distinguished camp range (i.e., the foraging and logistical radii) from annual range, the latter being the cumulative product of the former during an annual seasonal cycle. Binford noted that among the Nunamiut, annual ranges shifted through time, with local groups repositioning the locations of seasonal residential bases, usually in such a way that did not overlap with the previous range. The reasons given for these shifts centered on the short-term depletion of the local resources (e.g., fuel, small game), accumulation of various forms of debris, and the stimulus these conditions provided for inter-personal conflict. According to Nunamiut informants, this resulted in a shifting of the summer hub of the annual range approximately every nine years. Through a normal lifespan individuals might experience as many as five such major shifts.

The existence of "lifetime" ranges has important implications for the study of long-term hunter-gatherer adaptations in both contemporary and archaeological contexts. One factor that potentially influences the formation of long-term adaptive patterns, but has not been considered in the forager/collector model is the role of environmental or ecological stress.

Laughlin and Brady (1978:13) define ecological stress as:

> "...any change in the operational environment that represents a potential or actual threat to the continued survival of the organism. Such stress may be caused by a decrement in the quantity or type of basic resources normally available to the population. The decrement itself may derive from changes in the incidence or type of predation, from intensification or alleviation of competition with other human or non-human populations in the ecosystem, or from climatic variations such as hurricanes, floods, droughts, and earthquakes."

Vayda and McCay (1977) similarly argue that stress can be conceptualized as:

> "any event or property of the environment which poses a threat to the health and ultimately the survival of organisms, including people, may be regarded as a hazard for them and that responding adaptively to such hazards involves not only deploying resources to cope with the immediate problem, but also leaving reserves for future contingencies."

The key points here are that stress is viewed as a constraining or impelling force that produces or tends to produce "deformation" of a body through its action. However, when we consider that all cultural systems must cope with variation in environmental productivity, in order to trigger a response the force must exceed some threshold value. In many circumstances then, it is inappropriate to overgeneralize the effects of these fluctuations by categorizing all of them as necessarily stressful. In his discussion of living systems, Miller (1965) argued that a range of stability exists for all system variables and that stress within a system only occurs when a variable exceeds this range. As a result, stress exists only to the degree that it creates a strain, which can be identified as the change (i.e., "deformation") in structure that results from the stress. It follows, therefore, that "processes - action or communication - occur in systems only when a stress or threat has created a strain which pushes a variable beyond its range of stability" (Miller 1965:224). Miller's definition introduces the important point that stress is system-specific (cf. Reid 1978; Gibbon 1985), and underscores the need to view the form of an adaptive response as contingent upon the characteristics of the selective pressures (particularly their magnitude), as well as the manner in which their effects are perceived. As a result, the identification of potentially stressful factors in the environment, viewed generally, are invalid indicators of sociocultural stress (Gibbon 1985:190).

The consequences of stressful conditions in the biophysical environment are generally recognized as powerful catalysts for change in many forms of human behaviour in subsistence-level societies. In archaeological contexts, the identification and significance of these influences are usually assessed through analyses of variability observed in patterns of settlement and subsistence behaviour that correlate closely (i.e., spatially and temporally) not only with the general structure of the environment in question, but with important changes in its productive potential as identified through independent analyses. The behavioural variability is seen as an indirect reflection of the effects of ecological constraints on the adaptive system, and represents efforts made to restore it to a state of dynamic equilibrium (cf. Clarke 1968). This approach is common to research dealing with contemporary hunting and gathering societies, who arguably maintain the most intimate relationships with their natural environment, but it is equally relevant for other forms of non-industrial socio-economic organization (e.g., Turnbull 1978; Rappaport 1968; Waddell 1975).

An additional concept pertinent to a discussion of adaptation and environmental stress concerns the manner in which environments are defined. Environments can be defined both analytically (i.e., in terms of their constituent elements) and cognitively (i.e., as visualized by the people who act in it). These perceptual categories have been variously termed "objective/subjective" (Gibbon 1985), "things/images of things" (Miller 1965), and "operational/cognized" (Rappaport 1968, 1971; Laughlin and Brady 1978; Ellen 1982). Rappaport (1971:247) summarizes the distinction as follows:

> "The operational model includes those organisms, processes, and cultural practices which ecological theory and empirical observation suggest to the analyst affect the biological well-being of the organisms, populations, and ecosystems under consideration. It may include elements of which the actors may be unaware (such as microorganisms and trace elements) but which affect them in important ways. The cognized model, on the other hand, may well include components, such as supernaturals, whose existence cannot be demonstrated by empirical procedures, but whose putative existence moves the actors to behave in particular ways."

Establishing connections between environment and its perception to understand human behaviour is a prominent research area in behavioural geography and psychology (e.g., Saarinen 1969; Saarinen et al. 1984). Anthropological research has also demonstrated the influence of subjective environmental categorizations on man-land relationships (e.g., Moore 1965; Burch 1971) and any study of adaptation linking human behavioral responses to ecological stress requires close attention to the role of perceptual classifications. In the present context, these classifications are of greatest relevance in defining cultural thresholds to environmental stimuli.

Finally, it is important to emphasize that because stress is a value-laden concept, carrying intrinsic negative psychological implications, it is necessary in any discussion of its measurement to define the term and any related concepts clearly, and to distinguish environmental conditions that potentially induce stress from those that do not. In the present study, the concept of ecological or environmental stress is a <u>systemic</u> one, employed as a heuristic device to aid the investigation of human responses to resource depletions. It is considered appropriate for this purpose since the environmental situation under analysis involved a key resource, had regional implications, and its effects were sustained over a multi-year period. The term stress does not, however, refer to the psychological state of individuals or social groups involved in the adaptations to be discussed. The influence of this variable on decision making processes is acknowledged but is not considered in the the present study.

Forms of Environmental Stress and Change

The stability of the environment to which an organism or population is adapted is especially relevant to the general model of culture as an adaptive system. Survival in highly stable environments theoretically requires less flexibility in the range of procurement activities, than in stable habitats. In the present context, stability refers to the dependability of the resource base. Societies confronted with dramatic shifts in resource availability (of non-cultural origin) can be expected to maintain a broader range of subsistence strategies having both social and technological properties. As Laughlin (1974) has emphasized, any social system faced with resource fluctuations of ecological origin must provide a measure of structural flexibility if they are to remain adaptive. Moreover,

> "...if the ecological fluctuation involves alternating minimal/maximal resource availability such that during one phase in the cycle basic resources become both more limited in type and scarce in quantity, then we would expect to find more dramatic flexibility in the social structure."(Laughlin 1974:393).

Laughlin and Brady (1978:18-23) distinguish two forms of ecological stress and two types of environmental change to which human groups must respond (cf. Thoday 1935; Scott 1984; Gibbon 1985). Although the emphasis here is on responses to change in the biological and physical environments, these concepts are applicable to perturbations of sociocultural origin and importance. The two forms of ecological stress are disaster and deprivation. The key difference between these categories is that disaster represents a significant negative shift in resource availability (measurable along several axes) for which a population is conceptually and, therefore, adaptively unprepared. By contrast, deprivation, while often involving similar constraints, is perceived to be cyclical in nature, and as such allows some measure of predictability and preparedness (Laughlin and Brady (1978:18).

The first type of environmental change is termed progressive in which there is an essentially continuous change along a gradient in the value of a specific environmental variable (e.g., precipitation, temperature, competition). Progressive change may eventually lead to a near-exhaustion of a population's resource base (e.g., through unremitting drought), but because it is usually a gradual process the groups affected have, as a rule, an opportunity to develop adjustments to the conditions (Scott 1984).

The second type of change is recursive or cyclical. Recursive change can be further divided into two sub-types based on the frequency of its oscillations and their amplitude. High frequency cyclical change has a generally predictable range of consequences (i.e., amplitude) and is anticipated. As a result, groups are conceptually prepared to deal with these events, which are formally integrated into the cultural system as normal attributes of the environment, and appropriate responses are developed to deal with the short-term repetitive cycles. A good example of high frequency change is environmental seasonality, which is a feature of all ecosystems. The degree of seasonality, however, varies considerably between environments, from slight changes in biological rhythms in equatorial regions, to extreme fluctuations in polar regions. In human terms, the importance of seasonality in environmental productivity is that it induces and sustains variations (i.e., cycles) in cultural behaviour (Harrison 1988:29). That these variations are not generally regarded by scholars as stress-induced results from the repetitious character of the environmental fluctuations and, accordingly, the cultural responses to them. Closely related to variations resulting from seasonality are intermediate-scale changes, or interannual variations. Year to year differences in precipitation, temperature, recruitment, etc., can occur within broader trends and affect biological productivity at various levels.

Low frequency events, however, pose different but equally complex types of adaptive problems (or opportunities) depending on their periodicity, duration and severity. Examples of these would include dramatic fluctuations (negative or positive) in resources or major habitat shifts brought about either by natural or cultural causes (e.g., flood, fire). Unlike progressive changes, low frequency incidents tend to occur within a short span of time, although they can nevertheless have lasting consequences. This does not imply, however, that all such episodes are immediately or necessarily accompanied by stress. To be of immediate importance to survival the type or magnitude of the event must exceed one or more threshold values; however, even in cases where the magnitude of the episode does not introduce stress conditions, the persistence of its consequences over time might. Since by definition, such changes occur infrequently, in many cases they are also more difficult, if not impossible, to predict accurately. This unpredictability may be increased if the periodicity of the event spans several human generations. In such a case, the potential exists for the knowledge of appropriate (i.e., successful) responses to be lost or severely attenuated and group survival threatened. It is very important, therefore, that certain behavioural variations which may demonstrate little adaptive value during normal circumstances, be maintained in the cultural repertoire (Kirch 1980; Minc 1985). From an ecological perspective, the diversity reflected in both high and low frequency variations is a measure both of the constraints within which the system operates, as well as its potential for long-term stability.

Cultural Responses to Periods of Environmental Stress

Ethnographic research dealing with cultural strategies developed to mitigate the impact of environmental stress on resource supply has revealed a wide range of responses, but which share common principles of operation. These involve both technological and social adjustments, typically organized in a hierarchy whose levels have been shown to correlate proportionally with the scale of the environmental problem (Laughlin 1974; Waddell 1975; Little and Morren 1976; Vayda and McCay 1977; Laughlin and Brady 1978; Colson 1979; Johnson 1982; Minnis 1985). Colson (1979:21), for example, argues that five basic strategies are employed to reduce a group's vulnerability to periods of extreme variability in food supply. These are:

> "(i) diversification of activities rather than specialization on a few plants or animals, (ii) storage of foodstuffs, (iii) storage and transmission of information on what we can call famine foods, (iv) conversion of surplus into durable valuables which could be stored and traded for food in an emergency and (v) cultivation of social relationships to allow one to tap resources of other regions".

Halstead and O'Shea (1989) identify four similar options used to minimize the effects of spatial and temporal resource uncertainty. These are: storage, diversification, exchange and mobility. The utility of any strategy will vary according to the specific cultural context, and it is important to note that food assumes priority over other commodities in the majority of discussions. However, there appears to be a consensus in the literature that social links form the optimal insurance (e.g., Vayda and McCay 1977; Colson 1979; Minnis 1985; Minc 1985). Storage, for example, may be an effective strategy for localized, short-term crises, but the potential for surviving long-term, regional events is best increased through traditional social mechanisms, including unrestricted mobility, as well as institutionalized and less formal patterns of exchange (e.g., Rowley-Conwy and Zvelebil 1989). These patterns may have several dimensions and include the widespread practice of food sharing, exchange of non-food items for food, or the exchange of information concerning the location of resources and/or the means necessary to secure them (but see Turnbull (1978) for an exceptional case in which such an adaptive response is apparently dysfunctional and replaced by one of social disintegration).

In the event of severe shortages, access to information, which plays a generally important role in hunter-gatherer adaptations (Moore 1981, 1983), may become a critical factor in reducing the impact of provisioning problems. The existence of social contexts to facilitate communication (i.e., the extension of kin and non-kin networks through marriage, trading partnerships, etc.) underscores the point that information is also a resource that is not evenly distributed. As such, access to it may have special relevance for dealing with unpredictable or cyclic changes, whose last occurrence may be well beyond the direct experience of all but a few members of a society. These individuals, who retain the cumulative reference knowledge of appropriate responses to threatening situations are valued beyond their hunting abilities and may themselves be thought of as "long-term resources" for encoding and transmitting information (Colson 1979; cf. Minc 1985). This knowledge does not carry with it, however, any ability to predict the occurrence of such changes. The potential importance of these individuals to long-term group survival contrasts markedly with the widespread view that because of their generally reduced level of activity and, therefore, inability to hunt successfully, the aged are always among the most expendable members of a society during periods of hardship. Rogers and Black (1976:32), for example, report that among the Weagamow Ojibwa, all members of local groups made essential contributions to survival during the late nineteenth and early twentieth centuries, at which time several important resources became unavailable. Minc (1985) has similarly argued for the adaptive significance of oral traditions (both secular and sanctified) as means of archiving and transmitting crucial information regarding strategies for survival during episodes of resource scarcity.

The hierarchical nature of the generalized response patterns is also evident in other social contexts. In general, as problem conditions persist or worsen, the network of social relationships drawn upon as a means of survival is expanded from the local to the regional scale.

> "Responses to environmental problems may include processes whereby the unit of action shifts from individuals to various forms (and degrees of inclusiveness) of groups and perhaps back to individuals in accord with the magnitude, persistence and other characteristics of the hazards in question." (Vayda and McCay 1977:412).

Waddell (1975), for example, identified three distinct levels of adaptive response among the Fringe Enga of highland New Guinea, which correlated with the severity of frost conditions affecting agricultural production. Because minor frosts are a recurring and, therefore, normal attribute of the Enga's high altitude environment, the lowest or "local" level mechanisms (e.g., variable cultivation strategies) were found to be in constant operation. Intra- and extraregional strategies (cultivation of distant land holdings, out-migration to unaffected neighbouring regions) involved increased individual and group mobility and incorporated expanded social networks. These strategies were operationalized under more extreme and widespread frost conditions, the most severe of which recurred approximately every three human generations (Waddell 1975:267). Other examples of behavioural strategies having organizational similarities to the Enga pattern are presented in Laughlin and Brady (1978), Scott (1984) and Minnis (1985). More recent publications (e.g., De Garine and Harrison 1988; Halstead and O'Shea 1989) reflect the continued interest in the relationships between natural environmental variation and contemporary human economies.

The influence of environmental conditions, particularly climatic change, is also given high priority in archaeological analyses of prehistoric society, at all levels of social and economic organization. Environmental variation plays an especially prominent role in the study of hunting and hunting-gathering societies generally, and is routinely implicated in temporal variability in subsistence related behaviour. Many studies, however, tend to focus on societies with horticultural/agricultural economies in which larger residential units are affected, and thus leave potentially more visible, if not more varied, evidence of the effects.

Reid (1978), for example, examined the relationship between diversity in subsistence behaviour (as an index of environmental stress) and the abandonment of the Grasshopper Pueblo in eastern Arizona. Although the results of the study were not conclusive, several operational problems relevant to the present study were discussed. Despite the fact that environmental stress is system-specific, (i.e., it does not exist independent of a specific cultural system and its thresholds (Gibbon 1985:190)) it may nevertheless be difficult to define for any given case. Moreover, even when potential sources of stress have been identified, this does not mean that its presence has been, or will be, indicated in the archaeological record, since there is "no a priori basis for asserting that specific change in the environment will or will not force a particular system beyond the range of stability" (Reid 1978:197). A second difficulty relates to the measurement of strain in cultural systems. Since the interaction between environment and behaviour is mediated through various cultural "buffers" (e.g., social organization, procurement technology) strain can not be measured directly. As a result, it is necessary to examine behaviours associated with these mechanisms for evidence of the presence of, or increase in, diversity, which can be used as an aid in the identification of specific limiting factors.

Thus,

> "a relative increase in diversity of subsistence-related tools, facilities and behaviours should identify strain and its locus as somewhere within the subsistence system. This identification of subsistence strain is methodologically prior to and should assist in locating the source of environmental strain." (Reid 1978:198).

In other words, it is necessary first to identify technological or behavioural diversity (i.e., variation) that is potentially the result of ecological constraints, and which are directly related to the system being affected.

In a similar study, Minnis (1985) examined the social responses to food stress in southwestern New Mexico brought about by shortages of land suitable for cultivation, and insufficient precipitation (1985:114-155). Minnis argued for the existence of hierarchical levels of response to food stress, in which the degree of social "inclusivity" (and, therefore, cost) increased proportionally from local (household) to regional (extra-community) levels with increasing severity of food stress (1985:20-25, Figure 1). In this model, more inclusive responses are attempted after lower order ones either fail initially or as conditions worsen.

Caribou Population Dynamics and Hunter-Gatherer Procurement Strategies

Archaeological analyses of hunter-gatherer subsistence adaptations tend to approach environmental stress in an implicit rather than explicit fashion. This probably relates to the fact that while limited resources are still considered to be a prominent characteristic of the bio-physical environments in which many contemporary hunters and gatherers exist, ethnocentric depictions of hunting and gathering as a meagre lifestyle have long been replaced by one of relative "affluence" (Lee and Devore 1968; Sahlins 1968), in which flexible social organization (e.g., open social boundaries, high degree of individual autonomy) plays a pivotal role. Through such flexibility (e.g., in group size and mobility) hunter-gatherers are now seen to be much less vulnerable not only to "routine" environmental constraints, but also more serious hazards.

However, to accommodate all situations to an intrinsic capacity to adapt is simply to replace one normative view with another. In the revised model, hunter-gatherer economic behaviour has shifted from being viewed as relatively inflexible and governed by immutable rules, to that of cultural "contortionists": able to make relatively seamless (i.e., cost-free) adjustments to virtually any environmental challenge. As Bettinger (1987:122) has noted, anthropology has always portrayed hunting and gathering societies in a theoretically self-serving fashion. As a result, it is difficult to change intellectual expectations that archaeologists bring to their data. Ethnographic studies provide unequivocal confirmation for the existence in traditional societies of effective strategies to deal with a wide range of situations in their social and physical environments, and these characteristics are easily projected to prehistoric cultures. Nevertheless, certain forms of spatial and temporal variability in settlement and subsistence behaviour observed archaeologically imply the existence of thresholds or limits in the adaptive capacity of any society.

Figure 1 illustrates a simplified model for southern Baffin Island of the interaction between caribou population dynamics and a coastal-maritime hunter-gatherer society in a dependent relationship with the species. The principles underlying the "system-state" model are: (i) that the annual requirement for the resource by the human population is constant, (ii) that reductions in the caribou herd size from maximum to minimum values are, in

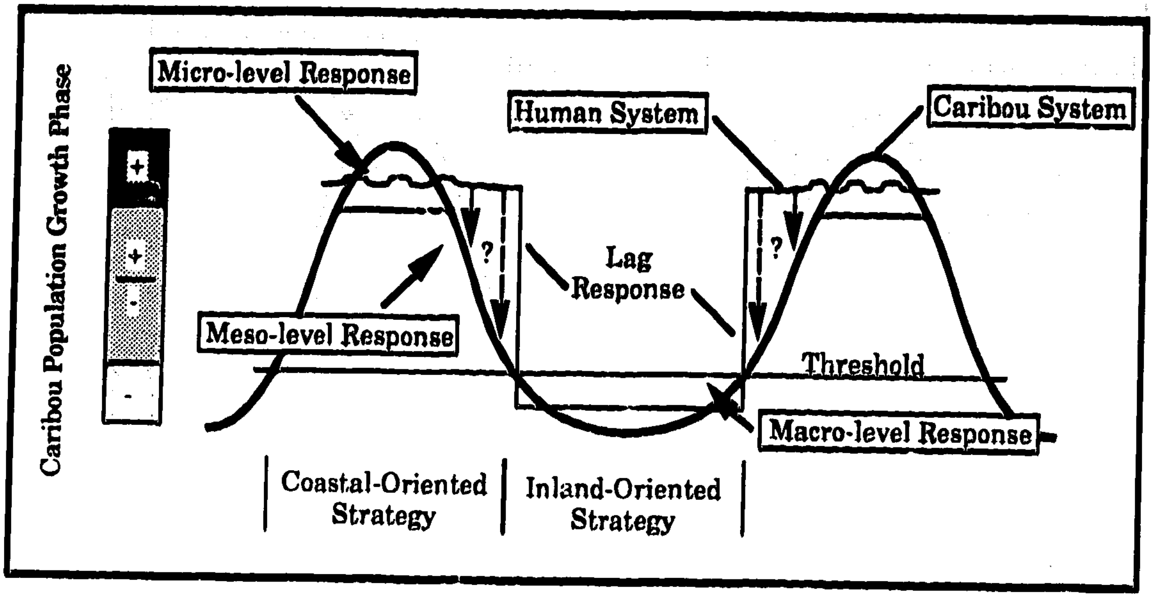

Figure 1. Simplified model of relationship between caribou population fluctuations and hunter-gatherer procurement organization.

quantitative terms, significant, and (iii) necessitate behavioural adaptations in the cultural system.

The figure portrays variability in caribou population size as distributed along a gradient which can be partitioned into positive, intermediate and negative phases, each of which has spatial and temporal properties. During a positive phase of the cycle animal numbers are at a maximum and extend their range beyond its former limits. In an intermediate phase, herd size is reduced and distribution is uneven, and during a negative phase these attributes assume minimum values. Certain forms of temporal and spatial variability in herd demographics within each state may remain constant (e.g., seasonal aggregation/segregation of animals by age or sex class) while others (e.g., interannual variations in migratory behaviour, range shifts) may be dramatically altered .

In the human system, organizational responses to the consequences of seasonal variation in resource availability or the onset of a new phase can be considered in a hierarchical fashion. Individual or "micro" level responses will occur during a positive phase since resource fluctuations are essentially qualitative in nature. In these circumstances, small families are able to exercise considerable economic autonomy since the level of resource availability remains high and may be well above basic human requirements. By contrast, intermediate conditions promote greater coordination of effort or "meso" level responses. In this case, extended families or other groups affiliated through kinship would cooperate in the hunt to meet group needs, resulting in a potential loss of independence. A negative phase of the cycle, in which resources are scarce, induces regional or "macro" level responses. In this context kin and non-kin groups interact for common purposes and decision making processes may subordinate individual or family goals.

Spatial adjustments in the cultural system correlated with the changes in herd size and distribution are also shown in Figure 1. During a positive phase of the cycle, when caribou herd size and distribution are at a maximum the procurement strategy is coastal-oriented.

The required or desired number of animals can be obtained from residential camps established along the coast and from which a range of other resources (e.g., seals, fish, whales, waterfowl) can be obtained. As caribou population levels begin to shift from maximum to minimum values, spatial and temporal uneveness in the decline may permit implementation of a number of strategies which mitigate the effects of the reduction with the result that for any group the form and timing of "meso" level responses will vary. Lag responses may also occur following periods of decline with groups delaying their response to improved conditions.

The archaeological record generated during positive and intermediate phases is modelled, in locational terms, as coastal-oriented, with most or all of the population distributed in coastal settlements in the summer and fall seasons. Accordingly, it is expected that a greater concentration of archaeological remains related to summer and fall procurement systems will occur within the coastal zone.

A change in organizational strategy is hypothesized to occur with the onset of a negative phase of the caribou population cycle. This phase is delimited by a quantitative threshold (which has spatial and temporal properties introduced in a later section), below which either the rate of return from a coastal based strategy cannot meet human requirements in terms of costs/benefits, and compensatory strategies are ineffective. The principal organizational response to these conditions is the shift from a coastal to inland-oriented procurement strategy. This strategy is both feasible and adopted because the study area is an insular one in which the regional pattern of caribou range reduction during population minima is characterized by withdrawal to the interior of the island. The record produced by this strategy is distinctive, with little evidence of winter occupancy expected, and with most summer/fall settlement s being of small size. Although from a regional perspective greater numbers of people can be expected to travel inland, because resource levels are low it is considered unlikely that they would support large groups of people in any one location.

As resource conditions improve, it is expected that the efficacy of the inland strategy will be reassessed and, it is suggested, followed by a return to a coastal procurement strategy. The model thus addresses the "elastic" dimension of organizational flexibility in which an altered strategy returns to its previous (original) configuration. Parenthetically, it should be noted that the model is developed using economic principles,specifically that individuals and groups respond in a manner which maximizes their output and, therefore, survival potential. It is clear, however, that from a cultural perspective caribou population dynamics are viewed as a normal course of events, and their consequences for human society are considered to be a customary part of life.

Statement of Research Hypotheses

It is generally accepted that following the adoption of snow houses as the principal form of winter residence, the pattern of seasonal aggregation (winter) and dispersal (summer) documented for historic Inuit was also characteristic of Thule societies. Central to the summer and fall components of the model are small and highly mobile co-residential groups, shifting camps frequently to take advantage of resources as they are phased in through these seasons (e.g., eggs, fish, berries, caribou, etc.). The general distinctions between collecting and foraging systems have already been discussed. By definition, the pattern described above would be classified as a foraging strategy, or what Binford (1980:17) calls "serial specialists". To the extent that certain of the available resources may be localized in their distribution (e.g., fish, shellfish, eggs), in residential terms this component of the annual settlement system might also be considered as "tethered" or tied down to more or less specific places, despite frequent movement between them. In this sense, individual and residential mobility need to be distinguished since they often may not have operated on the same level. Thus, broad characterizations of summer and fall subsistence behaviour as highly mobile may refer more to potential rather than actual movements of co-residential groups.

However, as reconstructed from ethnographic sources, caribou hunting introduces a logistical dimension to this otherwise foraging strategy. Available information regarding mobility patterns associated with nineteenth-century caribou hunting clearly indicates that groups of "producers" ranged out from summer residential camps to procure food and raw materials for general consumption and use by "dependents" (cf. Hitchcock 1982). Such behaviour can be expected to produce functionally differentiated archaeological sites similar to those discussed by Binford (1980) for the Nunamiut. However, it differs from the idealized collector strategy in that the accumulation of a food surplus for later consumption was not a primary objective. Nevertheless, skins as well as other raw materials (e.g., bone, antler, sinew) were being procured (and stored during the hunting season) for use during a different time of year and in its basic organization the coastal-upland pattern approximates Binford's (1980) collector strategy.

To understand the organization of the inland pattern, changes associated with significant declines in caribou numbers must be kept in mind. Among the most important of these are range contraction and alteration of seasonal migration patterns. In the present context these changes combine to increase the distance between hunter and prey, since caribou in southern Baffin Island apparently retreat away from coastal areas to the interior district. The magnitude of the increase in distance creates a spatial barrier that cannot be accommodated by logistical mobility alone. Moreover, and paradoxically, resource shortages of this type tend to <u>restrict</u> both logistical and residential mobility by reducing the number of places where target resources can be successfully obtained in desirable quantities. Under conditions of "normal" availability (i.e., during a positive phase), and possibly during short-term fluctuations, caribou hunting might be successful in any one of several fjord or valley systems, but during periods of regional shortages fewer locations will theoretically be available as animals no longer frequent former ranges. In areas where animals continue to be found a number of hunting locales might still exist. Moreover, it is likely that specific locations known or considered to have the highest probability of success (i.e., in the context of shortages) would be the focal points of subsistence and settlement activity. Residential mobility in the interior-lake pattern would thus play an overall role similar to that in the coastal pattern, (i.e., it can be considered to be somewhat "tethered").

The logistical component, however, is hypothesized to play a different role. By establishing residential camps at or near hunting locations specific to caribou procurement (e.g., where a task group might ordinarily operate to acquire this resource) the requirement for logistical mobility is reduced, since the target resource should be found within the foraging radius, conventionally established at approximately 10 km. (e.g., Vita-Finzi and Higgs 1970; Roper 1979; Binford 1980; Burch 1984). This does not imply that logistical mobility will cease and the basic strategy for caribou procurement will become a purely foraging one. No single location can be expected to remain sufficiently productive throughout a single hunting season of several weeks to months duration to remove all need for logistical mobility. Caribou may habitually cross a river or moraine at a particular point, and a residential/hunting camp may be established near such locations. However, animals may not be available on a regular basis or in sufficient numbers at any one time to meet consumer needs. Accordingly, site types associated with logistical strategies (e.g., field camps, caches, stations) are expected to be generated as groups temporarily hunt or monitor game away from residential camps. It is suggested, however, that since the decision to establish a residential camp in a particular location is assumed to have been made with primary reference to the availability of caribou (and secondarily to other resources), in general, such special function sites will not be located a great distance away from the base camps.

On these assumptions the following competing study hypotheses are proposed. The null hypothesis states that the occurrence of protracted, regional declines in caribou numbers on southern Baffin Island modified the basic pattern of settlement and subsistence related to their procurement from a coastal-upland orientation, emphasizing low residential mobility and high logistical mobility, to an interior-lake strategy, but with no accompanying change in the pattern or scale of residential or logistical mobility.

The alternative study hypothesis states that in addition to the spatial relocation of the caribou hunting procurement system brought about by a decline in the availability of the resource, the scale of residential and logistical mobility are reduced as groups position their camps in preferred locations both for caribou as well as secondary resources.

These hypotheses focus directly on procurement strategies and only indirectly on social behaviour. It is recognized, however, that important social changes may have accompanied settlement shifts to the interior of Baffin Island. In particular, group size may have increased during periods of resource scarcity, either deliberately, as a means of reducing risk by increasing the number of hunters and, therefore, the potential return, or spontaneously, as increased numbers of family groups moved inland independently to hunt. In either case, the importance of social mechanisms as a means of dealing with caribou shortages should not be underestimated. However, despite their potentially significant role, social aspects of interior land use are difficult at present to assess archaeologically due to the potential for repeated occupation of specific locations yielding a palimpsest effect (Binford 1982). This is reflected archaeologically by different numbers and types of structures/features between which there may be no temporal connection whatsoever. In addition, temporal control needed to evaluate several variables, including social factors is not sufficiently precise. It is not possible, therefore, to establish unequivocally the contemporaneity of many sites and/or features, which can be considered a minimum requirement for this type of archaeological analysis.

Test Implications

Four classes of data are employed to evaluate the study hypotheses: (i) site type (ii) site location, (iii) artifacts, and (iv) faunal remains.

Confirmation of the null hypothesis will be found in a clear functional and spatial differentiation of sites. Under the logistical model it is expected that functionally specific sites (e.g., field camps, caches, stations) will form a prominent part of inland settlement systems, and that these will occur in spatial terms, beyond the foraging radius of residential sites. An observed distribution of this nature will be taken as a measure of the importance of logistical mobility.

Artifact assemblages provide an indirect means of evaluating the scale of logistical organization. The composition of the assemblages can be used to reconstruct procurement techniques for which the organizational requirements and, therefore, role of logistical mobility can be inferred. In the present context a high frequency of artifacts related to stalking hunting (e.g., bow and arrow), considered to be a more individualistic/small group strategy will be taken as evidence of the importance of logistical mobility.

Because logistical strategies imply spatial incongruity in resource availability, the faunal remains from consumption (i.e., residential) sites are expected to display a distribution of anatomical parts according to their economic value. In contexts where logistical hunting strategies are in operation, only highly valued parts are expected to be transported from the kill location to the consumption sites as a consequence of the distance factor. Where such a pattern is observed it will be considered as evidence in support of the null hypothesis.

Support for the competing hypothesis of reduced logistical mobility will be evidenced by fewer numbers of special purpose sites, and a general reduction in the distance separating residential from logistical locations. Artifactual assemblages are expected to be characterized by forms associated with communal procurement strategies (e.g., lances, kayak hunting paraphernalia). The faunal assemblages are expected to reveal a lack of evidence for radical culling of anatomical elements as a means of accommodating transport conditions.

CHAPTER TWO

THULE SETTLEMENT AND SUBSISTENCE

Introduction

The name Thule (Mathiassen 1927) refers to a cultural tradition which emerged along north coastal Alaska circa A. D. 900, and subsequently expanded eastward to occupy most of Arctic Canada and Greenland by A. D. 1500 (Mathiassen 1927; Larsen and Rainey 1948; Giddings 1967; Dumond 1977; McGhee 1978; Maxwell 1985). The Thule were the biological and cultural ancestors of the modern Inuit, had a primarily maritime economic adaptation and possessed a complex technology and social organization which allowed them to colonize successfully the Arctic North American mainland and archipelago. These attributes also permitted adjustments to significant environmental changes that characterized much of the Thule period up to the time of sustained contact with Euro-American cultures.

The purpose of this chapter is to briefly examine the development and persistence of the maritime perspective which dominates archaeological analyses of Thule culture phenomena, and in particular, to assess the potential importance of the terrestrial environment in expanding our understanding of Thule adaptive behaviour.

Maritime Adaptations

In the past two decades, the organization of Thule settlement and subsistence systems has been a major focus of Arctic archaeological research of the late prehistoric period. The basic form and regional homogeneity of the Thule economic adaptation was originally defined in Mathiassen's (1927) pioneering study. Subsequent investigations by Collins (1937), Ford (1959), Giddings (1967) and later work (Stanford (1976) among others), have supported Mathiassen's hypothesis of an Alaskan origin for the Thule, and provided a framework through which the development of the distinctive Thule social and economic adaptive system, with its primary specialization on the hunting of large marine mammals, can be reconstructed. This framework rests on a technological and ecological foundation, whose earliest manifestation appeared with the enigmatic Old Whaling Culture dated to between 1400-1300 B.C. (Giddings 1967; Anderson 1984:85; Giddings and Anderson 1986), but is more clearly traced through a sequence of archaeological cultures dated to between 0-1000 A.D., consisting of Okvik, Old Bering Sea, Punuk, Birnirk and finally Western Thule, known collectively as the Northern Maritime tradition (Collins 1964). With the exception of the latter group, whaling appears not to have been a key component of the subsistence base. Open-water sea mammal hunting was, however, and there is archaeological evidence for social change (e.g., increase in settlement size) and in particular technological diversification (e.g., open-water float technology) through this sequence, which as discussed by Giddings and Anderson (1986:316), may have served to "preadapt" Western Thule peoples to the specific requirements of a whaling economy. Although whaling did not form the core of all coastal Alaskan economies, the activity greatly influenced later cultural developments in many areas and remains one of the most distinctive traits of Alaskan Eskimo society.

The emergence of the Thule culture in north Alaska also had dramatic effects on the Dorset culture which had existed in eastern Arctic North America and Greenland. At approximately A.D. 1000, small Thule populations began spreading eastward and, within one or two centuries, had apparently replaced the Dorset people who had occupied the territory for nearly two millennia. (McGhee 1984; Maxwell 1985).

The most detailed reconstruction of the eastward Thule expansion out of Alaska, and subsequent localized variability, is McGhee's (1969/70) correlation of the event with a sequence of hemispheric climatic changes originally outlined by Bryson and Wendland (1967). The sequence of paleoclimatic variation in the eastern Arctic has been further developed by Nichols (1968, 1972), Miller (1973) and Barry et al. (1977), but only the last millennium of it is relevant to the Thule era. During this period directional environmental change occurred, beginning with a relatively warm period from approximately 1000-800 B.P.

(correlating with Classic Thule). This was followed by a cooling trend from about 800-400 B.P. (coincident with Developed/Modified Thule), which intensified between 400-100 B.P. (equating with Historic Thule) in what is referred to as the "Little Ice Age" (Lamb 1966; Bryson and Wendland 1967; Barry et al. 1977).

McGhee (1982) has since cautioned archaeologists regarding the strength of the perceived links between these general paleoclimatic and cultural events. However, following publication of his study, Arctic archaeologists were quick to apply this model, or derivatives of it, to the study of Arctic prehistory. For the Thule, Schledermann (1976) explored the implications of environmental change on the ethology of key subsistence resources, and the resulting structural transformation of winter settlement patterns and social relations. McCartney (1977) advanced a model of Thule settlement and subsistence for northwest Hudson Bay in which abrupt climatic change affecting sea-ice characteristics restricted human accessibility to bowhead whale stocks, resulting in a fundamental reorganization of Thule social and economic organization. Jacobs and Sabo (1978) identified a pattern of Thule site selection along the Davis Strait coast of Baffin Island , in which topoclimatic variables correlate with the locations of Thule habitation sites. In one of the more detailed examinations of Thule socio-economics, Sabo (1981; Sabo and Jacobs 1980) defined eleven procurement systems on the basis of species/habitat configurations for the Lake Harbour district of southern Baffin Island. Sabo argued that the characteristics of these systems, particularly their flexibility, played a vital role in making necessary adjustments to environmental changes, and thus to cultural stability. Eastern Thule subsistence and settlement patterns have also been investigated within this general paradigm in Cumberland Sound (Schledermann 1975); Frobisher Bay (Stenton 1983, 1987); Coronation Gulf (Morrison 1983); Ellesmere Island (McCullough 1986, 1987), Devon Island (Park 1986, 1988) and Somerset Island/Boothia Peninsula (Savelle 1988).

These analyses all reflect the traditional approach to the study of Thule social and economic systems in Arctic Canada: the focus on the maritime foundation of the subsistence economy, and/or hypothesized correlations between human adaptive behaviour and varying productivity of the marine ecosystem generated by changing patterns of hemispheric climate. This approach has been very productive and has clearly established the formative role of the maritime ecosystem through some eight centuries of Thule cultural development, to the point where Thule archaeology is now essentially synonymous with the investigation of coastal sites occupied during the winter season. A few studies have considered the summer and fall components of Arctic economies (Grønnow 1983, 1986; Meldgaard 1986; Jacobs and Stenton 1985; Jacobs et al. 1989). The marine emphasis remains evident, however, with several investigations having as their primary interest coastal sites associated with the procurement of open-water marine resources, especially bowhead whales (McGhee 1984; McCartney and Savelle 1985; Savelle 1987). In general, non-winter sites believed to be of Thule origin have simply been enumerated and assigned to temporal periods on the basis of subjective criteria (e.g., estimates of lichen cover), and often without benefit of excavation.

By contrast, archaeological research in Alaska reflects a long-standing interest in the relationship between coastal and interior facets of late prehistoric settlement and subsistence. Based on excavations during the 1940's in the valley of the Kobuk River and its tributaries, Giddings (1952) defined the Arctic Woodland Culture with an occupational sequence tree-ring dated to A.D. 1250. Excavations at the Onion Portage site by Anderson (1968:37, 1988:134) indicate a Western Thule presence as early as A.D. 1000, and work by Hickey (1976, 1977, 1979) at the Kayák and Ivisahpat sites has demonstrated a continued Eskimo presence in the interior through to the nineteenth century. The archaeological evidence also indicates a fundamental change in interior land use from short-term seasonal occupations to year-round exploitation of the riverine environment (Giddings 1952; Anderson 1968, 1988; Hickey 1979). Hickey (1976, 1979) has modelled this aspect of North Alaskan socio-economic change within an economic framework, arguing for the emergence during the Western Thule post-expansion phase of a very complex cultural system involving regional specialization in resource procurement, increased territoriality and social stratification (e.g., Hickey 1979:413). It is suggested that these developments evolved in response to (i) differential general access to specific food and material resources between territories, and (ii) the potential for localized reductions of basic subsistence resources given the nature of Arctic ecosystems. Mitigating these and other potential hazards, was a complex system of inter-societal exchange which, among its several functions, served as a mutually beneficial economic "levelling device" by providing a context for continued access to necessary goods between coastal and interior groups (Hickey 1979:411-425).

Several factors may account for the general lack of interest in the terrestrial economy of Eastern Thule. In practical terms, Thule winter sites are among the most distinctive features of the Arctic cultural landscape, and their locations are often well known or easily determined through survey. This high visibility has made these sites particularly attractive to settlement pattern studies, an interest which is clearly reflected in the archaeological literature (e.g., Schledermann 1975; McCartney 1977; Jacobs and Sabo 1978). The most important attribute of winter habitation sites, however, is their artifact yield. Thule semi-subterranean house ruins and their associated middens typically contain impressive numbers, and classes, of artifacts facilitating the development and refinement of local and regional chronologies. The excavation of these features can also produce literally thousands of faunal remains, which permit the reconstruction of a range of subsistence-related activities (Stenton 1983; Morrison 1984; McCullough 1987). These characteristics are not associated with warm season (i.e., summer and autumn) sites regardless of their location (coastal/inland)(cf. McGhee 1984; Sabo 1981:41). The diverse forms and relatively low artifact yield of features such as tent rings, hearths, caches, cairns, kayak stands, burials and Inuksuit makes it very difficult to assign them with confidence to temporal periods and thus meaningfully include them in comparative studies. These are legitimate problems, but tethering research designs to artifact and/or faunal productivity effectively labels all sites consisting of these feature types as archaeologically unproductive. This has resulted in a small base of accumulated information and little incentive for additional study.

On theoretical grounds, two factors have helped establish the maritime perspective. The first was the acceptance of Mathiassen's (1927, 1932) arguments for an Alaskan origin of Thule Eskimo culture and its subsequent expansion eastward following the coastal zones of the Arctic North American mainland and archipelago. Of particular importance in Mathiassen's reconstruction was the characterization of the Thule economic base as diverse, yet fundamentally maritime in orientation given its apparent reliance on the hunting of large baleen whales and other sea mammals. These conclusions were generated from data collected from Thule winter sites and subsequent investigations, which have improved our understanding of Thule settlement and subsistence behaviour, have nevertheless continued to follow the precedent set by Mathiassen in focussing on the maritime dimension of Thule culture. The rejection of the competing hypothesis advanced by Birket-Smith (1929, 1932, 1959), which argued for an inland and, therefore, terrestrial origin of Eskimo culture may also have contributed to the course Arctic archaeology would follow during the postwar years when an active interest in Thule prehistory resumed.

A second factor is the apparent belief that existing ethnographic and historical sources provide an adequate framework for understanding prehistoric summer and autumn adaptive strategies. In view of the evidence for biological and cultural continuity between Thule and Inuit populations (e.g., McGhee 1978), abstracting elements of Thule adaptations from traditional Inuit patterns is an accepted and valuable procedure (Boas 1888; Jenness 1928; Damas 1969; Balikci 1970). However, there are potential interpretive difficulties associated with the uncritical extrapolation of ethnographically-documented behavioural models to reconstructions of Thule summer and fall lifeways. Although strong formal and functional similarities have been demonstrated between the material cultures of both groups, it may be inappropriate to assume that these technological comparisons necessarily extend to, or accurately inform us about, social organization and subsistence-settlement behaviour.

It is evident from nineteenth century ethnographies, for example, that the Thule pattern of winter settlement, for at least several centuries following their initial arrival in the central and eastern Arctic was quite unlike that of the "traditional" Inuit. The "Inuit pattern" was characterized by comparatively large and mobile co-residential groups, living in temporary camps of snow houses constructed on the sea ice in order to facilitate the harvesting of ringed seals at their breathing holes or the open water of the floe-edge (Boas 1888; Damas 1969; Balikci 1970). By contrast, the Thule occupied typically smaller, seasonally permanent, shore-based villages of sod/stone and whalebone houses, and presumably relied in part on food reserves stored from spring and summer harvests (e.g., Mathiassen 1927; McCartney 1977). Despite these fundamental differences, the strength of correlations in material technology between the two groups are, with a few noteworthy exceptions (e.g., firearms), unaffected.

The projection of ethnographically described patterns of summer and fall settlement to the Thule period also introduces the problem of comparing Thule winter "apples" with Inuit summer/fall "oranges" when attempting to reconstruct a comprehensive prehistoric settlement-subsistence cycle (cf. Hickey 1984:81). Given the fact that important differences can be demonstrated between aspects of Thule and Inuit winter adaptations, there is no logical reason to assume that the organizational features of the summer/fall component have remained static through time. Apart from the obvious problem of mixed data sets, imposing ethnographic patterns on the archaeological record without verification may obscure rather than illuminate our understanding of the range of Thule adaptive behaviour. For example, the ethnographic characterization of the summer/fall period as one of maximum band dispersal involving high residential mobility and short-term occupations, while valid in certain respects, incorporates simplistic assumptions about the distribution of terrestrial and riverine resources (i.e., static and/or predictable) and the organization of procurement strategies (i. e., resources are easily obtained, few special requirements in terms of personnel, etc.). A subsidiary complication is the fact that some of the most detailed ethnographic sources date to the middle and late nineteenth century, and describe patterns at least partially conditioned by the rapid changes in traditional Inuit culture at that time. In Boas'

(1888) classic study of the Baffin Island Inuit, for example, he described groups with a long, if initially discontinuous, history of contact with Europeans. Moreover, the intensity of this relationship had passed an important threshold prior to Boas' study, due to the sustained presence of the Euro-American whalers in winter ship and shore stations, particularly in Cumberland Sound which was the focus of his study. Ross (1979:246-248) has discussed the profound effects of contact on both the summer and winter phases of the traditional Inuit settlement and subsistence pattern, including a general reorganization of the seasonal round, with attendant loss of traditional knowledge, and demographic restructuring (e.g., population centralization and increased mortality) to name only two consequences (cf. Wakeham 1898, in Millward 1930:35).

These arguments do not dispute the valuable contributions already made and future opportunities afforded by the use of ethnographic and historic analogues in testing ideas concerning Thule prehistory. In fact, these data sets form an integral part of the present study. There is a need, however, for more critical evaluations of ethnographically-derived models that relate to indigenous patterns of summer/autumn subsistence patterns on the one hand, and the archaeological record they are purported to explain on the other. Specific behavioural implications of similarities in material culture notwithstanding, the direct application of ethnographically-documented patterns to the prehistoric period, independent of archaeological verification, has the potential to obscure the dynamic properties of this component of the Thule adaptive system. In other words, the recovery of artifacts related to terrestrial adaptations (invariably from <u>winter</u> houses) do not in themselves reveal much about the specific organization of terrestrial hunting or how patterns of terrestrial land use might have developed through time. Ethnographic accounts do provide an excellent framework on which to build, but to accept uncritically their reproduction in prehistoric contexts introduces a potentially significant bias to the study of Thule culture. It seems appropriate, therefore, to treat ethnographic analogues dealing with terrestrial socioeconomic behaviour, or generalized models derived from them, as hypotheses to be tested against the

Thule archaeological record, rather than assigning them intrinsic value as explanatory devices.

Terrestrial Adaptations

Despite the fact that the culture history of Eastern Thule and "processual" models of settlement and subsistence behaviour continue to be generated almost entirely from coastal-winter data, the evidence shows that the marine environment was not of exclusive importance to Thule people. It is generally recognized that both the Thule and their Inuit descendants were forced into a dual marine/terrestrial economy primarily by the need for winter clothing of caribou skin, but also a range of other food and material resources (Taylor 1966, 1968; Maxwell 1985). Based on archaeological investigations in central Labrador, Fitzhugh (1972) developed a typology of prehistoric subsistence-settlement systems with Interior, Modified-Interior, Interior-Maritime and Modified-Maritime categories (Fitzhugh 1972:158, Table Z). This system has not been widely applied outside of Labrador; however, most Thule would appear to fall into the Modified-Maritime category, with a year-round adaptation to marine fauna and coastal settlement pattern. McCartney and Savelle (1985) have explored the utility of subtypes of these adap. e categories as a means of characterizing regional economic variants of Thule, but the comparatively small base of accumulated information concerning the organization of terrestrial land use in other eastern Arctic regions is a clear indication that the role of the terrestrial ecosystem has been undervalued generally, and particularly in research designed to understand Thule social and economic behaviour.

The terrestrial resources of primary importance to human populations in the Arctic are the caribou and musk-ox. Caribou appear to have been important in all areas where they were available, and musk-ox have been considered a key resource for both Paleoeskimo (Knuth 1967) and Neoeskimo populations (e.g., Wilkinson 1975; Will 1982). The importance of fox, wolf and hare in prehistoric times was regionally variable. Faunal studies indicate, however, that none were utilized to the same degree as the larger mammals. Since the focus of the present study is on caribou it will be the only species considered in detail.

In most analyses of Thule culture, the importance of caribou as a resource is evaluated primarily in terms of its dietary (meat, fat, marrow) rather than raw material (skin, bone, antler, sinew) contribution. The former is estimated through analyses of faunal data recovered from winter houses and middens while the latter are acknowledged to be important (especially skins), but very difficult to quantify in a meaningful fashion. Less consideration has been given to the importance of caribou (and, therefore, the terrestrial ecosystem) in the exploitation of the winter marine environment, and thus the interrelationship between the marine and terrestrial ecosystems in the general adaptation of Arctic hunter-gatherers. It is argued here that the terrestrial environment does not merely complement the maritime adaptation, but is in fact an integral part of it. Before considering this point more fully, the role of caribou in traditional northern economies is examined.

CHAPTER THREE

CARIBOU AS AN ECONOMIC RESOURCE

Introduction

The importance of caribou to the economic welfare of Arctic and Subarctic cultures in North America and Europe has been treated in detail by several authors. The role of Alaskan and Canadian herds to traditional economies has been the subject of study for decades (e.g., Speck 1936; Spencer 1959; Gubser 1965; Kelsall 1968; Burch 1972; Fitzhugh 1972; Spiess 1976; Binford 1978; Smith 1978; Amsden 1979; Damas 1984; Saladin d'Anglure 1984), and recent biological and archaeological investigations in Greenland (Vibe 1967; Grønnow et al. 1981; Grønnow 1986; Meldgaard 1983, 1986) have made significant contributions to our understanding of the cultural importance of the species there.

This chapter reviews the general importance of caribou as a source of food and raw materials for human populations, with the emphasis on caribou skin clothing as an integral component of a suite of technological adaptations to Arctic winter conditions.

The Ideological Context

The relationship between man and caribou in the Arctic is not generally as heavily invested with spiritual concerns as are those with certain marine species (especially large whales). The importance of the species is nevertheless reflected in the many ethnographically-described behavioural proscriptions associated with caribou procurement, processing and consumption. The degree to which such restrictions were observed, and the severity of the penalty for failing to do so, appears to vary according to the extent to which a particular group relied on the species. The Caribou Eskimo occupying the interior region west of Hudson Bay, and the Nunamiut of north-central Alaska, for example, depended heavily on caribou for both food and other materials (Birket-Smith 1929; Spencer 1959; Gubser 1965;

Arima 1984). As a result, these groups upheld various beliefs related to the species, and there was a more careful observation of them during the precontact era. Even groups with less emphasis on caribou as a subsistence resource, however, often attached complex behavioural rules to man's interaction with this species (e.g., Boas 1888:passim; Rasmussen 1929:190).

A detailed listing of the many regional variations in behaviour associated with the treatment of caribou is beyond the scope and purpose of this discussion. Perhaps the best-known prohibitions are those designed to prevent contamination by segregating the products of the land and sea, including the utensils used to procure and process them. In general, marine and land mammals could not be cooked together or consumed during the same meal or day. In addition, weapons used to hunt one class of resources could not be used to hunt the others, or if they were, it was not until after the proper steps had been taken to "cleanse" them (e.g., Boas 1901). Other activities, either ritualistic in nature or consequence, relate to procurement and processing. Pre-hunt ceremonies have been described for both southern Baffin Island (Bilby 1923:241) and Labrador (Taylor and Taylor 1986). In each case, groups assembled at specific locations to organize the fall caribou hunt, and to participate in competitive contests of archery and strength. Bilby (1923:265-66) noted the importance of these "recreational" events to the development of social relationships through marriage between various regional groups. Taylor and Taylor (1986) describe a similar situation for eighteenth century Labrador Inuit, and argue that an important function of such assemblies was to promote/ensure good hunting inland. Since caribou are believed to be very sensitive to Inuit women, who ordinarily are not hunters, they usually observed strict rules of conduct when participating in the hunt (Boas 1901:150, 493; Birket-Smith 1959:169; see also Driscoll 1980). It was also common for individuals to leave an "offering" of a small fragment of caribou skin, meat or fat beneath a rock at or near a spot where the hunting camp was located, or the place where the animal was killed (e.g., Hall 1865:423, 574).

In terms or processing, and consistent with the separation of the land and sea, caribou skins could not be prepared for clothing until after the hunt had stopped and once skin processing had started, the work had to be finished before sea mammal hunting could commence, after which time apparently no one would work on caribou skins (e.g., Hall 1865:575). Bones were not to be processed (i.e., broken) for their marrow at caribou crossing places, nor were they to be left out on the land where the animals would see them and, as a result, their spirits or inua (Gubser 1965:326) might possibly be offended (Rasmussen 1929; E. Akashook 1985:pers. comm.). These taboos were strictly followed due to the belief that caribou, like other animals, allowed themselves to be killed by hunters and if offended would no longer permit this.The ethnographic and historic literature suggests that although most of the proscriptions were sanctioned supernaturally, the penalties for breaking the taboos (either deliberately or inadvertently) were usually minor in their consequences. They typically brought (or, viewed alternatively, explained) bad luck in hunting to the individual and/or group, although folktales also refer to occasionally harsher repercussions, including deaths attributed to the offended spirits of the animals or their guardian deities (Boas 1888; Rasmussen 1929:57,71).

Caribou as a Food Resource

The high economic value placed on caribou in all regions where they occur derives from the fact that the species is capable of meeting virtually all of the subsistence needs of a population. As a result, caribou have often been referred to as a "complete" resource (e.g., Rasmussen 1929; Marsh 1942; Burch 1972). The economic significance of the species nevertheless varies both on regional and temporal scales. The Nunamiut and the Caribou Eskimo represent groups heavily dependent on caribou for their dietary (and material) needs. By contrast, populations occupying coastal zones from Alaska to Greenland harvested caribou for food, but in terms of their diet were far more dependent on marine and riverine resources (e.g., Damas 1984).

Food Preferences

Much of the basic economic status of caribou is derived from and varies according to the broad range of food items that it provides. The main components of the dietary contribution are meat, marrow and fat, but as already noted, a range of preferences exists within these categories based on the animal's age, sex and health, the season of the year and its general availability (e.g., Boas 1888; Stefansson 1960; Gubser 1965; Binford 1978; Spiess 1979; Anoee 1982; Karetak 1982; Piryuaq 1986). Gubser, for example, includes caribou fetuses and calves heads on the Nunamiut list of preferred body parts, as well as the internal organs (e.g., kidneys, heart, intestine) and any attached fat from prime bulls (1965:300-301; cf. Burch 1972:342). He also notes that as a rule, immature animals with lower percentages of body fat were killed only if adults were unavailable. According to Stefansson (1960:32-36), the Mackenzie and Copper Inuit favoured, in addition to meat, the brain, tongue and "pads" of fat behind the eyes, the esophagus and occasionally the neck. Interestingly, he suggests that the liver and portions of the tenderloin were often fed to the dogs, and that the Inuit preference for caribou liver was the result of European contact (op. cit.:35). Turner (1894:87) observed that the tongue was always consumed as were the stomach contents, often mixed with blood. This sampling of ethnographic accounts illustrates the range of edible materials in addition to caribou meat, back fat and bone marrow that can be utilized according to preferences, or as conditions require. Inuit elders consulted for the present study stated that virtually the entire carcass can be eaten if necessary (and with some specialized processing), a point which was later demonstrated by an Inuit field assistant, who ate the tip of an antler tine (in velvet) while field butchering a young bull (T. Papatsie pers. comm. 1987).

Procurement Strategies

Most anthropological discussions of caribou focus on species ethology and procurement practices in cross-cultural contexts (Burch 1972; Spiess 1979). Spiess (1979:103-130) has summarized ethnographic and historical accounts of caribou procurement techniques in

North America and Europe. Considerable variation in technique is evident depending on the (i) importance of the species to subsistence, (ii) general availability and density of animals (i.e., migratory/resident herds), and (iii) objective of the hunt (i.e., for immediate consumption, storage, skins or other raw materials). Several tactics appear to have been in general use including pitfalls/snares, stalking by one or two hunters and where condition permit, cooperative techniques involving the spearing of animals driven into river crossings or directed using drive fences/Inuksuit into enclosures constructed on land.

Procurement strategies were also keyed to seasonal biological cycles of caribou. It is well known that fat accumulation and deposition on various parts of the caribou anatomy varies according to age, sex and season (Anderson 1951; Jenness 1922; Stefansson 1951; Kelsall 1968; Spiess 1979). Adult males accumulate the most substantial fat deposits on their back and hindquarters during the late summer and early fall, prior to the rut in October. Anderson (1951:505) describes two large bulls killed in the autumn that had slabs of back-fat alone weighing approximately 17.7 kg. and 22.7 kg. Fat is also deposited on various internal organs, including the intestines and kidneys, and attached to the ribs and sternum, pelvis, behind the eyes and tongue (Gubser 1965; Kelsall 1968; Binford 1978). The fat deposits in adult males are virtually depleted during the rut, and they are leanest through the winter and spring. Adult cows and younger animals of both sexes accumulate less fat, and slightly out of phase with the adult males. In general these age/sex classes retain more fat during the winter than the older males, but these reserves are depleted during the spring migrations (Kelsall 1968:41; Spiess 1979: Figure 2.2).

A seasonal cycle of pelage development also exists, which influences not only the timing of procurement, but the potential uses to which the skin may be put. Three factors, schematized in Figure 2, have important effects on caribou procurement strategies in that they combine to concentrate harvest activities, for clothing needs, within a relatively short period of time. The first factor, which affects the quality and, therefore, suitability of caribou

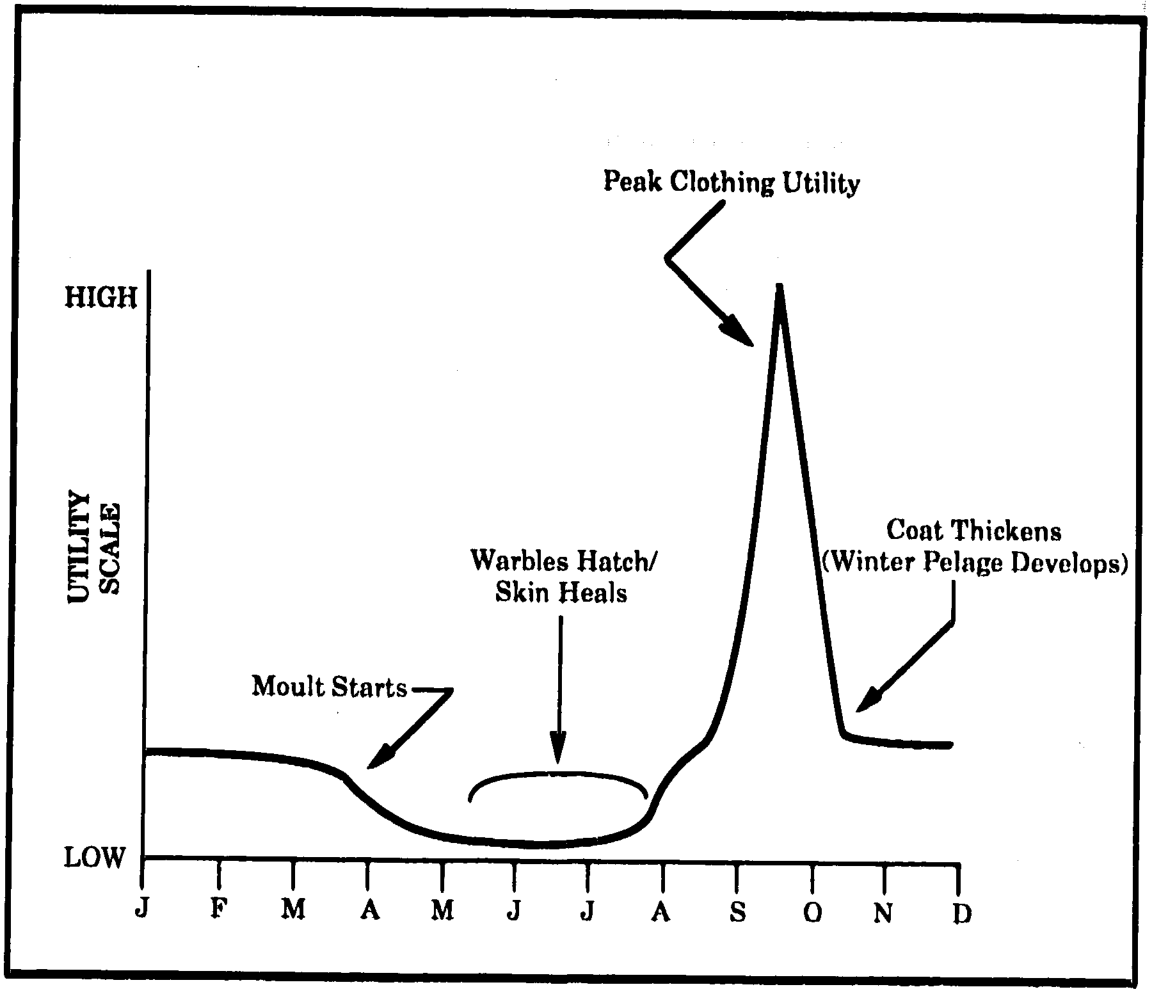

Figure 2. Seasonal Variation in Utility of Caribou Skin for Clothing Manufacture. (after Anderson 1955; Kelsall 1968; Spiess 1979; Calef 1981).

skin for use as clothing is the annual shedding of the outer layer of guard hairs and some of the shorter underwool. As in the case of body fat accumulation, adult males begin to shed their winter pelage sooner than younger animals and breeding females. The process begins in spring (April/May) for bulls and continues until early summer. According to Kelsall (1968:34) breeding females may still retain much of their winter pelage at this time (i.e., June and July). In general, during the moulting period the quality of the skin for clothing ranges from worthless to poor. Even though animals may have a more or less new (but short) coat by early summer, the utility of the skin remains low due to the effects of the parasitic warble fly (*Oedemagena tarandi* L.).The warble fly is similar in appearance to a small bumblebee and lays its eggs between June and September on the hair of the caribou's legs or abdomen. The larvae hatch in approximately one week and then migrate subcutaneously to the back and rump of the animal. They cut breathing holes through the caribou skin and remain to develop through the winter in fibrous capsules. In late May and June the larvae exit from the host animal through the breathing holes and pupate on the ground (Kelsall 1968:269-274). In data summarized by Kelsall (1968:272), up to 93% of caribou had warble fly infestations; the males had a higher average rate of infestation than females, but with larvae typically numbering in the hundreds in both sexes. The season of warble fly activity has been implicated in the weight difference in caribou of as much as 20% between summer and autumn (op. cit.), and can also debilitate animals through infection and increased susceptibility to predation (Dieterich 1980). These parasites also drastically reduce the quality of the skin for human use, with exit holes making the skin worthless for clothing and most other purposes until the passages have healed, or until about early August (Stefansson 1951; Spiess 1979; Calef 1981). A third factor affecting the use of skin for clothing is the thickness of the hair layers. By late autumn, and throughout the winter the hair is too thick and heavy for use in clothing, but skins from winter kills were used for sleeping robes and other purposes (e.g., Banfield 1951; Hoffman 1976; Bruemmer 1981).

Caribou as a Raw Material Resource

Other than skin for clothing, which is discussed separately, the caribou skeleton is the most important source of raw material for tools and weapons. Antler is of particular importance because it has certain qualities (large supply, easy to work, holds a working edge, plasticity) that make it a preferred material for a wide range of implements, including harpoon and arrow heads. The list of other skeletal parts known ethnographically and archaeologically to have been utilized includes: teeth (clothing decoration, amulets, games), scapulae (skin scrapers), the astragalus (bowdrill mouthpiece), ribs (bowdrill), sesamoids and phalanges (games) and metacarpal/metatarsal (scrapers) (cf. Boas 1888; Mathiassen 1927; Balikci 1970; Morrison 1988). Caribou sinew from the back and legs is also a valuable commodity. This material is prepared by scraping and drying and then used for thread and braided into cord for a variety of purposes including bowstrings and backing (cf. Boas 1888; Turner 1979; Gubser 1965; Balikci 1970; Anoee 1982). Among the important attributes of sinew thread is the fact that it expands when wet and seals the stitching holes in waterproof garments (e.g., Manning and Manning 1944; Issenman 1985).

Caribou Skin Clothing

Of all the technological innovations developed by prehistoric groups to adapt to Arctic conditions it is surprising that clothing has received so little attention from archaeologists. Although items of clothing are only occasionally recovered and/or reported from Arctic excavations (McCullough 1986; Park 1986), they are the products of tedious labour and represent one of the pivotal adaptations of the human species to circumpolar regions. All Arctic groups shared a need for high quality winter clothing, for which caribou skin is clearly the preferred material (cf., Boas 1888; Turner 1894; Manning 1942; Rasmussen 1929; Manning and Manning 1944; Wright 1944; Webster 1949; Anderson 1951; Birket-Smith 1959; Hatt 1969; Oswalt 1967, 1979; Driscoll 1980; Soper 1981; Issenman 1985; Piryuaq 1986). The superiority of caribou skin clothing over other materials derives primarily from its insulating properties which allow the body to maintain thermal balance (thermoregulation) in the Arctic winter environment. Other factors that should be considered include the ease of capture, amount of skin and subsidiary raw materials a single animal provides, as well as the aesthetic qualities of the material.

The insulating quality of caribou-skin clothing is determined by the structural properties of the skin and hair fibres, and the skilled tailoring of the garments. As such, Inuit winter clothing (in fact all traditional Inuit clothing) can be viewed as a complex system integrating "fabric" attributes, design principles and ideology into what Watkin (1984:xvi) calls a "portable environment". This environment is a vital component of human behavioural adaptation to Arctic conditions generally, and as will be argued, is critical to several traditional resource procurement systems.

As Watkin (1984:35) has pointed out, thermal protection must be considered in terms of the environmental circumstance for which the clothing is being designed. In the present context, two functional attributes of cold environment clothing are most desirable: (i) protection of the body and (ii) the maintenance of task efficiency. The first requirement is met by creating a nonconductive barrier between the wearer and the atmospheric environment. The key attributes of caribou skin in this regard are its outer layer of hollow guard hairs, specifically, their strength, compression resistance, and lightness. Because each guard hair on a caribou skin has an air-filled cavity, and air is a very poor conductor of heat, cold weather clothing that naturally or artificially traps it is exceptionally warm. This same principle accounts for the insulation provided by snow houses: the blocks of snow contain pockets of air. The insulative quality of caribou skin is enhanced by boundary air (Watkin 1984:17) trapped between the inner and outer layers of the caribou coat (cf. Fuller and Holmes 1972; Edholm 1978; Issenman 1985:103), and the orientation of the guard hairs to the skin (i.e., parallel) may also act to reduce heat loss through conduction by increasing the effective thickness of the layer of hair (Watkin 1984:26).

The insulative quality of the skin is further improved by the tailoring of the clothes, in particular, the use of layering. A basic set of winter apparel consists of an undergarment (qulittaq) of fine and soft fur worn with the fibres lying against the wearer's body. Worn in this fashion, the skin of the garment is prevented from touching the skin of the wearer, and by doing so maintains an air space between the two. An outer parka (attigi) is worn over this in which the fur faces away from the wearer. The layer of air trapped between the inner and outer garments further restricts heat loss, and the deliberately loose fit allows freedom of movement and circulation of warm air around the body including, when necessary, ventilation at the neck or waist (Hatt 1969:7; Driscoll 1980:11; Issenman 1985:103). Proper ventilation is an essential feature of cold weather attire because the layer of warm air next to the body is saturated with water vapour. If evaporation is restricted, the water will condense and in winter freeze, resulting in a radical loss of insulation, comfort and the ability to move freely (Birket-Smith 1959:111; Edholm 1978:35). One of the principal drawbacks of woolen garments, widely introduced to the Inuit in the nineteenth century, is that they readily absorb this moisture (see Soper 1981; Birket-Smith 1959; Issenman 1985). The skillful manipulation of caribou skin to meet the prerequisites of the Arctic winter environment demonstrates the complexity of Inuit winter clothing systems and attests to the expertise involved in their construction and maintenance.

It is worth noting that caribou skin clothing also served social and ritualistic functions in traditional Inuit society. The style and design of the garments communicated personal information on both individual and group levels, primarily the age, sex and geographic origin of the wearer, as well as elements of their belief system (e.g., Swinton 1980:24; Saladin d'Anglure 1984:404). In her discussion of animal-human bonding represented in caribou clothing, Issenman (1985:106) notes that the ventral mane of the skin (pukiq) which covers the animal's heart, is commonly inserted into the front of the amautik and hunting parka. In similar fashion, the ears of the caribou were often incorporated into the hood of the hunting parka as a metaphoric reference to the animal and to improve the hunter's ability to track game. For some central Arctic groups, Boas (1901:151) mentions the practice of sewing the tip of the animals tail to the hunters coat to bring luck. Other examples of symbolic parallels include the use of foetal and calf skins for infant and children's outfits, the use of the skin taken from the caribou leg for leggings and footwear (although this also has a functional basis, cf. Turner 1894; Gubser 1965; Hatt 1969), and the use of sleeve inserts (stripes) of white fur to represent the joints of the animal's limbs (e.g., Boas 1901; Hatt 1969; Driscoll 1980; Swinton 1980; Saladin d'Anglure 1984).

Despite the superiority of caribou skin, and the multiple functions it served, it must be stressed that the use of other materials for winter clothing is well-documented ethnographically (cf. Birket-Smith 1959; Hatt 1969; Holtved 1967; Saladin d'Anglure 1985). In a detailed cross-cultural survey Hatt (1969) lists bird, fish, seal, polar bear and dog skin as being in regular use by specific groups, or as substitutes for caribou skin that were occasionally used by Arctic Eurasian and North American populations. However, consistent with all other reports, he states unequivocally that "reindeer unconditionally supply the most important material for circumpolar peoples" (Hatt 1969:7). The Polar Eskimo, for example, who relied on polar bear, bird and fox skin for winter clothing despite the availability of caribou, increased their use of caribou skin when the technology necessary to hunt the animals, and a modified ideology, was introduced to them late in the nineteenth century by emigrants from Baffin Island (Holtved 1967:34; Peterson 1984:578). In the islands in Hudson Bay, (Belchers, Mansel, Ottawas), reinforced eider skin was used extensively because caribou were locally unavailable (Saladin d'Anglure 1984:482). Birket-Smith (1959:111) has argued that a variety of other materials can be used for winter attire, but that each has certain drawbacks. Polar bear and musk-ox skin are both warm, but are apparently quite heavy and the latter evidently becomes very dirty due to the length of the hair fibres. By comparison, a complete set of caribou skin clothing weighs only between about 3.0 - 4.5 kg (Stefansson 1955). Consideration must also be given to the obviously greater risk factor attached to acquiring bearskin (which provide up to three pairs of trousers, (Freuchen

1935:61)). Sealskin is very durable and worn in many regions during the summer, but is not warm enough for general winter use. Garments manufactured from fox or bird skin are light and provide excellent insulation, but are not sufficiently durable (see Freuchen 1935:68-70, 78). A larger number of skins are also required due to their smaller size (e.g., Saladin d'Anglure 1984:Figure 4; Gilberg 1984:582-583).

Among the most important drawbacks of caribou skin are those which affect the use-life of garments. The long guard hairs on the skin lack resiliency and are brittle (Birket-Smith 1959:111; Hatt 1969:8; Soper 1981:104). As a result, they break off easily (particularly at the elbows, knees, and on the mittens) and decrease insulative efficiency. Opinions vary as to how long a winter outfit will last, but most estimates have a maximum range of about three years (e.g., Jenness 1928). There appears to be a consensus, however, that if at all possible, winter garments were replaced annually (Hatt 1969; Saladin d'Anglure 1984).

Thermoregulation

The functional properties of caribou skin clothing can also be expressed in more formal terms. A concept employed in physiological research involving cultural adaptations to cold environments is the clothing unit or "clo". This descriptive unit expresses the thermal resistance of clothing systems, and is a standardized measure of insulation required to maintain comfortably the human body under variable metabolic rates and environmental conditions (Auliciems et al. 1973; LeBlanc 1975). Expressed in its simplest terms, a clo is "a unit of thermal insulation which will maintain a resting-sitting man, whose metabolism is 50 kcal./m^{-2}/hr^{-1}, indefinitely comfortable in an environment of 21°C, relative humidity less than 50 percent and air movement 10 cm/sec" (Auliciems et al. 1973:9). Under these basal conditions one clo unit is the equivalent of the insulative properties of a business suit or fabric approximately 6.25 mm thick (Leblanc 1975:4; Auliciems et al. 1973: Table 6). Auliciems et al. (1973) have established an index of clothing requirements for Canada covering the period between September and April, using a metabolic rate of 100 kcal./m^2/hr.

These data were transferred to seasonal maps depicting predicted requirements by season (op. cit. 1973: Figs. 9-12). The mean clo requirements by season for southern Baffin Island using this data are presented in Table 2.

Assuming increases in metabolic rate as a result of the weight of a given set of clothing and the extent to which its bulk impedes movement, Auliciems et al. (1973:15) suggested a mean value of 5 clo for a set of clothing (including air space), with an upper limit of 8 clo for those garments covering the torso. However, LeBlanc (1975:8-9, Fig. 1-3) suggests that two layers of caribou skin provide a total thickness of between 5 and 6.25 cm, with maximum corresponding clo values ranging between 8 and 10, allowing relatively unimpaired activity at temperatures of -40° to -60° C. Frisancho (1979:62) similarly argues that caribou fur clothing 3.75 - 7.50 cm thick provides between 7 and 12 clo units of insulation. These figures must be interpreted carefully. Although higher clo values indicate a capacity to maintain adequate levels of comfort under conditions of extreme cold, (the product of several meteorological variables including temperature and wind speed), in the present context these high insulation values assume their greatest importance in conjunction with low rates of metabolic activity. Since heat energy is a byproduct of physical (muscular) activity, less insulation is hypothetically needed as exertion becomes more strenuous at a given temperature. This inverse relationship between ambient temperature and clo requirements is illustrated in Figure 3.

A simplified model of the interaction between cold environments and cultural/physiological responses is illustrated in Figure 4. Among cold-adapted human populations two general classes of response occur. Physiological responses are not considered in detail in this study, but research into environmental physiology has shown that among populations in regions of low ambient temperatures, higher basal metabolic rates and increased blood flow to peripheral extremities (vasodilation) are two common characteristics among a range of far more complex thermoregulatory responses (Bedford 1953; LeBlanc 1975, 1978; Edholm 1978;

Table 2. Summary of Mean Clo Requirements for Southern Baffin Island.

SEASON	CLO VALUE
Fall	2.25-2.50
Winter	3.50-4.00
Spring	2.75-3.25
September-April	2.75-3.25

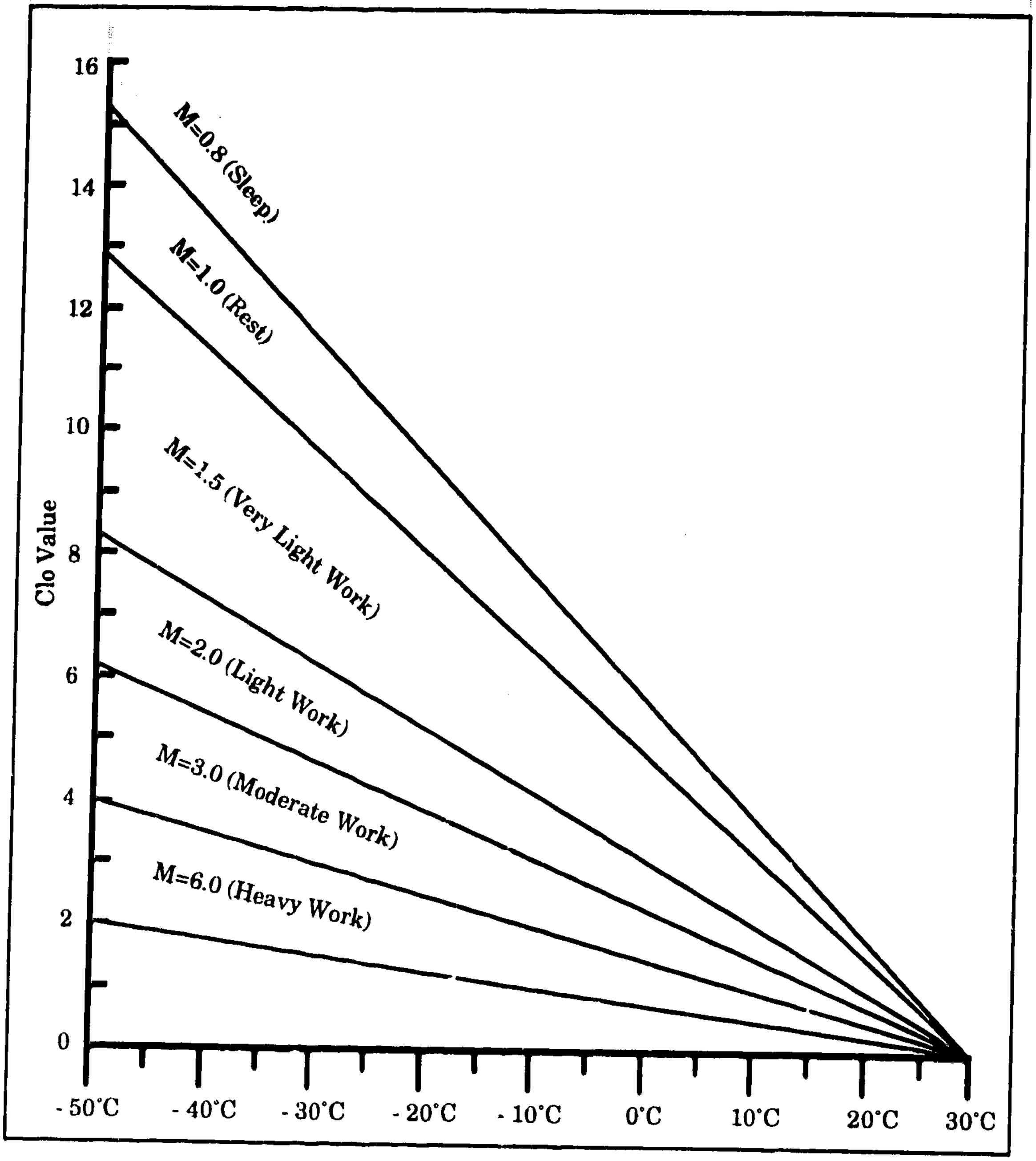

Figure 3. Total Clothing Insulation plus air required for different metabolic rates. 1Met = 50/kcal/sq.m/hr. Modified from LeBlanc 1975.

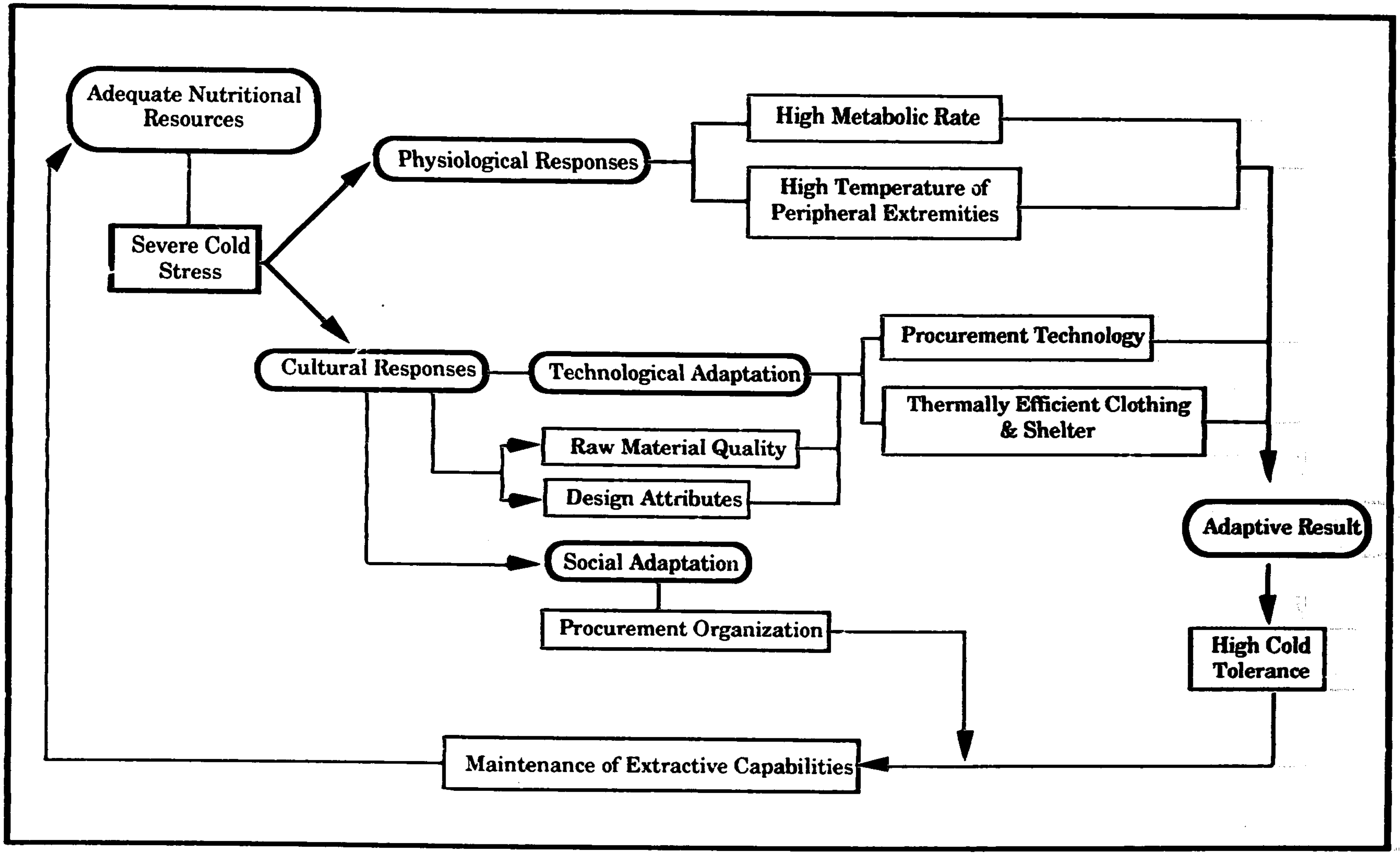

Figure 4. Schematization of interaction of environmental, physiological and cultural factors influencing cold adaptation among Arctic populations. Modified from Frisancho 1979.

Frisancho 1979). Cultural responses have both technical and social dimensions which, when combined with physiological mechanisms, increase cold tolerance and by doing so maintain extractive capabilities (i. e., the ability to hunt and travel) under conditions of extreme low temperature. It is in this context that caribou skin clothing, as a key terrestrial resource for most North American Arctic cultures, is being considered.

Skin Requirements

Although quantitative data is limited, ethnohistoric sources provide estimates of the number of caribou skins required annually for clothing and ancillary purposes. Data summarized for five regional Inuit populations are shown in Table 3.

These figures suggest an average requirement of eight skins/individual/year for winter clothing needs. Additional skins were also required for a variety of other purposes, including tents (e.g., Banfield 1951; Gubser 1965), kayaks (Hoffman 1976), and sleeping robes/blankets (Soper 1981). When combined, the figures suggest that somewhere between 40 and 70 skins would be required annually for a family of five. It should be noted that many of these estimates are derived from caribou-dependent or inland oriented economies (e.g., Nunamiut, Caribou Eskimo), and coastal populations would have a theoretically lower requirement. In Spiess' view (1979:30), coastal Inuit would require considerably fewer skins, but assuming annual replacement whenever possible, and using an average of 8 skins for adult garments and 4 for children, a family of five would still require between 28 and 36 skins for clothing purposes alone. The estimate of 6 skins/outfit for the Quebec Inuit is derived from the total requirement (i. e., clothing and bedding) of 40 skins for a family of three adults and two children (Saladin d'Anglure 1984:491). However, the author elsewhere suggests (op. cit. 489) that 60 skins could renew the wardrobe of a band of thirty people. This lower figure is presumably based on an assumption of only partial replacement of certain garments (e.g., boots, mittens, possibly outer parka) or complete replacement for specific personnel (e.g.,

Table 3. Number of Caribou Skins Required for Winter Clothing.

Source		Regional Group	Number of Skins
Mathiassen	1928	Iglulik Inuit	8
Jenness	1928	Copper Inuit	7
Lawrie	1948	Caribou Inuit	7
Webster	1949	Caribou Inuit	12
Banfield	1951	Caribou Inuit	12
Bruemmer	1971	Copper Inuit	8
Mitchell	1973	Baffin Inuit	8
Hoffman	1976	Caribou Inuit	8
Arima	1984	Caribou Inuit	6-8
Saladin d'Anglure	1984	Quebec Inuit	6

active hunters). Nevertheless, in view of the other ethnographic information, 60 skins would seem barely sufficient to meet the annual clothing needs of a band of thirty people.

The lack of sufficient caribou skins (in number or quality) with which to replace winter clothing can be hypothesized to effect: (i) a population's general health, (ii) their ability to shift winter camps to more productive hunting grounds (i.e., their residential mobility) and (iii) their ability to hunt. Poor health could result from a reduced insulative quality of caribou skin due to hair breakage or damage to the garment (or the necessity of using of inferior substitute materials). It could also result from unsanitary conditions promoted by the clothing being dirty. While it is difficult to assess empirically this type of potential impact on the physical well-being of individuals, historical accounts confirm its existence.

> "... The importance of these skins for winter clothing cannot be too strongly emphasized, and to lack of it can be traced a considerable mortality amongst the Eskimo as a first cause of lung affection [sic] or bronchial sickness. No white man's clothing is even a tolerable substitute for these admirable skins." (Munn 1922:271)

> "In regions such as parts of Ungava, where for one reason or another the natives are unable to get caribou, there is a great deal of suffering from the cold, with a consequent falling off of the birth rate. It is understood, also, that such people are more susceptible to disease." (Soper 1928:69)

> "...deerskins were scarce, and winter clothing was in bad shape. The inhabitants, some ten families, were in a filthy condition."
> (Ann. Rep. R. C. M. P. 1930:70)

> "The lack of clothing has a lot to do with the cleanliness of the native. In the case of "scabies" they are given ointment (sulphur) and told to keep themselves clean. It is impossible for the natives to do so when he has to make one deer-skin suit last two or even three years."(Ann. Rep. R. C. M. P. 1932:99)

> "...is a very incompetent individual and his wife and family are in a wretched state, due to a lack of clothing."(Ann. Rep. R. C. M. P. 1932:98)

> "The lack of skins... causes considerable hardship, and may have an adverse effect on the health of the Eskimo." (Manning 1942:29)

Despite their occasionally pejorative tone, these descriptions suggest that a lack of good quality clothing could be a contributing factor to poor health during the winter season.

Group mobility, the sine qua non of hunter-gatherer adaptations generally, and a key element of Arctic cultural adaptive strategies, could also be adversely affected by a lack of suitable winter clothing. For most traditional Inuit, caribou-skin clothing was an indispensable part of winter subsistence strategies, because they focussed on the exploitation of the sea-ice environment and extended periods of outdoor activity. Historical accounts indicate that the ability of families to relocate during winter could be impaired when shortages occurred. For example,

> "Occasionally the seal fail at certain settlements, as happened in 1920-21, when I was compelled to feed about eighty natives at our station for nearly three months, the seal failure coinciding with a failure of the deer hunters to obtain winter clothing; consequently the women and children could not be moved to better sealing grounds." (Munn 1922:271)

> "The necessity of keeping so many Eskimos here for the arrival of the ship prevented several families from making their annual summer deer hunt; as a result, skins for clothing were scarce, the movements of some families were materially handicapped." (Ann. Rep. R. C. M. P. 1925:38)

A reduction in the ability to hunt effectively during the cold season is a logical extension of these first two points, and the general role of caribou skin clothing is best expressed by the Inuit:

"...caribou had to be used for clothing in those days.... At that time, they had to have good clothing made of caribou skins. If they were hunters, they would have to have good caribou clothing and that was the only way." (Karetak 1982:57)

"If we hadn't had caribou-skin clothing in those days we would never have survived the winter." (Piryuaq 1986:8).

"The caribou had an important place in the lifestyle of the Inuit of the past. It was very important for survival." (Karetak 1982:59)

Clothing Requirements in the Thule Period

It is widely accepted that environmental change was a principal catalyst in the modification of the original pattern of Eastern Thule winter settlement. Winter settlements of seasonally permanent, shore-based, semi-subterranean houses were apparently supplemented and eventually replaced by larger, temporary camps of snow houses built on the sea ice (Schledermann 1976; McGhee 1978; Sabo 1981; Maxwell 1985). Although snow house villages were the predominant form of winter residence at the time of sustained contact with Euro-Americans, it is unclear when they assumed this status. Some investigators have argued that snow houses were in use throughout the 4,000 year occupation of the North American Arctic (Meldgaard 1960; Taylor 1968; Maxwell 1985). Their use has been inferred from the recovery of artifacts (e.g., snow knives) identified ethnographically as specific to their construction. Others have questioned this interpretation (McGhee 1983), challenging the functional specificity of these tools.

McCartney (1977:29) has argued for such a transition relatively soon after A. D. 1200 for the west Hudson Bay region. On Baffin Island, however, semi-subterranean houses were apparently still in use by Frobisher Bay Inuit during the late sixteenth century (Stefansson 1938), and Sabo (1980:501) has reported historic-era components in the Lake Harbour district that contained evidence of winter occupation. Schledermann (1976:43) has suggested that a move away from the preferential use of sod houses may have taken place in the central Arctic sometime during the early sixteenth century, and slightly later in the eastern regions. He further suggests that they were replaced by snow houses and qarmat, the latter conventionally interpreted to function as temporary autumn dwellings (Mathiassen 1927; cf. Park 1988). Although we presently lack adequate empirical data to resolve this question, the year A.D. 1500 should serve as a reasonable estimate for the beginning of the period in which the use of snow houses predominated; however, this does not preclude their use prior to this time.

One of the many changes assumed to have accompanied the shift in residence type and location involves procurement strategies. Whereas shore-based settlements are thought to have been at least partially maintained from stored surpluses, a move to the sea ice would have involved frequent, if not daily, hunting at seal breathing holes, open leads, or the floe-edge. This implies increased levels of outdoor activity by a greater number of individuals (e.g., travel to new sealing grounds by hunters, relocation of entire settlements or parts thereof). This would be true particularly of hunters, who, if nineteenth century ethnographic accounts have any relevance, would have spent many hours waiting motionless at breathing holes, and extended periods of time at other kill locations. Boas (1888), Rasmussen (1931) and Balikci (1970) have noted that this hunting technique requires considerable training, endurance and patience. These hunting tactics were also co-operative (Damas 1969; Balikci 1970), involving not only groups of male hunters, but often other members of co-residential groups.

Although breathing hole sealing was a principal economic activity among central and eastern Arctic Inuit during the historic period (Hall 1865; Boas 1888; Balikci 1970; Damas 1973), the extent to which their Thule forebears engaged in this activity is unclear. Most discussions of Thule economic strategies consider seal hunting at the floe edge or at the breathing holes to have been an important winter subsistence practice. These interpretations are based on the recovery from Thule winter sites of artifacts that have ethnographic counterparts known to have functioned as components of breathing-hole hunting kits. Among the most functionally specific of these artifacts are snow and breathing-hole probes, and harpoon foreshafts. Snow probe shafts are typically straight and used to test the depth and consistency of snow when constructing an igloo. Breathing-hole probes have a curved shaft and are used to determine the size and shape of the breathing hole (Mathiassen 1927I:47; Balikci 1970:59, 69; Mitchell and Van de Velde 1973). Thrusting harpoons, which incorporate a stationary or "fixed" foreshaft are historically associated with breathing-hole sealing, while the throwing harpoon which has a moveable or "loose" foreshaft arrangement, is associated with open-water (including floe edge) hunting. The occurrence of fixed foreshafts and snow/breathing-hole probes in Thule artifact assemblages is generally viewed as evidence for breathing-hole sealing (e.g., Morrison 1983; Maxwell 1985).

However, a comparative thin-section analysis of seal teeth (used to determine season of death) from three Thule winter sites (Stenton 1987a) suggested that winter sealing may have played a minor role in Thule subsistence adaptations prior to the early historic period. While these results are preliminary, they are supported in a study by McCullough (1987) who conducted thin-section analysis on seal teeth from early (i.e., 12th - 13th century A.D.) and late (i.e., 16th - 17th century A.D.) Thule faunal assemblages from sites in the Bache Peninsula region of Ellesmere Island. McCullough found that in the early (Ruin Island Phase) Thule sites, winter kills accounted for 9.6% of the sample. In the late Thule samples, however, the number of seals killed during the winter had more than doubled to 21.7% (McCullough 1987:14). Although thin-section analysis does not discriminate between open water (i.e., floe edge) and breathing-hole hunting strategies, the late Thule sites also contained artifacts which support the faunal evidence for a shift toward increased seal harvesting in winter. Between the early and late occupations fixed foreshafts increased by 33.1%, whereas moveable types decreased in frequency by this same amount. Also found in the late Thule sites, but missing in the collections from the early houses were breathing-hole probes.

Assuming for present purposes that the pattern of Thule winter settlement was modified in the manner generally accepted by archaeologists, one could logically hypothesize that the relative importance of caribou would have increased as winter conditions became progressively colder, and as changing emphasis in subsistence activities required longer periods of outdoor activity. The results of faunal analysis, however, appear to contradict this intuitive conclusion, indicating instead a relative decline (measured as a percentage of total faunal assemblages) in caribou utilization that appears in the Developed Thule phase and continues through to the Historic period on southern Baffin Island (Sabo 1980, 1981; Stenton 3). There are, h ver, several problems with assessing the importance of caribou solely on the basis of faunal remains from Thule winter houses. For example, caribou faunal remains provide only an approximation of the relative dietary contribution made by the species, specifically meat and marrow. Yet it is clear from historic (Hall 1865) and ethnographic (Boas 1888; Jenness 1928) accounts that caribou was valued at least as much, if not more, for its skin as for its food value. This is confirmed by reports of wasting meat (and, therefore, bones) both in the nineteenth (Hall 1865:356, 360) and twentieth (Canadian Wildlife Service: n.d.; Muffitt 1937:3; Jenness 1928:152-174; Kelsall 1968:216-222) centuries. Again, if these ethnographic utilization patterns in any way reflect prehistoric ones, they limit the use of excavation data from Thule winter sites/components as a means of evaluating autumn hunting activities.

It is also very difficult, if not virtually impossible, to determine if the faunal assemblage recovered represents a discrete occupation, or the product of cumulative but intermittent use. In his discussion of Thule winter house "systems", McCartney (1977:307) suggests that faunal and other debris were removed from semi-subterranean houses prior to their reoccupation. This makes intuitive sense, but there is no way of empirically determining if, or the extent to which, this was actually done for any given case, especially since Thule houses routinely contain thousands of bones, as well as feathers, fur and skin fragments. If annual or periodic cleaning was done, then the practice of merging house and midden faunal remains into single analytical units should be avoided unless clear stratigraphic separations can be identified; but this is often not the case (McCartney 1979; Staab 1979; Stenton 1983).

Procurement patterns introduce further problems. Ethnographic and historic sources indicate that caribou hunting in much of the eastern Arctic was conducted either out of coastal camps, into which only select parts of the animal were introduced by small groups of male hunters, or from interior camps occupied by one or more families for various lengths of time ranging from a few weeks to months. These patterns are described in greater detail in a later section, but each has important implications for the formation of caribou faunal assemblages found in coastal winter sites. In the first case, if only certain anatomical parts of the animals (e.g., skin, fat and some meat) are returned to the late autumn/winter camps by hunting parties, the resulting assemblages can be used to estimate the dietary contribution only if logistical considerations (e.g., distance, means and cost of transport) at the time of procurement (and later if storage was practiced) are factored in (Binford 1978). This faunal data does not, however, permit a reliable estimation of the number of skins procured and, therefore, the actual (i.e., theoretically higher) number of animals harvested. If caribou were procured from interior family camps, most consumption would obviously take place away from the coast, although some processed meat (i.e., dried) might be returned to the late autumn/early winter camp as a temporary reserve to be drawn upon while waiting for the development of the landfast ice and the shift to snow house camps. This behaviour would introduce further bias into the character of faunal data from coastal settlements, which must be considered. In view of these and other factors influencing the nature of the caribou faunal record, it is suggested that deductions regarding the importance of caribou as a subsistence resource derived from Thule winter sites, are not necessarily accurate reflections of either the value or the degree of exploitation of the species. In other words, the importance of caribou may have been considerably higher than the faunal remains would indicate. Moreover, if this proposition is valid, it casts doubt on whether the observed changes in frequency can reasonably be attributed to climatic change alone, or whether they reflect more complex interactions between cultural formation processes or even sampling bias. That temporal differences exist in the bone frequencies is not disputed, at issue is the meaning that has been assigned to these changes.

CHAPTER FOUR

VARIABILITY IN THE TERRESTRIAL RESOURCE BASE

Introduction

The Arctic caribou is a primary terrestrial resource for most Arctic North American hunter-gatherers, but ironically an extremely unstable one. Anthropological and biological studies in Alaska (e.g., Burch 1972; Amsden 1979), Canada (e.g., Banfield 1951; Kelsall 1968; Messier et al., 1988) and Greenland (e.g., Vibe 1967; Grønnow et al., 1983; Meldgaard 1983, 1986) confirm aboriginal testimony (e.g., Peters 1984) and historical accounts (e.g., Brody 1976; Soper 1928) of dramatic fluctuations in the availability of the species through time. Having reviewed the general importance of caribou to traditional Arctic economies, this chapter briefly examines the types, characteristics and potential sources of such fluctuations.

Population Dynamics

Population dynamics refers to the positive or negative growth of a population expressed, in basic form, as a function of recruitment and mortality rates (Bergerud 1980:556). The instability of caribou as a human resource is derived from these growth trends and their spatial and temporal implications for animal density and distribution. Two general forms of variability along these lines have been identified. Short-term, localized variation refers to (i) seasonal patterns of movement between calving ground, summer and winter ranges and (ii) interannual variations within these patterns. These changes may take the form of altered migration routes or seasonal use of specific ranges, and include relatively minor increases/decreases in herd size due to annual recruitment/mortality. Apart from calving, the stimulus for and timing of the seasonal adjustments may involve a combination of factors including predation, insect harassment, competition, snow/ice cover and range depletion (e.g., Pruitt 1959; Banfield 1961; Kelsall 1968). Minc (1985:52-53), for example, has summarized data concerning habitat shifts for several northwest Alaskan herds and suggested they are conditioned largely by range quality and herd density, resulting in a cycle of habitat use/recovery averaging between 10-15 and 20 years. To the extent that these patterns are not necessarily associated with major population declines, in terms of human utilization they can be thought of as "qualitative" reductions in availability. The locations of calving and preferred seasonal feeding ranges and migration routes are well-known to hunting groups, as is the potential for change. As a result, animal behaviour within these spatial categories is regularly monitored (Laughlin 1976). If distributional changes are identified or considered immanent, the organization of procurement can, theoretically, be adjusted in order to accommodate these conditions.

By contrast, long-term, regional fluctuations refer to absolute reductions or increases in the total number of animals in a population. These growth processes are characterized by greater magnitudes of response than normally found in short-term changes. In the last few decades, biological studies conducted in Arctic North America (e.g., Banfield 1951; Kelsall 1968; Burch 1972) and Greenland (Vibe 1967; Meldgaard 1986) have confirmed historical accounts of the potential for dramatic fluctuations in the size of caribou herds. Moreover, there appears to be general agreement in the demographic trends between these regions to suggest that maximum population levels may occur every 60 to 100 years (e.g., Meldgaard 1986:60-62). The combined evidence further suggests that periods of maximum abundance are preceded and followed by rapid (ca. 10 to 15 years) increases and declines in population size, and separated by minimum population levels that may remain depressed for between 35 and 70 years (op. cit.). Dramatic changes in spatial distribution usually accompany these fluctuations, with range expansion during the period of maximum herd size and range contraction/reduced migration during population minima.

Regulatory Mechanisms: Density Dependent Factors

Although there appears to be little debate concerning the existence of cyclical fluctuations in caribou abundance and distribution, there is considerable disagreement concerning the proximate cause(s) of these oscillations. One of the most contentious issues is the cause of rapid population declines (e.g., Bergerud 1980). A variety of intrinsic or density-dependent (e.g., disease, predation, overgrazing) and extrinsic or density-independent (range destruction by fire, climatic change, human predation) factors have been implicated in the declines, but recent debates appear to focus on two competing hypotheses.

The "predation hypothesis" (e.g., Bergerud 1978, 1980) argues for a negative correlation between prey and predator abundance, specifically that predation by wolves (Canis lupus L.) is the primary mechanism limiting caribou population growth. This is accomplished primarily, though not exclusively, through high calf mortality and produces a state of equilibrium between the predator-prey subsystems (Bergerud 1980:560, 577). This balance may be upset by external factors (e.g., human predation) altering the abundance of either the predator or prey.

The competing "forage limitation" hypothesis (e.g., Klein 1968; Messier et al., 1988) states that through rapid growth a population may significantly overshoot range carrying capacity and result in a catastrophic decline in numbers. Two important features of this form of caribou-habitat interaction are mobility (range expansion) and time-lag responses to forage depletion. During periods of rapid increase populations expand to occupy previously unused ranges, presumably due to overgrazing of existing forage, but social factors may also play a role (Skoog 1968). Unrestricted access to under-utilized range may act to sustain population increases even if food resources are otherwise being overexploited (Messier et al., 1988:284). In terms of production of plant biomass, Minc (1985) and Messier et al. (1988) have stressed the importance of annual production differences between summer and winter forage resources. Contrary to popular belief, Arctic caribou are cosmopolitan feeders and consume a wide range of tundra grasses, sedges and shrubs (Porsild 1951; Kelsall 1968). Due to the freezing and/or die-off of new leaf/shoot production in fall, winter forage is more limited, primarily to various fruticose lichens (e.g., Cladonia sp.). The importance of these seasonal differences to food limitation models is that the annual growth rate of lichens is very low, on the order of a few mm/yr (Hale 1969, 1974; Seaward 1977) even under favourable growth conditions. As a result, sufficient regeneration to permit grazing may take decades following a period of high grazing pressure/trampling during peak population densities. By contrast, green leaf and shoot production in most grasses and sedges responds directly to temperature and moisture conditions. The implication of these differences for modelling population regulation is that there would be a delayed rather than immediate feedback effect on a rapidly increasing herd (Messier et al., 1988). May (1973:315) describes this form of relationship as follows:

> "... the effects of overgrazing may depend not so much on the contemporary herbivore population, but on an average reaching back into the past over a time roughly equal to the characteristic regeneration time for the vegetation."

Bergerud (1980) has disputed the existence of a correlation between food supply and population growth in regions where natural predation is in operation. He argues that predators will tend to limit growth to between 0.04/km^2 - 0.08/km^2, or well below the documented densities of 19/km^2 for predator-free St. Paul and St. Matthew Islands (Scheffer 1951; Klein 1968). In the decline of the latter herds, the effects of overgrazing, in combination with severe weather conditions was cited as the major regulatory factor. Overgrazing has also been cited as a primary cause in the rapid decline of populations in Canada (e.g., Messier et al., 1988) and Greenland (see Meldgaard 1986). Of special interest is the George River herd in northern Quebec/Labrador (Messier et al., 1988), the recent dynamics of which Bergerud (1980:573) acknowledges may constitute a disproof of his predation hypothesis. In the last thirty years, with an absence of predator control program, this herd has undergone a one-hundred fold increase in size and expanded its range by nearly three hundred percent.

Pregnancy rates and calf recruitment have dropped in the last few years, however, and the dynamics of this herd over the next decade will serve as an important test case of the forage limitation model.

Regulatory Mechanisms: Density Independent Factors

The three main density-independent factors that may act to regulate caribou population size are fire, human predation and climate. Winter range destruction by fire is a potentially important limiting factor; however, its impact is primarily restricted to boreal forest habitats. According to Kelsall (1968:263), tundra fires do not attain sufficient proportions to do more than relatively minor damage to range conditions due to the heterogeneous composition of the vegetation cover (cf. Scotter 1964; Bergerud 1978).

The introduction of non-traditional procurement techniques (e.g., firearms) and consequent increased hunting pressure (e.g., via greater year-round access, increased probability of success, non-traditional harvests to provision whalers (e.g., Bockstoce 1980) has been identified as contributing, if not actually causing, herd declines in the late nineteenth and early twentieth centuries (Gubser 1965; Burch 1972; Spiess 1979; Bergerud 1980; Grønnow 1983). Under special circumstances, increased predation by humans may have contributed to fluctuations. However, as Burch (1972:356) has pointed out several local Alaskan herds increased in number while experiencing heavy hunting pressure. Implicit in the argument that wildlife resources declined principally from the indiscriminate use of improved technology by aboriginal groups, are the assumptions that they (i) formerly lacked the technological efficiency capable of triggering such events, or (ii) failed to appreciate the need for resource management once the technological means became available. Neither assumption is supported by scientific evidence. Arctic hunter-gatherers have been part of natural ecosystems for thousands of years and must have expert knowledge of their environment and its resources. This knowledge is passed from generation to generation and takes many years of personal experience to acquire (e.g., Laughlin 1976; Nelson 1976; Feit

1978; Freeman 1984; Lewis 1982). Subsistence hunting, for example, could legitimately be included under density-dependent mechanisms given the number of caribou a regional population might require in a single year. "Regulation" of the herd could result either from the number of animals killed, or through selective procurement according to the age or sex of animals. There is no incentive, however, to continue to kill animals once human requirements have been met, a fact borne out in ethnographic accounts (e.g., Giddings 1956:24). "Commercial" hunting of animals beyond subsistence needs (i.e., for trade purposes), with the aid of non-traditional weaponry and transportation equipment may have contributed to declines in some areas, but as discussed by Burch (1972) this form of hunting pressure is thought unlikely to have resulted in the magnitude of the fluctuations in total herd size.

Of all the external mechanisms, climatic variability is considered by many to be the primary force regulating caribou herd size. In the short-term, interannual variability in temperature and precipitation have been connected with increased mortality among different age groups and to affect the feeding and movement strategies of animals (e.g., Kelsall 1968; Meldgaard 1986). Studies by Formozov (1952), Pruitt (1959; 1978) and Skogland (1978) for example, have examined the important role of snow in the winter ecology of caribou. Caribou are very sensitive to snow depth, hardness and density; qualities which change as the snow "matures" through the winter. Alone, or in combination, these conditions can present obstacles to locomotion, mobility and access to forage (Formozov 1952:36-67). Studies have also shown that caribou feeding strategies in winter contribute to structural changes in the snow cover by increasing its density at cratering sites which influences herd movements (Pruitt 1959). These short-term (i.e., seasonal) forms of variation can be amplified in frequency or magnitude if they coincide with longer-term changes in regional patterns of climate. Meldgaard (1986), for example, has presented a detailed reconstruction of long-term climatic fluctuations in West Greenland. Based on meteorological changes inferred from the shifting position of the polar front, primarily temperature and precipitation patterns, Meldgaard (1986:69) concludes that for caribou populations:

> "...the primary regulating factor is the existing weather,... and thus climatic change becomes the driving force in the long-termed (sic) population fluctuations."

Meldgaard (1986) suggests that as warmer conditions prevailed following a northward shift of the Arctic front, access to forage may have been restricted due to increased snow cover and/or frequent freeze-thaw episodes. Despite few natural predators, and little provision for out-migration (i.e., physical barriers between herds, distribution restricted to narrow coastal fringes) in West Greenland, he (1986) concludes that forage depletion through increased grazing pressure was of secondary importance in population declines.

From this brief review it is evident that no single hypothesis accounts satisfactorily for fluctuations in caribou populations. Although some authors cavil at "multiple-causation" (e.g., Bergerud 1980) all models recognize the importance of other variables. According to the predation hypothesis, recent declines are triggered by poor management strategies which permitted excessive harvesting, or attributed to geographically small, predator-free habitats. This would not adequately explain fluctuations in West Greenland, for example, where wolves are only a minor predator. In addition, this model would seem to imply that even traditional (i.e., precontact) harvesting by humans could theoretically trigger a decline (cf. Haber and Walters 1980). Most cases cited as demonstrations of the forage limitation hypothesis have been drawn from studies of herds in spatially restricted habitats, containing few, if any, natural predators. Severe weather conditions have apparently also been instrumental in these particular studies, and climatic explanations in general seem to be favoured by anthropologists (e.g., Fitzhugh 1972; McCartney 1977; Sabo 1981) as well as some biologists (e.g., Gates et al. 1986; Ferguson 1987). A recent study by Jacobs (1989), however, indicates that caution should be exercised when invoking causal relationships between population dynamics and climatic constraints. A statistical analysis of meteorological data from central Baffin Island and Foxe Basin revealed that valid regional extrapolations can be made based on temperature values, but that precipitation values (e.g., snow cover, snow depth) are not spatially correlated, even over relatively short distances.

> "...there are no significant correlations in snowfall and snow depth data over the region. Extrapolations over any distance are meaningless." (Jacobs 1989:55)

These data do not dispute the influence of these variables on habitat conditions and thus population dynamics, but instead underscore the difficulties in extrapolating local conditions to a regional or interregional scale. It may be inappropriate, for example, to extrapolate specific climatic mechanisms or trends presumed to be operating to control caribou populations in West Greenland, to the Ungava district or the central Arctic mainland. However, in spite of the number of important factors and their potentially complex interaction to effect regulation of caribou populations, the agreement between regional studies concerning population growth provides a general basis for suggesting that dramatic fluctuations in number are intrinsic to the species. This assumption is of particular relevance for prehistoric contexts given the difficulty of measuring paleoenvironmental variables (cf. Lamb and Fitzhugh 1986). For archaeological purposes, Minc (1985:55) has suggested a useful proposition:

> "The widespread occurrence, regular periodicity, and consistent amplitude of these population oscillations suggest that although historical factors may have contributed to the decline of a caribou herd, cyclical fluctuations in herd size are characteristic of the species and can be extrapolated into the prehistoric period."

Responses to Caribou Shortages

Human groups that rely on caribou may be affected by three types of spatio-temporal variability. As already noted, a number of cultural responses to general shortages of food resources have been distinguished. Many of these can also be extended to non-food resources. Following Rowley-Conwy and Zvelebil (1989) responses to shortages of caribou are considered according to seasonal, interannual and long-term fluctuations in supply.

Fluctuations in resources at the seasonal level can result from changes in the physical attributes of the habitat (e.g., melting of sea-ice for seals) or from species ethology. Seasonal level changes in caribou derive primarily from the latter, specifically migratory behaviour. Both resident and non-resident caribou herds shift between ranges and calving grounds on a seasonal basis. They may also move within ranges during specific seasons according to forage quality, insect harassment or predator avoidance. Seasonal variations may be more critical for caribou-dependent groups and/or where herds are non-resident. The Caribou Eskimo and other central Arctic groups, for example, depended upon herds which wintered south of the tree line and migrated north in spring to calving and summer feeding grounds, and south in the fall toward the winter range.

At this scale of variation human mobility assumes the greatest importance in responding to seasonal changes in distribution and abundance, including cases where economies are more diversified. It is particularly important for monitoring the movements of animals and, therefore, to planning and having the ability to position groups quickly, either to intercept caribou during the migration or at other times/locations where topographic conditions present advantages. Given the temporal regularity of this level of variation and its predictability, diversification probably plays a more minor role, although information exchange would be significant. Storage might play a role among caribou dependent groups (i.e., those relying on the species as a dietary staple) if the spring migration were somehow missed or less productive than anticipated. However, it is unlikely that reserves would be sufficient to carry a group for more than a brief period.

Interannual variation is derived primarily from the general unpredictability of caribou migratory and feeding behaviour. This could relate to a slight change in the timing of a seasonal migration, but more often an unexpected change in the route followed. More or less discrete routes may be followed for several years and then suddenly abandoned (Kelsall 1968; Spiess 1979). This type of event can have disastrous effects where herds are non-resident and thus migrate over long distances, since it is more difficult to monitor their movements. Shifting patterns of range use have already been mentioned. Minc (1985) has suggested that during periods of caribou abundance, frequency of range shifts increases as a function of grazing pressure, resulting in an inverse relationship between overall herd size and the predictability of movement and location. Range reduction and attenuated migratory behaviour associated with periods of decline, however, suggest the possibility of less interannual variation in herd movement, and greater predictability of location for resident herds. At the interannual level mobility and information exchange are also the most effective responses. Since these events are often spatially localized (i.e., within band territories) access to hunting in a neighbouring area may be relatively certain where social links (e.g., marriage, trading partnerships) have been developed and maintained. Diversification and storage also play a role depending on the spectrum of alternative resources and their seasonal abundance.

Long-term variations are typically regional in scope and result from processes already outlined. Exchange and mobility are again primary forms of response, and in this context closely linked. A specific form of mobility, emigration, may be especially important since, in order for exchange (of any commodity) to occur, mobility must be unrestricted. As such, social links between regional groups play a key role, although given the scale of the event, it can be assumed that neighbouring groups will also affected by the shortage to some degree, and access to information/supplies might be less certain. In the context of food shortages, storage as a primary form of response is not practical given the time scale involved and a sustained level of demand. Diversification may not be possible or effective if the habitat contains relatively few species or the economy of the group is heavily dependent on a single resource. In such cases, qualitative changes in the economy may become necessary. The discontinuous record of human occupation in interior Alaska, for example, reflects a shifting emphasis between land and sea mammal hunting. During periods when caribou numbers were depressed some families moved to the coast and subsisted on marine resources (Campbell 1968; Burch 1972; Anderson 1988).

Amsden (1979) has examined the responses of the Nunamiut Eskimo of northern Alaska to a critical shortage of caribou, their primary food resource, in the late nineteenth century. Within four related categories of response, Amsden (1979:404) suggests that there are five basic means of alleviating the imbalance caused by critical resource shortages. These are:

1. Increased dependence on other resources within the same territory;

2. Expansion of the territory exploited, thus increasing the total supply available;

3. Adoption of more efficient techniques for exploiting the deficient resource;

4. Emigration of some or all of the population from the territory;

5. Adoption of other population regulation techniques.

As discussed by Amsden (1979:404), the Nunamiut case involved, to a certain extent, a hierarchy of responses similar in some respects to other ethnographic examples mentioned in chapter one. Demographic shifts followed or accompanied economic diversification, as groups emigrated out of the interior region to take advantage of relationships with coastal populations, or as dependence upon alternative resources increased mobility requirements as the territory necessary to exploit was expanded. Where emigration took place, Amsden (1979:406) has suggested that Alaskan trade networks were important in this context not for the movement of goods, but people, who were permitted to relocate in another region on the basis of social connections previously established through trade.

Among coastal groups who required caribou primarily for winter clothing, an alternative strategy may have been to increase the food harvest during the summer and fall and store the surplus for winter use. Diversifying behaviour during the winter season is also possible. The locations of traditional winter settlements could be adjusted in order to be closer to supplies of fresh foods (i.e., closer to the floe-edge or to areas kept ice-free by tidal action).

With specific reference to caribou, mobility in various forms (e.g., emigration, territorial expansion) emerges as a primary response in all contexts of shortages in supply. This would appear equally true for contexts in which caribou is a major component of the diet and where greater use is made of skins and other byproducts.

Research Aims

The primary objectives of this study are: (i) to construct a basic organizational model of terrestrial land use for late prehistoric (Thule) hunter-gatherers on southern Baffin Island, (ii) document and evaluate the archaeological evidence for a variant of the model in the Nettilling Lake region, and (iii) determine the nature of Thule subsistence strategies in this interior region of Baffin Island, following the assumption that a principal catalyst for seasonal movements to the interior was periodic and sharp declines in caribou numbers.

The first objective is addressed through the use of late nineteenth and early twentieth century ethnographic sources, and oral historical information collected as part of the investigation. These data are used to provide a general understanding of the annual settlement and subsistence cycle, and specific information regarding patterns of terrestrial land use.

The second objective is addressed through archaeological surveys and excavations in the north, west-central and southern regions of Nettilling Lake. The results of this work provide a chronological framework for the study, a provisional classification of site types, and artifactual/faunal material required to meet the third study objective.

To determine the nature of Thule subsistence strategies in the Nettilling Lake district, two hypotheses are advanced which can be tested using the archaeological data. These are formulated in terms of Binford's (1978, 1980) collector-forager model, and models of inland settlement and subsistence systems recently developed for West Greenland (Grønnow 1986; Grønnow et al., 1983). The collector-forager model has been presented in detail in Binford's (1978, 1980, 1982) ethnoarchaeological study of Alaskan Nunamiut land use patterns, in which caribou is the primary subsistence resource. As a major part of this analysis, Binford (1978) constructed a series of faunal analytic techniques for investigating assemblage-level patterning for which certain behavioural correlates can be deduced. The recent investigations in Greenland are especially relevant to the present study since they model land use patterns for groups whose primary adaptation is also coastal-maritime, and in which caribou hunting was done to meet both food and non-food requirements. These hypotheses are presented following a discussion of the study area and reconstruction of traditional land use patterns.

CHAPTER FIVE

STUDY AREA AND RESOURCES

Introduction

The focal point of the present study is the Nettilling Lake area, a major part of what has been referred to as the "large lakes region" of Baffin Island (Jacobs et al. 1989). The study deals, however, with the occupation of this district by groups normally distributed in the coastal areas of Hudson Strait, Frobisher Bay and Cumberland Sound. As such, it effectively includes all of southern Baffin Island south of 67° 05' N (Figure 5). This chapter briefly summarizes the biogeography of the Nettilling Lake area, including the resource base. Terrestrial subsistence-settlement systems are then modelled using ethnographic and historical data in order to provide a framework for the archaeological analysis which follows.

Physiography, Vegetation and Climate

Nettilling Lake is the largest lake in the Canadian arctic archipelago, with a total area of 5541.7 km^2 (Inland Waters Directorate 1973). It lies between 65° 56' N and 67° 02' N and has an elevation of 30 m a.s.l. The lake is shallow, ranging in depth from less than 4 m in Burwash Bay to more than 130 m in Camsell Bay, but with an average of approximately 20 m (Oliver 1964; Jacobs and Grondin 1988). Nettilling drains an area of approximately 55,590 km^2 (Jacobs and Grondin 1988:Table 4), with the Amadjuak River which empties into Burwash Bay as the main inlet. Both Nettilling and Amadjuak Lakes are drained by the Koukdjuak River which flows westward into Foxe Basin. This shallow river is approximately 75 km long and varies in width from 1 to 6 km.

Nettilling Lake is bordered by two physiographic regions which meet along a transect between Mirage Bay in the north and Magnetic Point to the south. The western shore of the

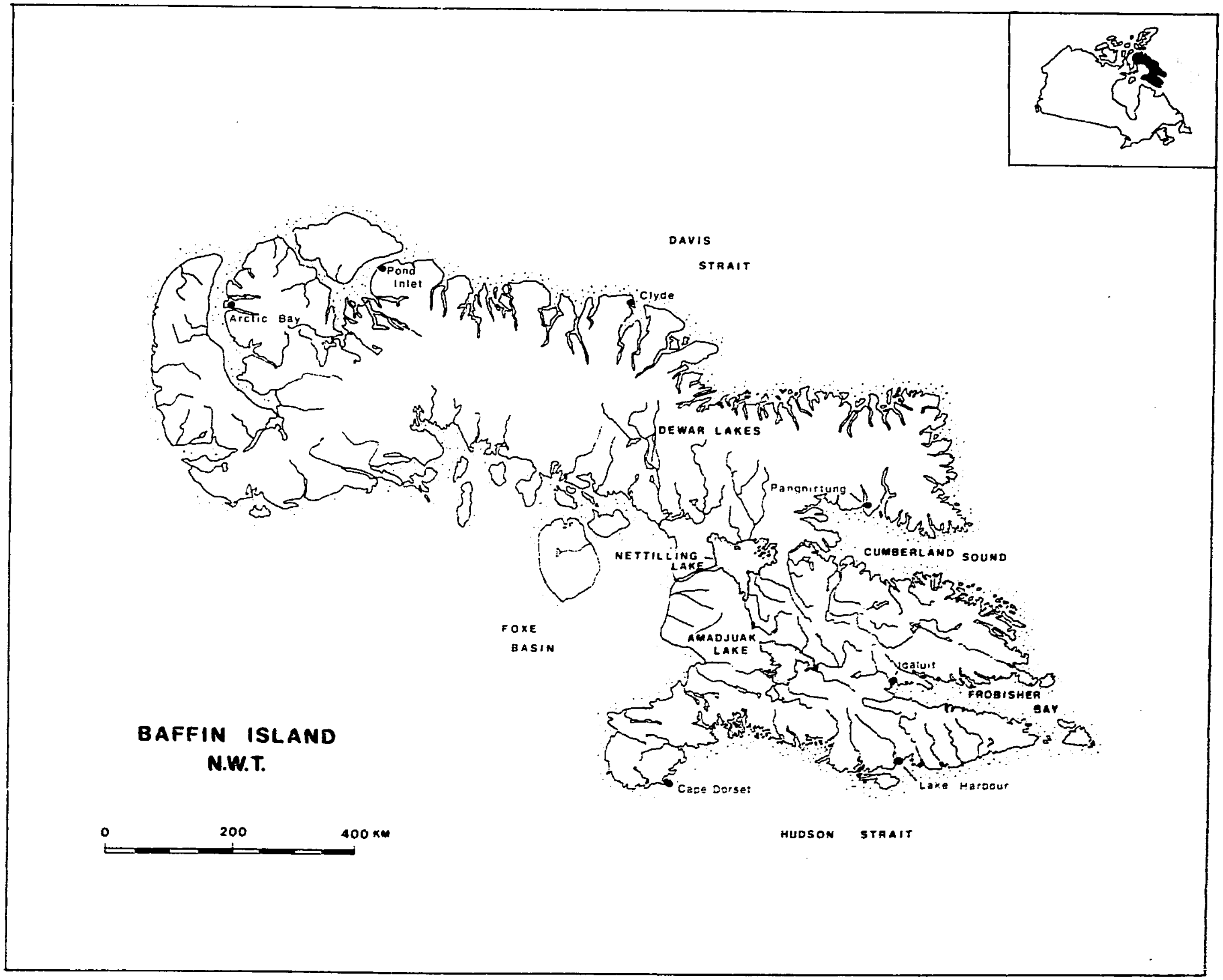

Figure 5. Map of Baffin Island showing the location of Nettilling and Amadjuak Lakes and modern coastal settlements.

lake is formed by the eastern edge of the Hudson Platform (Blackadar 1967). This area, known as the "Great Plain of the Koukdjuak" was deglaciated between 7000 - 5000 BP, and consists of sedimentary bedrock of fossiliferous Paleozoic limestone, covered with a generally level plain of glacial drift broken by a series of glacial landforms. This plain is poorly drained and contains many shallow lakes and ponds. The main topographic features in this area are a series of raised beaches located several kilometres inland at elevations between 5 and 20 m above lake level. Ice push-ridges are common along the west shoreline, and a network of eskers and recessional moraines cross the southern end of the lake, particularly in the Tikeraq and Burwash Bay areas. As will be discussed, these eskers and moraines are of particular importance to the human occupation of the region. The eastern side of the lake is formed by the low margin of the Precambrian Highlands which comprise the east coast of Baffin Island. The region consists of glaciated granite-gneiss bedrock of the Canadian Shield forming a topography of generally low hills. Camsell Bay, which is the eastern extension of Nettilling Lake, has an irregular shoreline and contains hundreds of small islands. Eskers and moraines in this area project inland at several points along the southeast shore of the lake, and represent eastern extensions of features originating west of Burwash and Tikera Bays.

Vegetation

The vegetation of southern Baffin Island is classified as Low Arctic (Polunin 1951; Jacobs 1988). This zone is more productive than Middle and High arctic categories (Wiegolaski et al. 1981), and is characterized by a mosaic of shrubs, sedges, lichen and heath, whose associations reflect microclimatic, topographic and soil conditions (Jacobs 1988:79). Vegetation in the study area is varied. Most of the low terrain bordering the west side of the lake supports a wetland meadow dominated by sedges, grasses and mosses. At higher elevations, and in areas of better drainage grasses and sedges predominate, although many of the moraine and eskers are only sparsely vegetated. In the shield areas to the east, bedrock vegetation consists of crustose lichens (e.g., Rhizocarpon geographicum L.), with tundra-heath (e.g., heather, willow, birch, saxifrage) predominant in areas of sufficient soil cover.

Climate

Maxwell (1980, 1981) divides the Canadian arctic islands into five climatic regions on the basis of four major climatic controls (1981:226). In general, the climate of southern Baffin Island is characterized by cold winters and cool, cloudy summers (e.g., Short and Jacobs 1982). The study area falls into Maxwell's (1981:232-234) Sub-Region IVb, which encompasses the entire Foxe Basin coast of the island. Mean January temperatures range between -32°C and -28°C, with July averages of between 5°C and 8°C (Maxwell 1981:Table 5). Total annual precipitation ranges between 175 and 250 mm, of which 40 to 50% falls as rain (op. cit.). These general characteristics are based on instrument record data from meteorological stations at Dewar Lakes and Longstaff Bluff, 200 and 300 kilometres north (respectively) of Nettilling Lake. Jacobs (1989) has demonstrated the potential for significant errors over short distances when single-station climatic data are extrapolated to broader regions. Accordingly, meteorological, botanical and palaeoenvironmental data were collected as part of the multi-disciplinary field investigation of the Nettilling/Amadjuak Lake district. Jacobs and Grondin (1988) correlated summer meteorological data collected over a two year period from Burwash Bay with regional temperature and precipitation values (Jacobs and Grondin 1988: Tables 1-3). Their preliminary results show summer climate at the southern end of Nettilling Lake (Burwash Bay) to be relatively dry and significantly warmer (up to 2°C) than interpolated regional values (cf. Maxwell 1980). They conclude that both lakes act as heat reservoirs, and serve to moderate local summer and winter climate. This interpretation is supported in the Burwash Bay district by the presence of low arctic vegetation types well beyond their typical range (e.g., Betula glandulosa L.).

Ice Conditions

Oliver (1964:72) recorded the ice thickness of Nettilling Lake in May, 1956, to be between 1.5 and 1.9 m. By late July the average ice thickness in the main body of the lake was 0.75 m, but was unsafe for travel as it was candled throughout. Wind, insolation and lead formation are the principal destructive agents and in most years the lake is not free of ice until early August (cf. Soper 1928). Our observations indicate that Burwash Bay becomes ice-free well in advance of the main body of the lake. A detailed discussion of the mechanisms contributing to the early break-up here (solar radiation/heat influx from the Amadjuak River) are presented in Jacobs and Grondin (1988).

Ice conditions on Nettilling are presently important for caribou migrations, and formerly provided access to traditional Inuit summer/fall camps. Between March and May, caribou cross the ice in Camsell Bay en route to the spring calving grounds (Indian and Northern Affairs 1986). For many south Baffin Inuit, particularly groups residing in Cumberland Sound, travel to and from summer camps on the west side of the lake was over the lake ice via komatik.

Resources

Resources in the study area are confined to two ecological subsystems, the freshwater and terrestrial.

Freshwater System

The low productivity characteristic of arctic freshwater lakes is the result of several factors including the formation of thermoclines and low nutrient influx from surrounding drainage (Freeman 1984). Although the level of productivity of Nettilling Lake has not been investigated, Oliver (1964) suggests that it is typically low. The lake does, however, support one major and one minor freshwater human resource.

Fish

Three species of fish occur in Nettilling Lake: arctic char (Salvelinus alpinus L.), three-spine stickleback (Gasterosterus aculeatus L.) and ninespine stickleback (Pungitius pungitius L.) (Oliver 1964). Atlantic salmon (Salmo salar) have been found entering the lake (Indian and Northern Affairs 1986), but are rare and char makes the only significant contribution to human subsistence. Soper (1928:116) reported only moderate success in catching char on Nettilling Lake; however, it apparently supports a large stock. According to Freeman (1984) char production in shallow lakes is greater than in deeper bodies of water, and studies by Oliver (1964) and Jacobs and Grondin (1988:215) have shown Nettilling to be shallow (averaging approximately 20 m), and well-mixed with no thermocline formation. In the 1960's and again between 1974 and 1977, commercial test fisheries were established on Nikko Island near the outlet of the Koukdjuak River. Although the lake is not fished commercially at present it was assigned an annual commercial quota of 22,700 kg (Indian and Northern Affairs 1986).

Ringed Seal

Nettilling Lake takes its name from the fact that it supports a small resident population of ringed seal (Phoca hispida). The size of this population, and thus its importance as a human subsistence resource for groups residing in the interior has never been adequately determined. Boas (1888:22) stated that seals were abundant in the lake and could support human settlement on a year-round basis. Subsequent reports by Hantzsch (Neatby 1977) and Soper (1928), however, suggest that the population is actually small. Hantzsch (Neatby 1977) also suggested the existence of morphological differences between Nettilling and salt water seals, but Soper (1928:41) was unable to confirm this in the specimens he collected.

Terrestrial Subsystem

The productivity of arctic terrestrial ecosystems is low in comparison to temperate regions (Bliss et al. 1973; Wiegolaski et al. 1981; Freeman 1984). Primary production is controlled by a combination of factors that restrict soil development, in particular low soil temperatures which limit nitrogen cycling. The amount and type of precipitation and solar energy also affects biological production by plants, and grazing animals have been shown to influence productivity at the local level (Peterson 1976:90; Freeman 1984:41).The terrestrial resources of primary economic importance in the Nettilling Lake region are caribou (Rangifer tarandus groenlandicus) and the snow goose (Chen hyperboreas hyperboreas). Other waterfowl, including eider (Somateria sp.), Canada geese (Branta canadensis) and loons (Gavia sp.) are present. Ptarmigan (Lagopus sp.) are common in the Camsell Bay and Burwash Bay areas. Fox (Alopex lagopus) and wolf (Canis lupus) also occur, however, these were of greatest importance during the twentieth century. Arctic hare (Lepus arcticus) is relatively scarce in the study area (Soper 1928).

A number of plant species are also of economic importance, either as food or as raw materials (e.g., fuel, padding). The list of edible plants includes sorrel (Oxyria digynia) leaves, knotweed (Polygonum viviparum) root and the fruit of bilberry (Vaccinium uliginosum), cranberry (Vaccinium vitis-idaea), bearberry (Arctostaphylos alpina) and crowberry (Empetrum nigrum). The dead branches of willow (Salix sp.) and birch (Betula sp.) can be used as fuel; however, arctic heather (Cassiope tetragona) with its high resin content and wide availability is more commonly used.

Snow Goose

The extensive wet lowlands of the Plain of the Koukdjuak are an important breeding/nesting ground for several bird species, particularly snow geese, whose number may exceed one million by the fall (Indian and Northern Affairs 1986). Snow geese are large birds weighing between 2.25 and 2.75 kg, and were an important traditional subsistence resource.

They are available at Nettilling Lake between May and September, but the most intensive period of traditional harvesting took place during the moult in July. These birds could be taken in large numbers during the moult either by forcing them into stone enclosures (Soper 1928:91), or, according to informants, by driving them out of the wetlands onto raised beaches or eskers where they could easily be caught.

Caribou

Compared with the larger mainland herds west of Hudson Bay and in Alaska, relatively little is known about caribou herd ecology on Baffin Island. Aerial census surveys have been conducted over Brevoort Island, parts of Hall Peninsula and the central Baffin Island district (Chowns 1980; Redhead 1979; Chowns and Popko 1980); but the most detailed study on southern Baffin to date has been the tagging program on the Koukdjuak River (Kraft 1984a). This study was undertaken in order to provide baseline information on the population dynamics of the South Baffin herd, as well as migratory and seasonal range use patterns (Ferguson 1982; Kraft 1984a, 1984b).

Brody (1976b) illustrates the general distribution of the three resident herds recognized on Baffin Island (Williams and Heard 1986: Fig 1f). The North Baffin herd occupies Brodeur and Borden Peninsulas, with the main concentration of animals in the territory bordering northern Foxe Basin between Fury and Hecla Strait and Grant-Suttie Bay. The calving ground for this herd is in the Quartz Lake/Erichsen Lake area (Brody 1976b; Williams and Heard 1986). No recent survey data exists for this range; however, Ferguson (1986:Table 1) estimates the current population to number in excess of 30,000 animals. The Northeast Baffin herd occupies the rugged highland district along the east coast of the island, between Home Bay and Eclipse Sound. Its range extends inland approximately one hundred kilometers along fiord and valley systems, to a calving area southeast of the Barnes Ice Cap, near Blackfield and Generator Lakes (Williams and Heard 1986). This area has yet to be surveyed, but total herd size is estimated at 10,000 animals (Ferguson 1986).

The South Baffin herd occupies the remaining area of the island and is the largest of the three herds, presently estimated on survey data to number in excess of 60,000 animals (Ferguson 1986). Major concentrations occur in the area bordering the north shore of Nettilling Lake (winter, spring and summer); the north shore of Hall Peninsula (winter); in the Chorback Inlet district along the Hudson Strait coast (summer), and in the region northeast of Amadjuak Lake (spring and summer). Minor concentrations are found on the Foxe, Meta Incognita and southeast Hall peninsulas (Brody 1976b:Map 46). Relationships between the main herd and the smaller satellite populations, in particular the seasonal migration patterns are not yet well understood. The analysis of tag returns from the Koukdjuak River project and Inuit reports of caribou calving on Hall Peninsula, for example, suggest the possibility that caribou on Hall and Meta Incognita Peninsulas belong to different populations (Stephensen and Hall 1984:8-9). A general pattern of movement of the main South Baffin herd can also be deduced from summary data from the tagging project. The migration pattern follows a north-south axis, with northward movement in spring toward the calving grounds in the Dewar Lakes and Longstaff Bluff district (Elliot 1972). In summer and fall animals begin to move southward toward winter range in Foxe, Hall and Meta Incognita Peninsulas. The tagging program has also yielded demographic information that is consistent with observations made by Hantzsch (Neatby 1977) and Soper (1928). Of animals tagged between 1974 and 1982 at the Koukdjuak River during the late summer and early fall southward migration, the proportion of adult males in the sample averaged 13%, for a ratio of 23 males per 100 females (Kraft 1984: Table 1). Fifty-nine percent of the sample was female, 9% yearlings and 19% calves. Elliot (1972:69) reported a similar ratio (23.5/100) for the Dewar Lakes calving area. The adult sex ratio is usually higher, on the order of 45-50 males per 100 females (Kelsall 1968; Elliot 1972; Parker 1972). The Nettilling Lake figures confirm earlier reports suggesting that most adult bulls spend the summer elsewhere on the island. In Kraft's (1984:12) view, bulls probably spend the summer south of the Koukdjuak River, possibly in the vicinity of Amadjuak Lake. Both Hantzsch (Neatby 1977) and Soper

(1928:65), with apparently rare exceptions, encountered only bulls in groups of one to three on the east side of the lake in summer. Inuit informants consulted for the present study state this to be the case, and our own field observations also confirm this general pattern.

CHAPTER SIX

ETHNOGRAPHIC PATTERNS OF TERRESTRIAL LAND USE

Introduction

To provide an interpretive framework for the prehistoric occupation of the Nettilling Lake region, nineteenth century ethnographic data are used to reconstruct "traditional" settlement and subsistence patterns. The most valuable sources concerning the seasonal distribution of Inuit groups on southern Baffin Island are the various ethnographic publications of Boas (e.g., 1885; 1888; 1901). Other sources (e.g., Hall 1865) also contain information relevant to reconstructing traditional patterns of settlement behaviour, but these are generally descriptive accounts which lack consistency in detail. In attempting to reconstruct indigenous patterns of terrestrial land use, the profound effects of Euro-American contact on the annual cycle of behaviour must be kept in mind. Few segments of Baffin Island Inuit life were immune to the distorting influences of sustained contact, which began in the late 1800's with the establishment of whaling ship and shore stations, and continued through the expansion of the fur trade industry, Anglican missions and government administrative centers (i.e., R.C.M.P.). The magnetic effect of the whaling stations, for example, with their stores of foreign foods and highly valued trade items disrupted long-established patterns of socio-economic behaviour. These patterns were further modified by diseases (e.g., tuberculosis, syphilis) affecting both local and regional demographics. Despite these limitations, these accounts provide the best baseline information available for developing models of terrestrial land use, and the patterns described by Boas for the Hudson Strait, Frobisher Bay and Cumberland Sound districts are summarized below (Boas 1964: 13-36). The rendering of place names is that used by Boas, those in parentheses have been suggested or used by Kemp (1976), Soper (1981) and current topographic maps. Population estimates, where used, are those reported by Boas for December 1883 (1964:18).

Nineteenth Century Land Use Patterns

Hudson Strait

According to Boas, the groups inhabiting the Foxe Peninsula region were known as Sikosuilarmiut. They resided in two main locations during the winter period: Nurata (Nuwata/Nuata) on the southwest side of Finnie Bay, and Sikosuilaq, located east of King Charles Cape (Figure 6). This apparently refers to the vicinity of the group of islands off the south coast of Foxe Peninsula where the modern settlement of Cape Dorset developed from the H.B.C. trading post established in 1913 (Kemp 1976:125). Only a minimum of information is provided regarding these groups, but it places the caribou hunting area inland from the heads of Sarbaq and Sarbausirn Fiords (Chorbak Inlet/Shugba Bay) north to the Foxe Basin coast. Interestingly, Boas speculated that the Sikosuilarmiut did not extend their hunting range very far toward the large interior lakes, particularly Nettilling, which he implied was the hunting ground of the Cumberland Sound natives.

Akuliarmiut

The Akuliarmiut occupied the district between Markham Bay and North Bay, with winter settlements located along the coast northwest of Crooks Inlet, and in North Bay (Figure 7). Boas reports that the more westerly group travelled in summer to Amadjuak Lake via White Bear Sound (White Bear Bay?) and Lesseps Bay to the south shore of the lake. He refers to a point of departure called "Tuniqten", the location of which he was unable to determine. Pitseolak (1974:53) refers to "Tunikta" as the Markham Bay area, and in fact, there are several possible routes to the interior from this vicinity, including Amadjuak Bay. From North Bay, and the modern settlement of Lake Harbour, the valley

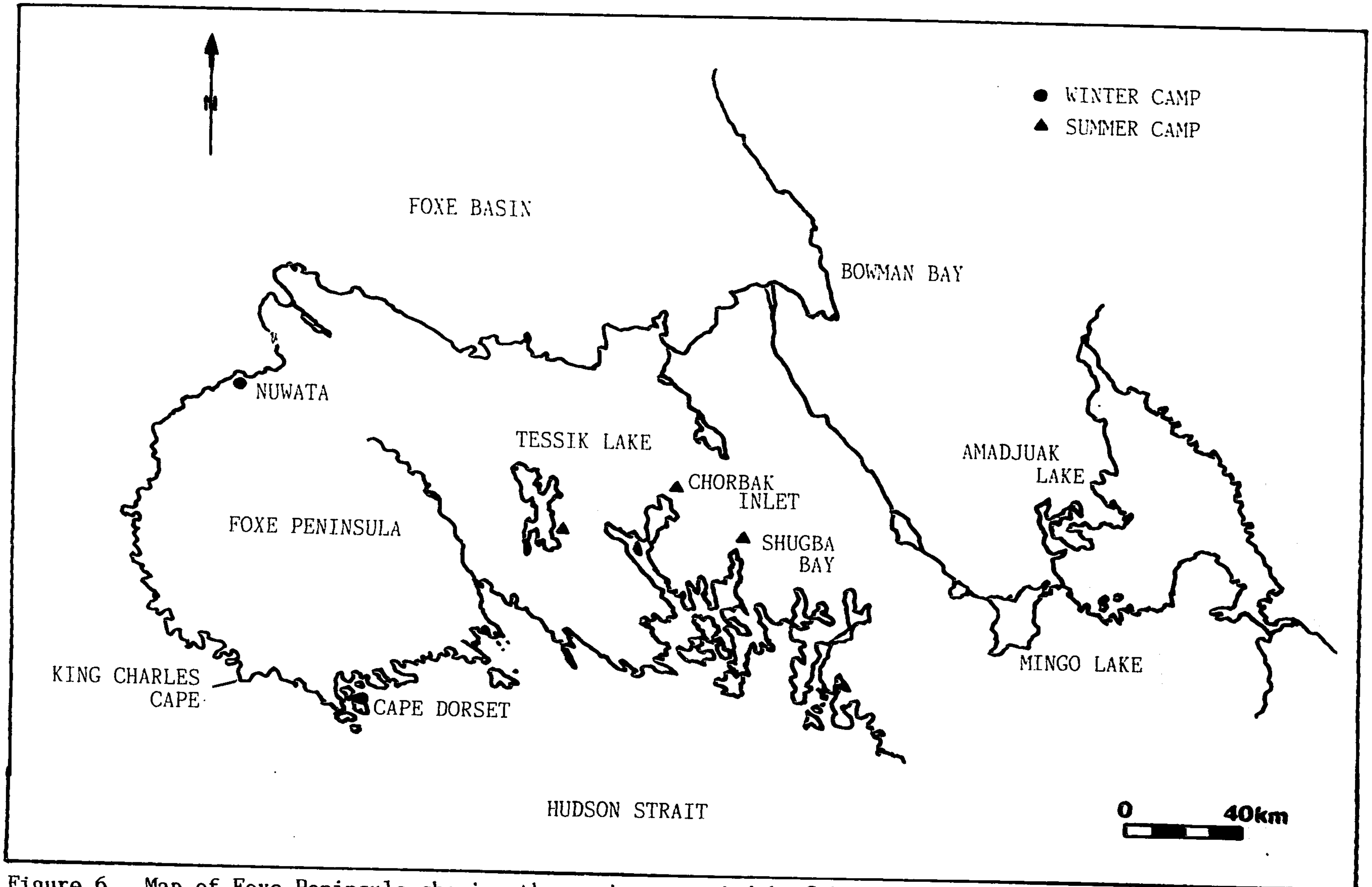

Figure 6. Map of Foxe Peninsula showing the region occupied by Sikosuiliarmiut.

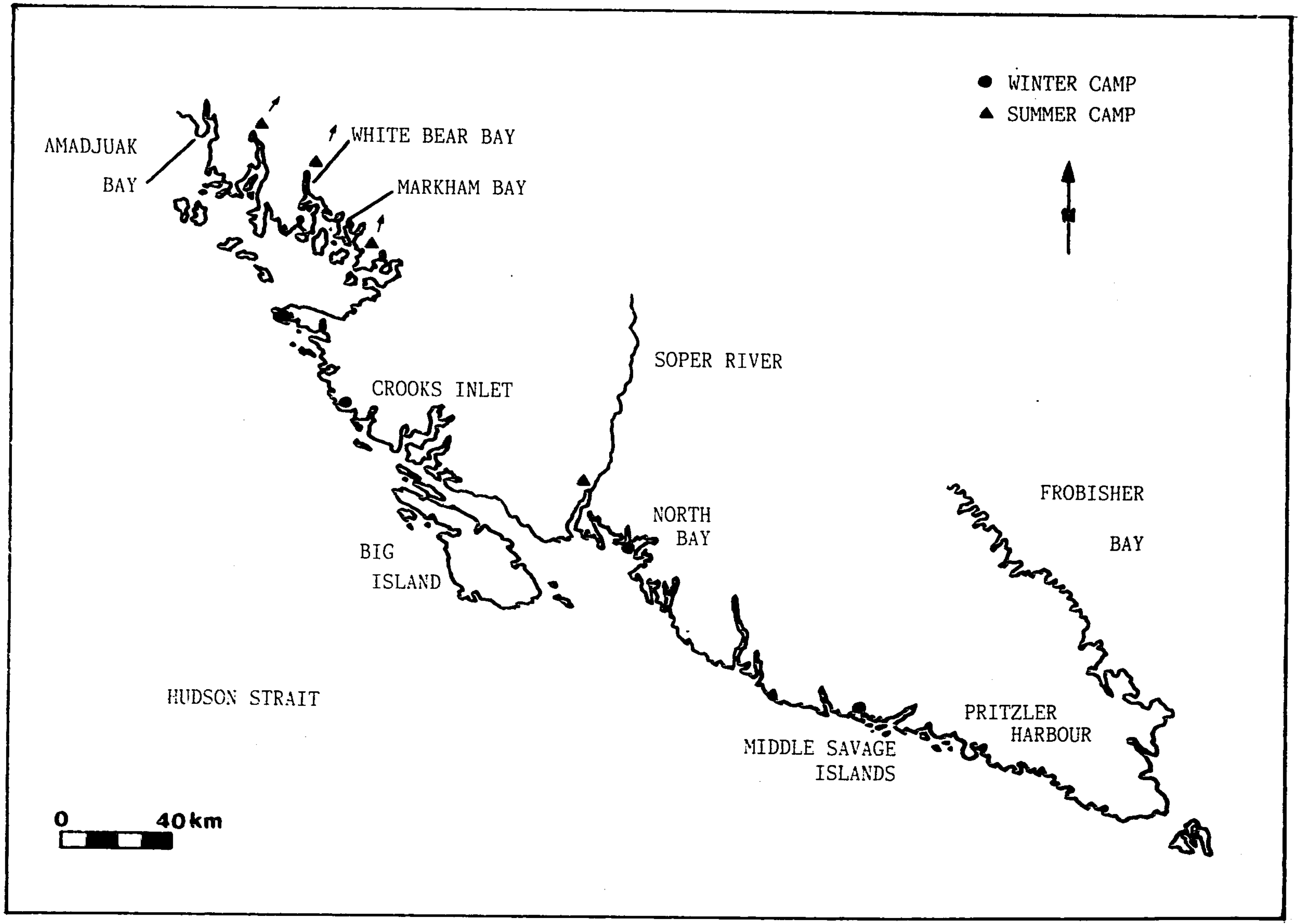

Figure 7. Map of the south coast of Baffin Island showing the areas occupied by Akuliarmiut and Qaumauangmiut.

along the Soper River provides excellent access to the interior of Meta Incognita Peninsula and Amadjuak Lake.

Qaumauangmiut

Very little information is available regarding this group who apparently resided in the area between the Middle Savage Islands and Pritzler Harbour (Figure 7). Boas reports their main settlement as located near Lake Qaumauang, the modern position of which remains uncertain. It is unclear whether he is referring to their principal winter or summer residence.

Frobisher Bay

Nugumiut

In the nineteenth century, the inhabitants of Frobisher Bay, or Nugumiut, had an estimated population of 80 individuals who occupied four settlements during the winter (Boas 1964:14, 18; cf. Hall 1865). Camps were located at Tornait (Jones Cape), at Operdniving and Tuarpukdjuaq (in Countess of Warwick Sound) and Ukadliq (Cornelius Grinnell Bay)(Figure 8). In spring some groups apparently moved toward the head of the bay to hunt seals basking on the fast-ice and in the many inter-island channels. Summer camps were established along the headland of the Hall Peninsula (e.g., in Cornelius Grinnell and Field Bay) and scattered along the north shore of Frobisher Bay as far as the mouth of Ward Inlet. Hall (1865), for example, encountered groups in August, 1861, at Jones Cape, Opera Glass Point and Rae's Point (Hall 1865:371-384). It is worth noting that while exploring the upper one-third of Frobisher Bay with members of the camp at Rae's Point, Hall encountered no Inuit settlements despite an abundance and variety of game. With reference to caribou hunting, Boas describes the general importance of Amadjuak Lake as a hunting ground forgroups residing in Frobisher Bay, and as a setting for interaction (e.g., trade) with

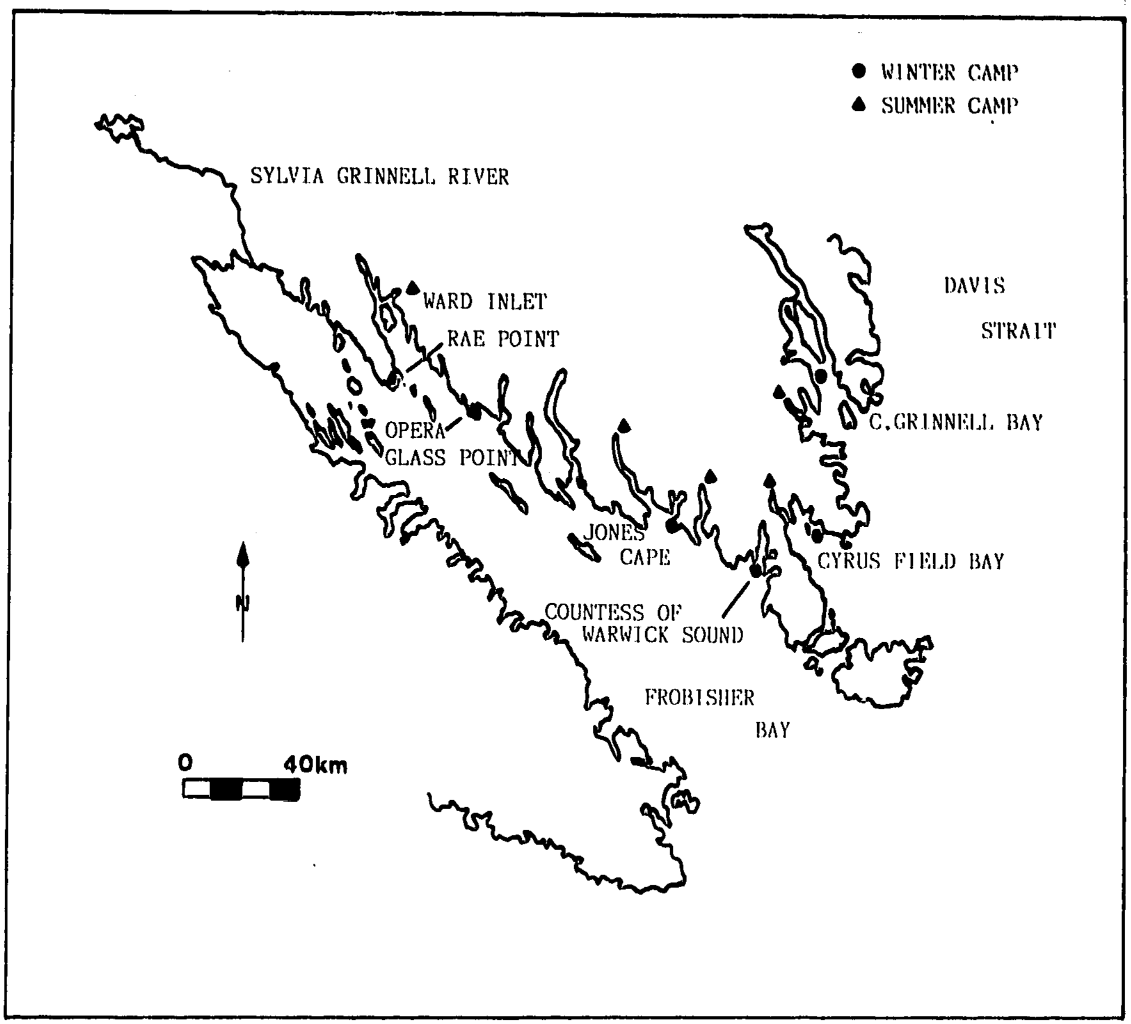

Figure 8. Map of Frobisher Bay region showing locations occupied by Nugumiut.

Hudson Strait communities (cf. Bilby 1923).

He also provides specific information regarding travel to Amadjuak. Although the reasons for it are not indicated, the men and women followed slightly different routes to a common destination on the lake. The men followed the Sylvia Grinnell River to Lake Amartung (Lake Ammatok), then travelled westward along a series of small lakes and rivers to the southeast corner of Amadjuak Lake where the Nuvungmiut River empties. The length of the men's trip is not stated; however, the women followed a different course to the summer settlement called Aqbeniling, so named because it took six days to reach it. This site is reported to be near a small bay called Metja (Boas 1901:68, 1964:15).

Cumberland Sound

In describing the Cumberland Sound Inuit, or Oqomiut, Boas divided the total population into four subgroups based on geographic distinctions formerly recognized, and at that time still occasionally used with reference to them. Because terrestrial land use patterns varied between these groups, the distinctions are maintained in the discussion which follows.

Qinguamiut

The population of the Qinguamiut was estimated at 60 individuals, occupying the head ("qinga") of Cumberland Sound from Imigen Island on the west to Ushualuk, near Quickstep Harbour (Figure 9). This area consists of several deep fiords (e.g., Kangilo, Clearwater), and along its northeastern shore, numerous large islands. The main settlements were located on Imigen and Anarnitung Islands. The winter settlement at Imigen (population=17) was situated on the south end of the island, shifting in spring to the Kilauting (i.e., Drum) Islands or the mouth of Kangilo Fiord, if the depth of snow in the latter area did not prevent sledge travel there. When this occurred camps were established on the sea ice between the Imigen and Sanigut Island groups (Boas 1964:27). Summer hunting and fishing camps were

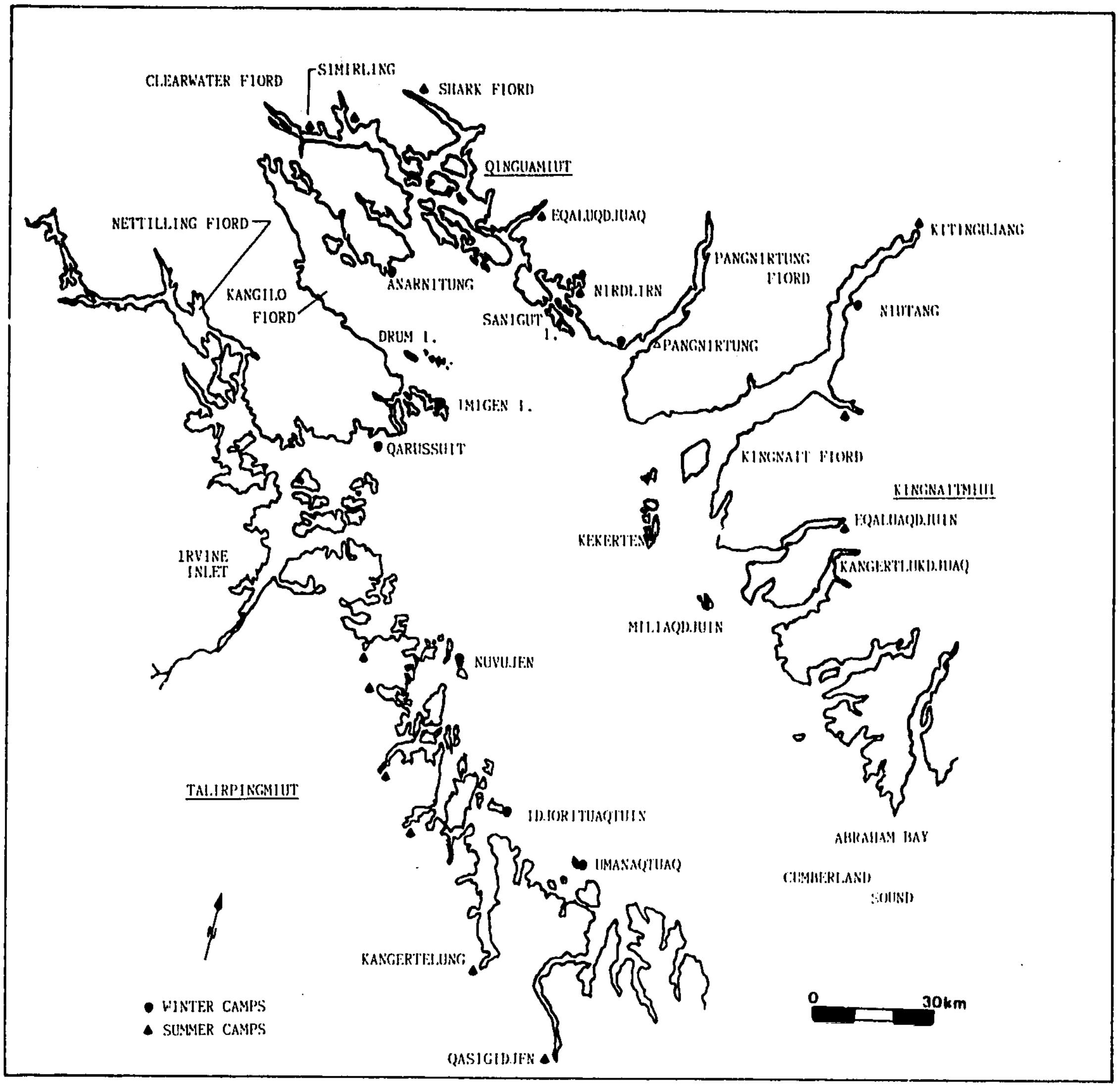

Figure 9. Map of Cumberland Sound district showing areas occupied by Kingnaitmiut, Qinguamiut and Talirpingmiut.

located at or near the heads of Issortuqdjuaq (Clearwater) and Eqaluaqdjuin (Shark) Fiords, or a small inlet opposite Qeqertelung Island.

In general, hunting was confined to the coastal strip defined by the southern boundary of the Penny Ice Cap. According to Boas, the terrain to the northwest was characterized by disconnected valleys, making it difficult for hunters to transport skins and meat. As a result, the Inuit preferred not to hunt there (op. cit.: 1964). In the fall, the residents of Imigen moved to two islands northwest of the camp, where they stayed until January. From Anarnitung, (population=43) which is on the north shore of Kangilo Fiord, immediately south of Bon Accord Harbour, winter hunting took place in the vicinity of the Drum Islands or near the entrance to Clearwater Fiord. The mouth of Kangilo Fiord was productive for spring sealing, although Boas (1964:28) notes Inuit often remained close to whaling stations as employees, or to trade during this season, as they did in 1878 when the whaler Florence wintered in Bon Accord Harbour. Specific locations for summer camps are not described, although presumably the same general areas utilized by the Imigen families were visited. Mention is made of Anarnitung residents formerly travelling across the mouth of Kangilo Fiord and overland to Nettilling Fiord en route to Nettilling Lake, but no other details are given.

Kingnaitmiut

According to Boas' population estimates, the Kingnaitmiut settlement on Qeqerten Island (Figure 9) was the largest single community in Cumberland Sound, with eighty-two residents (Boas 1964:18). The existence of this settlement, however, was a direct function of the presence of whaling stations there and prior to their establishment the Kingnaitmiut distributed themselves in presumably smaller numbers elsewhere along the coast between Pangnirtung and Kumlien Fiords. The late fall and early winter periods were spent in the immediate vicinity of Qeqerten, shifting in late winter and spring to seal hunting camps on the fast-ice west of the island. Caribou hunting in summer and early fall was conducted from camps at the head of Kingnait Fiord (e.g., Kitingujang); in Nirdlin, a small bay opposite the Sanigut Islands, and in Pangnirtung, Iqaluaqdjuin and Kangertlukdjuak Fiords. The area surrounding the base camp at Kitingujang was apparently a preferred hunting location, due to its good availability of animals, generally less rugged topography than neighbouring districts, and rivers well-stocked with fish.

Saumingmiut

The Saumingmiut consisted of seventeen individuals who occupied the headland of the Cumberland Peninsula between Exeter Sound and Abraham Bay (Figure 10). Major winter settlements were located at Qeqertaujiang, an island in Ugjuktung (Ujutuk) Fiord; and at Ukiadliving, at the mouth of Touakdjuaq (Touak) Fiord. The main summer camps were located in Touak Fiord and on the north shore of Exeter Sound. From these stations, hunting was concentrated on the peninsula separating the two fiords. Specific mention is made of the fact that caribou hunting in this district was often unproductive, since the number of animals apparently fluctuated considerably from one year to the next.

Talirpingmiut

Collectively, the Talirpingmiut formed the largest resident population in Cumberland Sound, totalling 86 individuals at the time of Boas' study. For discussion purposes, Boas divided the Talirpingmiut into four local groups, each of which had an historical association with a more or less distinct segment of the south coast of the sound between Nettilling Fiord southward to the vicinity of Littlecote Channel (Figure 9). With one exception, the annual cycle of subsistence activity between these groups was quite similar. The most southern camp was Naujateling. This group of twenty individuals wintered on Umanaqtuaq (Blacklead) Island, breaking up and moving in spring to the offshore floe-ice of the sound to hunt seal. In summer and early fall, hunting occurred inland from settlements at the heads of Qasigidjen (Ptarmigan) and/or Kangertelung (Chidliak Bay) Fiords. In late fall,

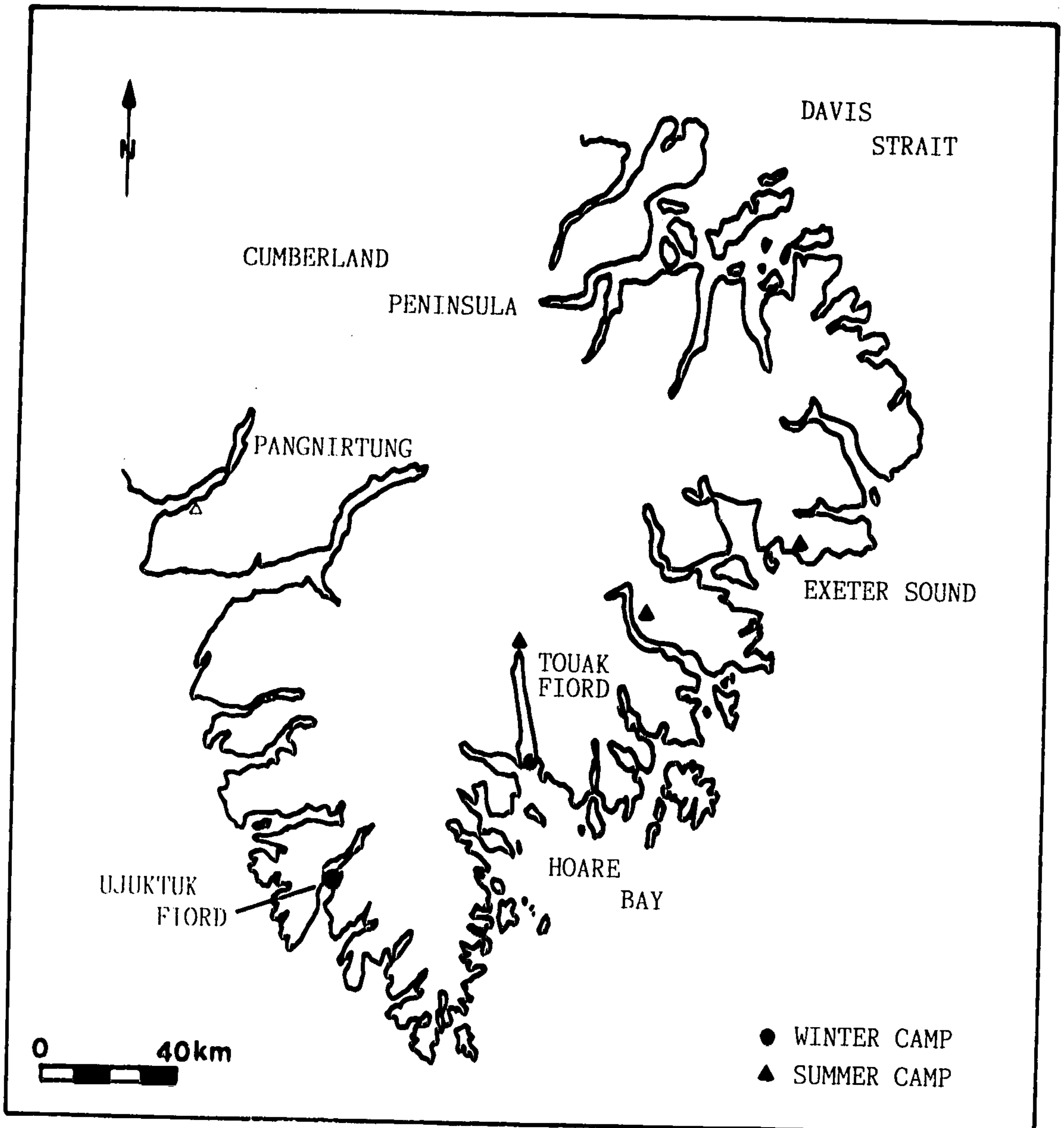

Figure 10. Map of Cumberland Sound district showing areas occupied by Saumingmiut.

families occupied temporary camps on the coast or near-shore islands in the vicinity of Umanaqtuaq. They remained here until freeze-up and then moved to their winter quarters on Umanaqtuaq Island.

A similar pattern was followed by the eleven residents of Idjorituaqtuin, approximately 20 kilometers NNW of Umanaqtuaq, and the twenty-six individuals residing at Nuvujen, on a group of islands immediately south of Brown Inlet. These groups spent the fall period waiting for the ice to freeze in camps at or near the coast opposite Kangertelung Fiord and Brown Inlet respectively; and wintered on islands situated within a few miles of the coast. In summer and fall, camps were relocated to the heads of major local fiords, where families resided until the end of the caribou hunt.

The fourth subgroup of the Talirpingmiut had a population of twenty-nine who resided in winter at Qarussuit, at the mouth of Nettilling Fiord. This group held special interest for Boas because they apparently shifted their residence from the coast in winter, to the Nettilling Lake district in the interior of Baffin Island in summer and fall. Boas mentions two variations of travel to the lake, but the general pattern of seasonal activity of the Talirpingmiut was as follows. These families normally spent the winter season, or from about November to May, at the mouth of Nettilling Fiord. At the end of spring sealing most departed for Nettilling Lake, travelling by komatik along a route that generally paralleled the north shore of the fiord. After reaching the head of the fiord, a chain of small lakes was followed to Lake Amitoq and then on to Lake Nettilling at a camp called Isoa. Supplies and equipment (e.g., kayaks, umiaks, tents) cached at Isoa the previous year were loaded on the komatiks and the trip continued along the south shore of Camsell Bay to Tikerakdjuak (Magnetic Point), then across the lake to Tikerakdjuk (Tikera Bay) and northward to the south bank of the Koukdjuak River, opposite Nikosiving (Niko) Island. The trip from Isoa to the Koukdjuak camp ('Kaggisaiktung') apparently took about two weeks to complete. From this point, two separate courses were taken (cf. Nugumiut). After the ice in the river had broken up sufficiently to permit safe boat travel, the men followed the Koukdjuak River by kayak downstream to the Foxe Basin coast and then adopted a course northward across Taverner Bay to a river called Qudjitariaq. This may refer to Pebble Brook which drains an area northwest of Mirage Bay, but from Boas' description, the river in question is probably part of the Hantzsch River system which provides access into a wide geographic area north of Nettilling Lake, known as Majoraridien ("places where one has to climb up"). No further details of the hunt are provided, but caribou were evidently harvested in this area here for several weeks until about late August, at which time the men made their way to Qarmang, a traditional camp at the north end of Mirage Bay. Here they rejoined the other members of the group (i.e., aged, women and children) who had moved by umiak to Qarmang early in the summer, after the ice on the west shore of the lake had broken up. They remained at Qarmang until the lake had frozen, and then returned by komatik to Isoa, cached extraneous equipment and returned to Qarussuit.

In the second variation, some Talirpingmiut would stay at the coast until break-up in July and then travel through Nettilling Fiord by boat. They stayed at the lake, possibly in the Camsell Bay, area only until the fall and returned to the mouth of the fiord prior to freeze-up. Occasionally, other Cumberland Sound groups travelled to the lake, also by boat, and for a short period of time, returning to the coast at the beginning of October (Boas 1888:26-27).

Twentieth Century Land Use Patterns

As already noted, sustained contact with Euro-American cultures disrupted traditional Inuit patterns of settlement and subsistence. This is equally true for both the nineteenth and twentieth century contacts, but by the latter period the pace and type of change had increased, and as a result there are certain factors which limit the utility of more recent accounts in the reconstruction of indigenous behavioural patterns. Kemp (1976) provides a detailed summary of land use on southern Baffin Island during this century, and additional information pertaining to the Hudson Strait district can be found in Pitseolak (1974). At a regional level the patterns described are consistent with many of the elements found in the earlier period, but there are some significant differences.

Among the most important factors is the strong link in the twentieth century between caribou hunting and fox trapping. Trap lines were often placed along inland caribou hunting routes and resulted in an increased emphasis on winter caribou hunting, at a time when animals would be hunted for food and not for clothing purposes. Winter hunting of caribou in the eastern arctic is "non-traditional" in the sense that prior to the introduction of firearms it was very difficult to hunt successfully using conventional weapons. Caribou are very sensitive to noise in winter making it difficult to get close enough to kill them with bow and arrows or lances. This point is substantiated in the testimony of Inuit informants. Prior to the archaeological phase of this project, discussions were held with twenty Inuit elders from Cape Dorset, Iqaluit, and Pangnirtung who had personal experience in the interior lake district of the island. Both men and women were interviewed, with the oldest informants ranging in age from approximately 70 to 100 years, and the youngest between approximately 40 and 60 years. Information was obtained regarding major travel routes to the interior, group composition, site locations and resource procurement scheduling up to the period of government centralization in the early 1950's.

Younger informants generally hunted in the interior in the late fall and winter, and the acquisition of fox skin and caribou meat were stated to be the primary objectives. Some caribou hunting also took place earlier during the prime season (i.e., fall), but few informants stated the need for caribou skin as a motivation to hunt inland. By contrast, older informants recalled very different experiences. Although a number of considerations obviously influenced travel plans, elders stated that trips to the interior lakes were undertaken in late spring or early summer specifically to acquire caribou skins for winter clothing. Some caribou meat was dried and packed out to the coast, but never at the expense of skins. Older informants also recalled how important these trips were and how much they enjoyed spending time in the interior. The abundance of caribou, fish and geese, the taste of the water, and a general love of travel were listed among the reasons given for travel to the lake district.

Aside from generational differences in the objectives of inland travel, it will be shown that caribou numbers were reduced on Baffin Island during the early decades of this century. If the historical accounts of the 1930's-1950's, and to a lesser extent more recent data, represented the only information available, it might logically be concluded that procurement patterns characteristically involved long trips into the interior (e.g., Wright 1944). Such a perception, however, would be inaccurate. Inuit informants of all ages stated unequivocally that regardless of purpose (i.e., whether for skins or meat), travel to the interior of the island to hunt caribou was undertaken because it was necessary to do so. Brody (1976a) has described a similar situation for northern Baffin Island. Both the North and South Baffin herds experienced significant declines during the 1920's, and in the former district Inuit who previously hunted caribou near the coast were forced to make long trips inland. Many of the historic observations, therefore, coincided with a period of reduced availability of caribou, and general characterizations of prehistoric caribou hunting patterns based on this information must take this factor into account.

Patterns of Spatial Organization

Although the available evidence is largely based on short-term descriptions, two general patterns of terrestrial land use can be distinguished from the ethnographic and historical literature.

Coastal-Upland Pattern

The first, or "coastal-upland" pattern involved summer residence at inner fjord sites situated close to productive fishing locations, and with unrestricted access to the interior for caribou hunting (Figure 11). The basic social group consisted of individual or small

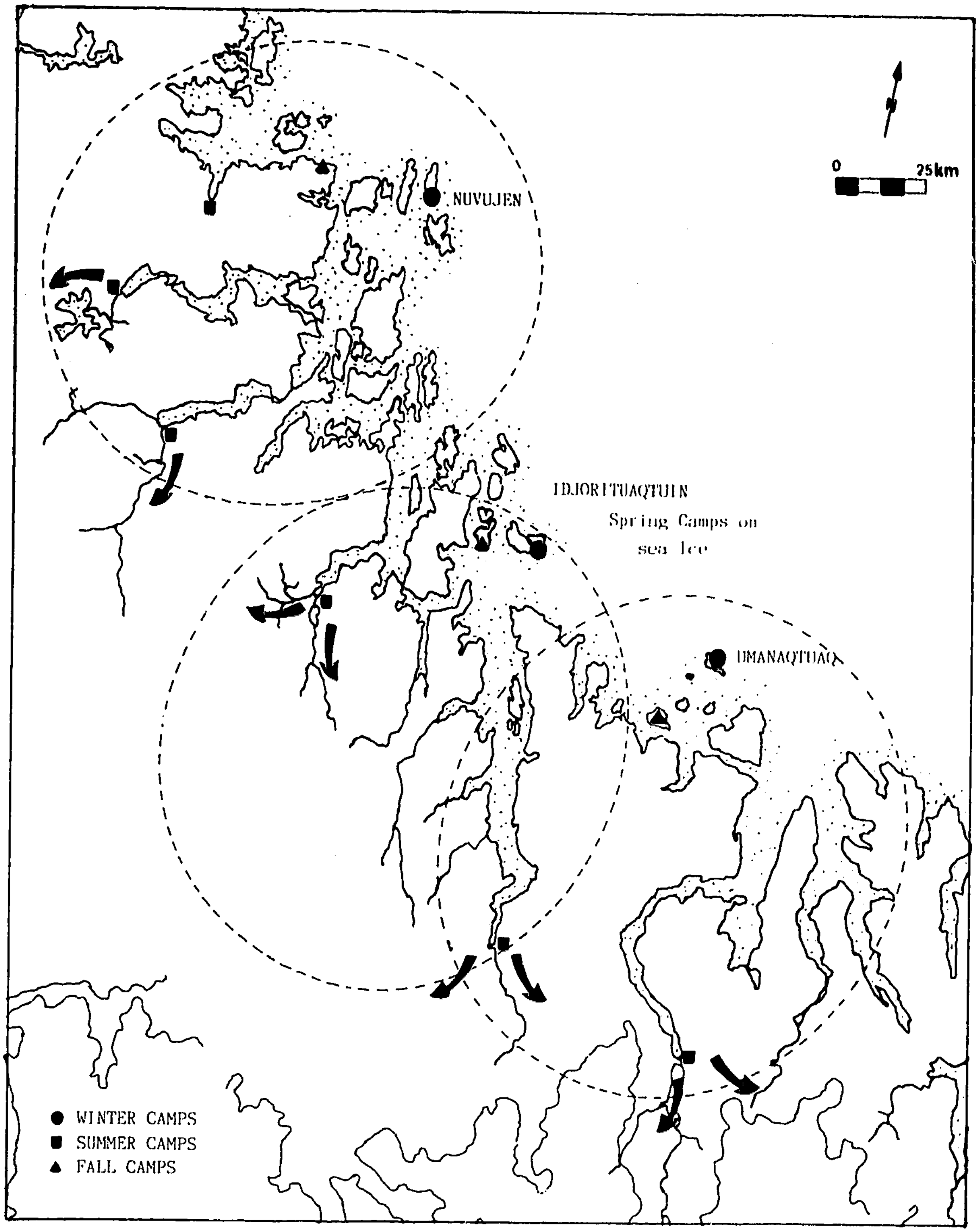

Figure 11. Schematization of Coastal-Upland Summer/Fall settlement pattern.

groups of related households (nuclear or extended) who normally resided within a relatively discrete geographical region. These camps were typically established at the heads of local fjords and inlets following the spring seal hunt. Women, children and the elderly restricted their subsistence activities to the immediate vicinity of the base camp (i.e., the foraging radius) where fish, shellfish, berries, waterfowl and other resources could be obtained. Small groups of male hunters would leave the base camps for periods of several days to weeks to hunt caribou in the interior, and return with skins, meat and fat for general use/consumption. The fjord base camps would be occupied until early fall (i.e., until the caribou hunt/char run had ended), at which time families returned to sites on the outer coast to prepare skins for clothing and make other preparations for the winter. The summer hunting camp locations presumably shifted over time from one fjord/inlet to another, and social group size and complement would be flexible as well. Based on the nineteenth century evidence, the coastal-upland pattern was adopted by many south Baffin Inuit. Ethnographically, Foxe Peninsula residents frequented the Chorbak Inlet area, occasionally going the short distance inland to Tessik Lake. Groups from Markham Bay and Lake Harbour made extensive use of local valley systems leading north toward Amadjuak Lake. Most Cumberland Sound and Frobisher Bay Inuit appear to have adopted a similar strategy, with camps established at the heads of fjords and inlets along both shorelines.

Interior Lake Pattern

The alternative strategy, or "interior lake pattern" (Figure 12), differs in several respects from coastal-upland hunting and was apparently a less commonly selected option. This pattern involved residential shifts of one or more extended families to traditional settlements along the shores of one of the two large inland lakes. Among the important decisions to be made when this pattern is in operation are when and, therefore, how to leave, how long to stay and which region(s) to exploit.

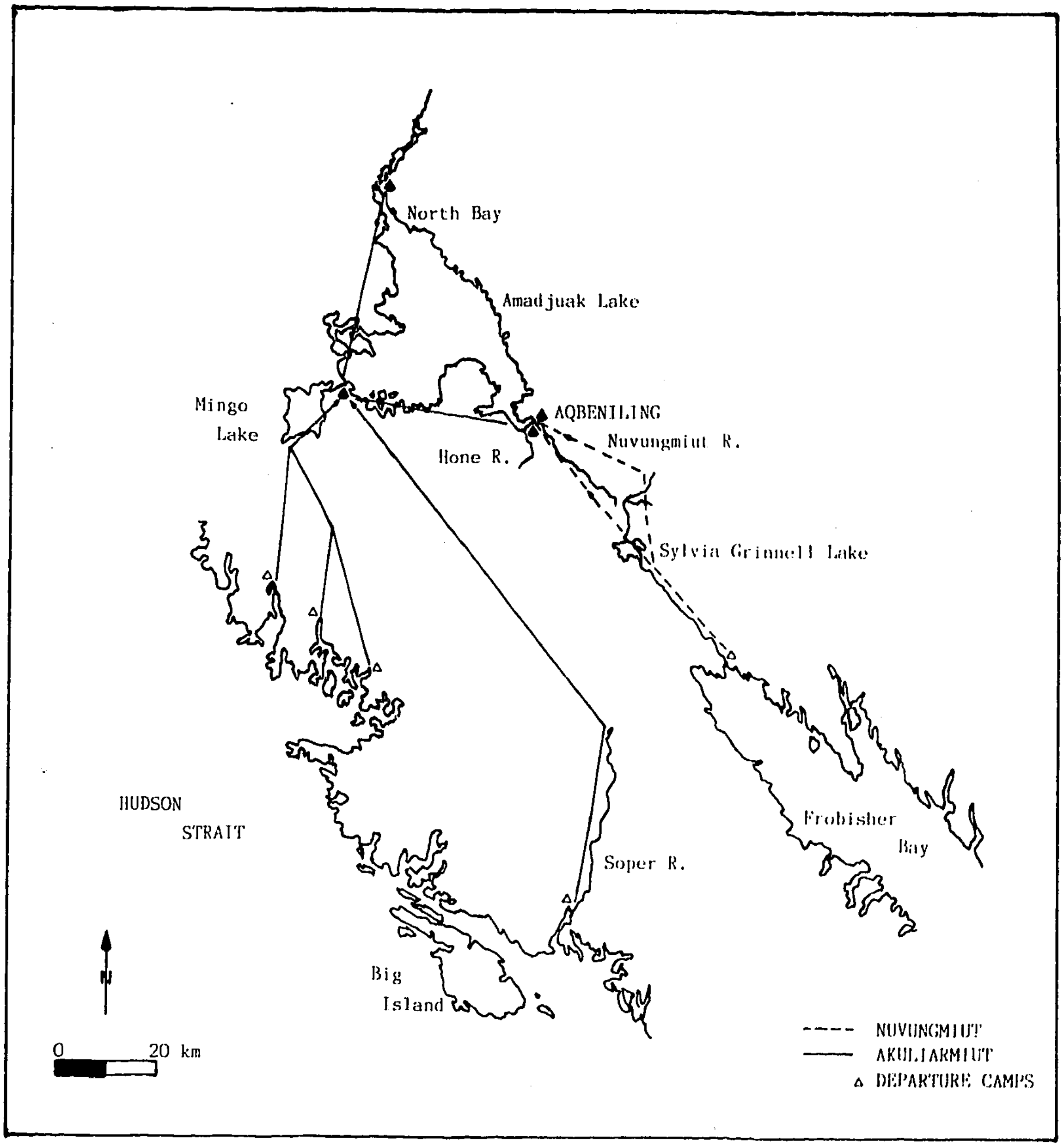

Figure 12. Schematization of Interior-Lake Summer/Fall settlement pattern.

On Amadjuak Lake, traditional inland sites were concentrated along the south shore between the Nuvungmiut River and Mingo Lake, and at the north end of the lake (North Bay) (Stenton 1987). Boas (1964) mentions that Amadjuak Lake was a particularly important caribou hunting region for both the Nugumiut of Frobisher Bay, and the Akuliarmiut of the central Hudson Strait coast. Part of its importance derived from the fact that these two groups occasionally met here. This is generally consistent with Bilby's (1923) account, but unfortunately, Boas was unable to provide specific information regarding the context or frequency of these meetings. It is unclear, for example, whether caribou hunting was the main purpose of the trips to the interior or merely provided a context for such meetings and was incidental to trips made in order to trade (e.g., wood, soapstone, metal) or for other social purposes. Hall (1865) spent two years with the Nugumiut twenty years prior to Boas' arrival on Baffin Island, yet made no reference in published documents of Inuit travelling to Amadjuak Lake to hunt caribou. He does, however, refer to a winter meeting between Nugumiut and Sikosuilarmiut families, noting that metals were a scarce and prized commodity among the latter, who would exchange disproportionally valuable items for small fragments of iron (Hall 1865:153, 256).

For Nettilling Lake, Boas (1964:22) lists three primary settlements: Tikeraqdjuaq (Tikeraq Bay) on the southwest side of the lake just north of Burwash Bay, an unnamed camp at the outlet of the Koukdjuak River and Qarmang, at the northern end of the lake in Mirage Bay. During the traditional period, Nettilling Lake was frequented primarily by Cumberland Sound Inuit, although reports of meetings there between regional groups exist and it was definitely used by Hudson Strait and Frobisher Bay groups during this century. The Qarmang site in Mirage Bay was apparently the main settlement of the Talirpingmiut for an unstated period of time prior to Boas' visit, but at the time of his investigation the focus of settlement had shifted to "Tikerakdjuk". The spelling of this location is inconsistent in the literature. Boas (1884:256), for example, describes it as being on the south shore of the lake near the mouth of the Amadjuak River. However, "Tikeraqdjuaq" more commonly refers to

Magnetic Point, which is nearly 60 km north of the Amadjuak River. Boas was presumably referring to "Tikerakdjuk" on the southwest side of the lake, listed on current topographic maps as Tikeraq Bay (cf. Boas 1885:49; Neatby 1977; Soper 1981). Inuit elders from Cumberland Sound consistently named Tikeraq Bay as a traditional settlement on the lake.

The interior option in summer may have been undertaken for a variety of reasons, but it is worth noting that regardless of the catalysts, a pattern involving residential shifts to the interior is not as easily reversed (i.e., it is less flexible) since it imposes greater time commitments on groups and involves higher energy and social costs. Organization thus becomes very important, and there is historical evidence of increased levels of organization associated with inland hunting on Baffin Island. Bilby (1923:236-241), for example, mentions that preparations for inland hunting began in early summer, with families moving to a common departure point at the head of a fjord along the Hudson Strait coast. Boats were hauled out of the water and all non-essential goods were cached. Families then moved to a predetermined inland location where they joined other local/regional groups. Decisions were made concerning what areas would be hunted by particular groups, and this process was followed by several days of recreational activities including competitive contests. As previously discussed in chapter three, these events were of special relevance to the establishment and maintenance of social relationships between local and regional populations. At the end of this period, which may have lasted for approximately one week, groups left for their respective hunting areas and there was no general assembly on the return trip to the coast in the fall.

The existence of two different patterns of terrestrial land use on Baffin Island can be attributed to several factors. Travel is an important element of the traditional Inuit lifestyle, partly from necessity, but it is also valued due to the variety of experience and, therefore, knowledge it provides about the environment. This knowledge is crucial for hunter-gatherers who require highly detailed understanding of the ecosystems upon which they depend for survival. Social factors can also be expected to have influenced mobility. Inuit populations on southern Baffin Island occupy four widely separated coastal districts (Hudson Strait, Frobisher Bay, Cumberland Sound and Davis Strait) and the interior region, since it was accessible from all major population centers may have served as a focal point for social interactions on an interregional scale. This has already been suggested for Amadjuak Lake; however, for Nettilling Lake it may have served such a function only on local or regional scales. Meetings at Nettilling between groups from Hudson Strait and Cumberland Sound were apparently quite rare, and travel between Cumberland Sound and Frobisher Bay, at least in the nineteenth century, typically followed a coastal route along the headland of the Hall Peninsula (Boas 1964:13, 15). Finally, interpersonal/group conflict has also been shown to influence hunter-gatherer mobility (e.g., Bicchieri 1969; Lee 1972) and it is possible that individuals or small groups occasionally occupied the interior region under such circumstances.

Both patterns, however, are also closely linked to caribou hunting and the status of this resource can be expected to influence which arrangement of summer/fall settlement is adopted. From the earlier discussion of species ethology and population dynamics, the coastal-upland pattern would appear to be favoured when caribou numbers are high. By contrast, and using the same criteria, the interior lake pattern might be favoured during periods of low caribou abundance, a form of event which often assumed regional proportions. It should be noted in this regard that if the demand for caribou were primarily a dietary one, a number of substitutes (marine mammals, fish) would be available during times of shortage.

Inuit informants consulted regarding interior settlement stated that they normally did not travel so far inland to hunt caribou unless it was necessary to do so. This sentiment is also reflected in Inuit responses to a 1935 questionnaire administered by the R.C.M.P. concerning the Baffin Island caribou (Wright 1944). Among the reasons listed by Inuit for not hunting in the interior of southern Baffin Island were: (i) the long distance that had to be travelled, (ii) the rough terrain and (iii) the fact that they had to walk inland and "pack out the kill on their back" (Wright 1944:188). Boas (1964:27) similarly noted that the Qinguamiut disliked (and presumably avoided) hunting the region northwest of Clearwater Fjord due to the rough terrain.

The factor of distance should also be considered. Although many Inuit groups covered impressive distances through their annual cycle, trips to both interior lakes were of considerable length. For example, the return trip from the mouth of Nettilling Fjord to Qarmang, as described by Boas (1964) for the Talirpingmiut covered approximately 550 km. A return trip from the head of Frobisher Bay to Amadjuak Lake covers ca. 260 km, and from Cape Dorset to Amadjuak Lake, approximately 475 km. These figures do not include additional travel once the lakes had been reached. The mode of travel to the interior might also affect decisions to hunt regularly there. Spring travel by komatik meant staying inland at least until early winter, and travel by boat meant starting later (i.e., after break-up of the ice) and returning earlier to the coast. Walking inland took more time (due to different ages of family members, terrain, and loads carried), and because all items had to be carried in, fewer goods could be taken. For the coastal pattern, distance and mode of travel may have been less critical, since travel to summer and fall camps at the heads of fjords/inlets could be accomplished fairly quickly by komatik or boat, and more goods could be carried (or cached during the winter).

On the basis of the available evidence, it is suggested that the interior lake pattern was adopted primarily during periods of caribou decline. To provide support for this assumption recent evidence for fluctuations in the caribou populations on southern Baffin Island is presented.

CHAPTER SEVEN

CARIBOU FLUCTUATIONS ON SOUTHERN BAFFIN ISLAND

Introduction

The South Baffin Island caribou herd apparently underwent a significant decline in the early decades of this century, which was similar in its magnitude and duration to population crashes reported from other regions (e.g., Alaska, Greenland, Quebec). Although investigators in other areas have been able to integrate various forms of evidence (e.g., biological, ecological, historical) in tracing herd dynamics through time, in the present study we lack: (i) environmental data of sufficient resolution and/or time depth, (ii) accurate information regarding the historical distribution of animals and (iii) detailed information on the ecology of the South Baffin caribou herd. As a result, long-term population trends cannot be reconstructed, nor can the influence of environmental variables on regional variations in herd density/distribution reported during this century be defined accurately. Nevertheless, historical accounts extending to a period several decades prior to the most recent herd reduction are available, as are summaries of regional climatic trends. Drawing upon these sources, and the testimony of Inuit elders who experienced the event, this chapter reviews the evidence for a decline of the South Baffin caribou herd in the twentieth century, the underlying factors that may have triggered or contributed to the decrease and the steps taken by human populations to mitigate its effects.

Nineteenth Century Conditions

In August, 1861, Hall (1865) and a small group of Inuit companions explored the north shore of Frobisher Bay between Cyrus Field Bay at the head of Hall Peninsula, and Cape Caldwell, on the south shore opposite the mouth of Ward Inlet. In his account of this journey, Hall does not comment directly on the abundance or availability of caribou, but it is clear from his narrative that caribou were in good supply a short distance from the coast, particularly near the head of Frobisher Bay (Hall 1865:391-424; cf. Jacobs and Stenton 1985). Although Hall was inconsistent in his treatment of a variety of subjects, he makes no mention of any shortages of caribou in the Frobisher Bay region, but does comment on the Inuit perseverance in the acquisition of skins for winter clothing (Hall 1865:380). In 1879, Kumlien (Soper 1928:67) reported that caribou were generally abundant both in Cumberland Sound and in the Nettilling Lake district. In his detailed ethnographic study conducted a few years later, Boas (1884, 1964) remarked on the interannual variability in the abundance of animals on Cumberland Peninsula, and occasional shortages of clothing material. No reference is made, however, to any general shortage of animals and Boas was able to purchase skins for his own use at the Qeqerten whaling station indicating an adequate local supply of animals (Boas 1884:252; cf. Ann. Rep. R.C.M.P. 1925). Since Boas was careful to record other forms of food/resource shortages (e.g., dogs) and their impact on human groups, it can be inferred from his study and the earlier accounts of Hall and Kumlien that in the late nineteenth century caribou were in reasonably good supply on southern Baffin Island. By the turn of the century, however, there are indications of significant changes in the number and distribution of animals.

Twentieth Century Conditions

In 1915, Archdeacon A.L. Fleming visited Inuit settlements in western Foxe Peninsula, whose subsistence base consisted of walrus, fish and caribou, the latter apparently being locally abundant. During the subsequent nine years, however, caribou were reported to have "entirely deserted" the area (Millward 1930:42). This could represent an example of a localized reduction due to a shifting pattern of range use, but if so, it seems to have been superimposed on a regional downward trend. Whereas most accounts indicate that caribou were formerly available near the south coast in large numbers, and were once common on Big Island opposite Lake Harbour, beginning in the 1920's and through to the late 1940's reports were regularly made of acute shortages of caribou on southern Baffin Island. The reductions appear to have been most pronounced in the Foxe Peninsula, Meta Incognita and Frobisher Bay regions (e.g., Soper 1928, 1931, 1932; Millward 1930), but also occurred in the Cumberland Sound district where, in 1909-1910, caribou were unusually abundant and had returned to range they had not used for many years (cf. Ann. Rep. R.C.M.P. 1937, 1938; Neatby 1977:389).

Soper (1928, 1981) travelled extensively throughout southern Baffin Island, in summer and winter, and his experiences provide useful information regarding the status of the caribou herd. He presents a generally grim picture, with the number of animals steadily decreasing on the island. Apparently no caribou were seen during the Canadian Arctic Expedition of 1923, and in Soper's view the species on Baffin Island was destined for extinction if conservation measures were not taken. Caribou were so scarce near Lake Harbour in 1930-31, for example, that trips of up to one hundred and sixty kilometers into the interior had only a modest chance of success (Soper 1931:17). In 1932, Soper called for a temporary ban on caribou hunting to allow their numbers to increase (Soper 1932:117). Caribou could apparently still be found around Nettilling Lake, but they no longer migrated south in their movements between seasonal ranges. Soper (1932) reported that they instead spent the spring and summer on the west side of the lake, shifting in winter to the eastern highlands surrounding Camsell Bay. Although harvest quotas were not introduced by the government, the R.C.M.P., who acted as game wardens in the eastern Arctic were actively promoting (and enforcing) conservation measures by the 1930's (e.g., Ann. Rep. R.C.M.P. 1937). Many patrols were undertaken specifically to investigate Inuit suspected of hunting caribou out of season (i.e., prior to September 1) (e.g., Ann. Rep. R.C.M.P. 1938).

Perhaps the most compelling demonstration of the magnitude of the shortage was the importing of caribou skins by the Hudson's Bay Company posts at Cape Dorset and Lake Harbour, for sale to the Inuit (Anderson 1941; Wright 1944; McLauchlin 1988). Wright (1944:188) states that trading of skins was a common practice, and that former residents of

Cape Dorset who had moved to Iglulik traded up to 200 skins annually with Cape Dorset Inuit. According to McLauchlin (1988: pers. comm.), skins were imported from Baker Lake throughout his eight year posting at the Lake Harbour R.C.M.P. detachment (1938-1945). A photograph of a partial shipment of caribou skins in Baker Lake being prepared for transport to Baffin Island is shown in Anderson (1941).

Causes of the Decline

Unfortunately, the small base of empirical data precludes a detailed analysis of the cause(s) of the population decline. Although Inuit informants stated clearly that dramatic fluctuations in caribou populations size were recurring phenomena, as a rule, they were reluctant to speculate as to the reasons for the reduced abundance of animals. Among those who did offer explanations, the response usually centered on "bad weather", meaning mild and wet conditions. The opinion was also widely shared that a small remnant stock of animals situated northeast of Amadjuak Lake was the core group out of which the herd eventually regenerated.

It is difficult to assess accurately the role of climate on the dynamics of the South Baffin caribou herd. The period of instrument record is comparatively short with incomplete coverage (Bradley 1973), and interannual variability in seasonal climate is characteristic of the region (Jacobs and Newell 1979). Bradley's (1973: Table 2-3) summary of temperature and precipitation records revealed seasonal trends, but generally of short duration (i.e., between 2 and 12 years) and with wide variations between stations (cf. Jacobs 1989). The timing of the decline does coincide, however, with a general rise in mean annual temperature in the eastern Canadian Arctic and Greenland (Hattemer-Frey et al. 1986:Figure 2). Between approximately 1880 and 1925, annual temperatures were between 1° C and 2° C below average. From 1925 to 1930, and also around 1940 and 1943, temperatures rose by nearly 2° C. Mean temperature values dropped below average in the early 1970's and have returned to slightly above average in the last decade (Hattemer-Frey et al. 1986:Figure 2).

Focussing on the 1920's, evidence for a warming trend generally coeval with reports of declining herd size might indicate periods of increased snowfall and/or freezing rain, both of which adversely affect caribou.

Instrument record data pertaining to specific climatic events within this general trend may be particularly instructive regarding a possible catalyst for the herd decline. Records from Lake Harbour show that temperatures between October 1923 and June 1924 were unusually mild, ranging between 0.6°C and 6.5°C above mean daily maximums (Table 4). Minimum values over the period of instrument record range between 1.6°C and 7.5°C above average. Rainfall is well above average in March (4.9 mm) and April (22.4 mm) of 1924, and again in October (27.5 mm) and November (22.4 mm). The combination of warmer temperatures and increased levels of rainfall strongly suggest periods of freezing rain in 1923-1924. Even more striking, and potentially significant, are the records for snowfall. Between September 1923 and April 1924, increases in snowfall are 2.4 to 6.0 times greater than mean monthly values, and represent a seasonal total accumulation of 6.4 metres. Unfortunately, comparative instrument records from other areas of southern Baffin Island for this period do not exist, thus there is no way of determining how widespread this anomaly may have been. However, it must have had a significantly negative impact locally, and it may be no coincidence that Soper, who first arrived in South Baffin Island in 1923, reported extremely low caribou population levels in the years following this event. Increased levels of snowfall, of similar magnitude to 1923-1924, also appear in the record between January and May, 1927, which might have had additional negative effects on local stocks.

The potential effects of climatic change on arctic fauna and, therefore, humans can be modelled in a variety of ways. In terms of the terrestrial environment, the generally accepted model is one which links warming climate and caribou population dynamics in a negative fashion, due to the probability of increased winter precipitation and freeze-thaw episodes that restrict access to forage during the most critical period of the species annual cycle (e.g., Kelsall 1968; Schledermann 1976; Maxwell 1985; Meldgaard 1986). Colder

Table 4. Summary of Meteorological Data[1]: Lake Harbour, Baffin Island, N.W.T.

Temperature: Daily Mean Maximums (October 1923 - June 1924)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
-	-	-	-	-	-	-	-	-	0.5 (-0.9)	-5.9 (-7.8)	-14.9 (-15.5)
-16.8 (-20.1)	-16.9 (-20.1)	-8.1 (-14.6)	-1.5 (-6.2)	5.6 (0.9)	11.6 (6.7)	-	-	-	-	-	-

Temperature: Daily Mean Minimums (October 1923 - June 1924)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
-	-	-	-	-	-	-	-	-	-4.6 (-6.2)	-12.2 (-14.5)	-23.7 (-23.1)
-23.4 (-27.9)	-24.1 (-27.6)	-15.3 (-22.8)	-10.1 (-15.1)	-0.2 (-5.8)	2.9 (0.4)	-	-	-	-	-	-

Rainfall: Total Monthly (mm) (March, April, October, November 1924)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
-	-	5.1 (0.2)	5.1 (0.6)	-	-	-	-	-	34.2 (6.7)	23.6 (1.2)	-

Snowfall: Total Monthly (cm) (September 1923 - April 1924)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
-	-	-	-	-	-	-	-	25.3 (6.4)	98.9 (27.3)	144.8 (41.5)	167.8 (27.2)
53.4 (18.6)	53.3 (20.7)	43.1 (16.6)	50.8 (21.0)	-	-	-	-	-	-	-	-

[1]Source: Canadian Climate Centre
Atmospheric Environment Service of Canada Records, 1987.

Numbers in parentheses are mean monthly values for period of instrument record (1909-1946).

conditions, particularly during the calving period, may also have a negative impact on caribou numbers (e.g., Kelsall 1968). It should be noted, however, that while the cumulative effect of temperature decline on terrestrial productivity can be viewed as negative for the species, lower precipitation associated with cooler and drier winters can also be advantageous for caribou (Schledermann 1976). The decline in the Baffin Island herds would appear to be consistent with a model of warming climate, although several points should be noted. First, the varied topography of the island offers a variety of range options for animals when conditions that restrict forage prevail locally. Combined with the recent evidence for a lack of spatial coherence in precipitation values, this suggests that warmer winters are not necessarily disastrous for caribou. Over southern Baffin Island, an area of some 200,000 km^2, alternative range (including altitudinal shifts) can be expected to be available for animals when deep snow or freezing rain restricts feeding in one area. Despite the poor range conditions hypothesized for 1923-1924, caribou on south Baffin Island were not exterminated. Second, increases in annual temperature imply greater primary production in the terrestrial biotope, and presumably good availability of quality forage (which might be prolonged in a warming trend) during the summer and fall periods. Hypothetically, these conditions might increase the nutritional fitness of animals going into the winter season, and thus be advantageous for adult cows and younger animals of both sexes, who retain much of the fat accumulated in summer through the winter. Hunting strategies may have also helped to keep numbers low on the local level. Soper (1932), for example, indicated that Inuit were so desperate for skins that they killed any and all animals encountered. There is little evidence available to assess the possibility of forage depletion prior to the population crash.

The rapid changes in the South Baffin herd were generally synchronous with declines in north Baffin Island (Munn 1922; Ann. Rep. R.C.M.P. 1923; Brody 1976a), and the Ungava district of Quebec (Elton 1942; Messier et al. 1989). For comparative purposes, reconstructed population curves for these areas are plotted in Figure 13, together with trends from northwest Alaska (Minc 1985) and West Greenland (Meldgaard 1986). Apart from their

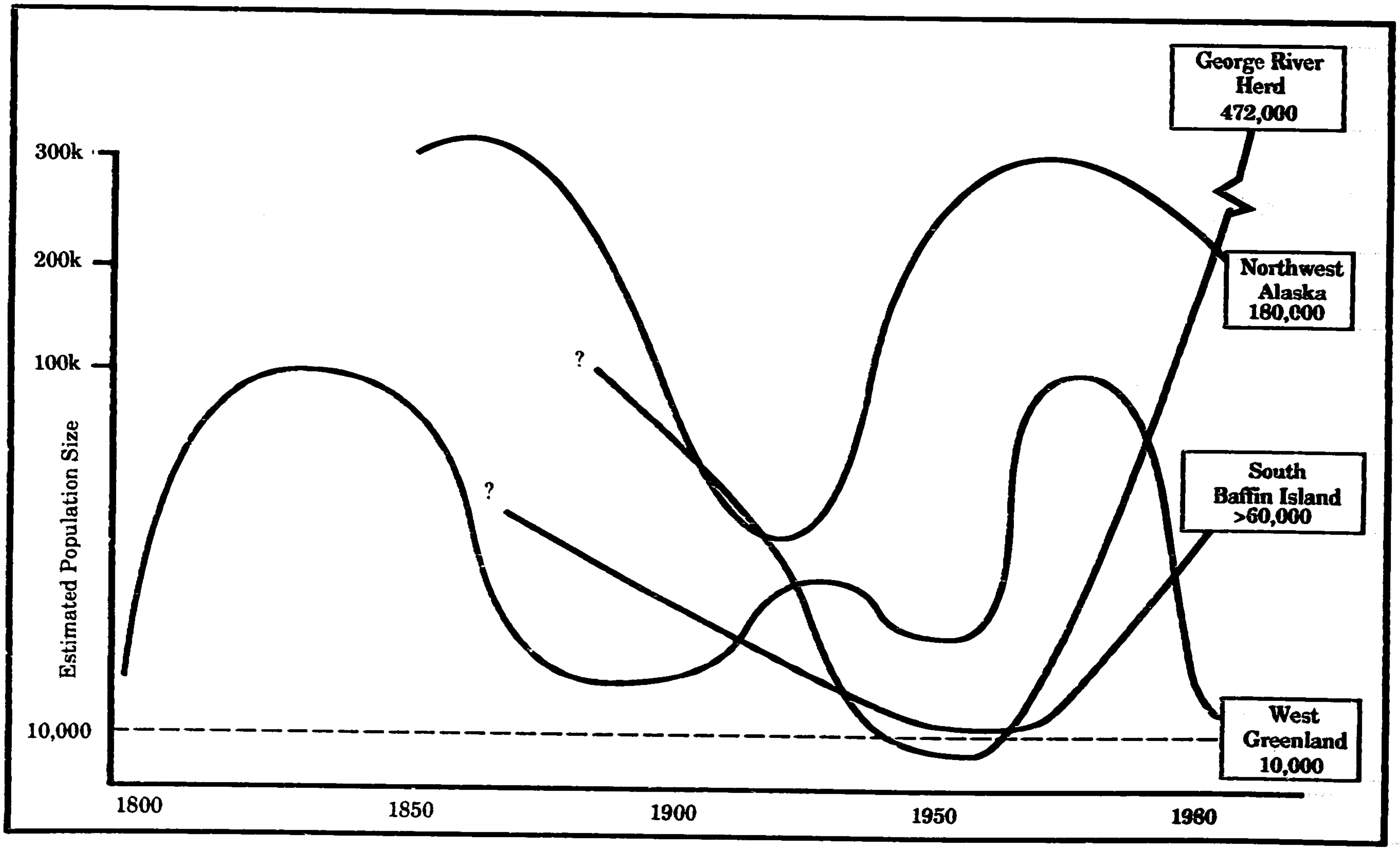

Figure 13. **Reconstructed population curves for caribou herds on Baffin Island, Alaska, West Greenland and Northern Quebec** (After Hall 1965; Boas 1888; Elton 1942; Wright 1944; Neatby 1977; Meldgaard 1983; Minc 1985; Messier et al. 1988).

respective sizes and the magnitudes of their recovery, the Baffin and George River herd declines closely approximate one another. In each case, herd size was at a minimum between 1920 and 1950, after which the George River herd (censused nine times since 1954) increased dramatically. During this same period the West Greenland herd had made a partial recovery from minimum levels between 1865 and 1900, and by 1950 it was also undergoing a rapid increase. However, if as suggested, the Baffin and Ungava herds were in a positive cycle during the middle to late nineteenth century, and the presently high levels are sustained for several more years, the periodicity of population minima between regions is asynchronous. By the late 1970's, the West Greenland herd underwent a sharp decline, whereas the others were apparently continuing to increase at this time. The cycle reconstructed for the northwest Alaskan herds (Minc 1984:Figure 4) also appears to be out of phase with the Baffin Island and George River populations. Although numbers were generally high in all areas in the 1860's according to Minc's reconstruction, North Alaskan caribou herds were increasing from about 1920-1960, and have since started to decline. The main elements of the fluctuations in the different areas are nevertheless strikingly similar. Rapid decreases in number were followed by decades of below normal herd size, range reductions and alterations in migratory behaviour.

The magnitude of the reductions on Baffin Island is admittedly difficult to reconstruct, since few reliable estimates of herd size exist for the period of minimum population. Those estimates that do exist must also be carefully interpreted, since many were obtained using questionnaires administered by the R.C.M.P. while on patrol to various Inuit camps. McLauchlin (1988: pers. comm.) has suggested that due to cultural differences in standards of measurement, allowances should be made for discrepancies in the number of animals reported to those actually counted. In the 1940's the main herd on the southern portion of the island was believed to number between 12,000-15,000 animals, and Wright (1944:191) estimated the total population for all of Baffin Island to be approximately 25,000. If the figures for south Baffin are compared with the current estimates of >60,000, the result is a projected decline between 1920 and 1950 of 75%-80%. The magnitude of this decline is smaller, but consistent with the characteristically large reductions of 90%-95% between minimum and maximum values in Alaska and Greenland (Minc 1985; Meldgaard 1986).

The recovery of the South Baffin herd and consequent range expansion toward the coastal areas is clearly conveyed by Inuit informants and supported by the analysis of tag returns between 1974 and 1984 (Kraft 1984). Between 1974 and 1982, 3,114 caribou were tagged crossing the Koukdjuak River. By June, 1984, 349 tags (11.2%) had been returned by hunters. The distribution of tag returns by community is as follows: Cape Dorset (61%), Pangnirtung (i.e., Nettilling Fiord/Camsell Bay hunting area) (23%), Iqaluit (12%), Lake Harbour (1.8%), Broughton Island (1.8%) (Kraft 1984: Table 5). The distribution of tag returns is instructive regarding both the current range frequented by caribou and the areas hunted by man, and allows a preliminary delimitation of the range of the South Baffin herd (Stephenson and Hall 1984:8). When compared with the historical evidence, it is apparent that caribou use of coastal-upland range has been re-established since the contraction of the middle decades of this century.

Although the reconstruction of the most recent decline in the South Baffin herd is based on incomplete data, and thus barely approximates a single "wavelength" (i.e., ca. 1860-1985), there are thought to be sufficient parallels in its essential properties with declines in other regions for which better data exists, to suggest that it represents one minimum phase in a longer-term pattern of cyclical fluctuations in herd size. While we presently lack specific evidence to correlate the sharp decline on Baffin Island with regulatory mechanisms implicated in other regions, it is suggested that the rapid and sustained reduction in numbers, and the subsequent recovery was not a unique event. It is further suggested that fluctuations of this kind represent a form of ecological stress as outlined in chapter one. Regional, protracted reductions in caribou numbers and distribution have been associated with declines in general human health and mobility, negative factors which, it is argued, combine to restrict the ability to hunt effectively during the most critical or winter period.

The significance of a long-term decline in caribou numbers is reflected in the mechanisms employed historically to mitigate its effects. Non-traditional strategies included "foreign" conservation measures, importing of skins from other regions and the use of substitute (e.g., wool) materials. It is interesting to note in this regard that unlike the situation documented for Alaskan societies, there is little empirical evidence to suggest that regional exchange functioned as an important part of traditional response mechanisms to periods of caribou shortage on southern Baffin Island. Exchange was one form of response employed during this century, and can be assumed to have generally characterized external relations of precontact Inuit society. Thus, it is not excluded as a possible response to caribou shortages, at least on a local level. Nevertheless, the small size of most populations,and the apparent lack of economic specialization, distinct territorial boundaries and ranked social status in traditional Baffin Inuit society (e.g., Wenzel 1981; Kemp 1984), each of which is well-documented for Alaskan groups, suggests that exchange in this context may have played a relatively minor role. However, such traits, alone or in combination, may have been expressed as a consequence of historical processes (e.g., Euro-American whaling and fur trade industries).

Although a degree of territoriality is implicit in several comments by Boas concerning the south Baffin Inuit (1964) he clearly indicates in his discussion of inter-societal relations a high degree of individual and group mobility operating at local and regional levels (Boas 1964:54-62). Distance was an important controlling factor in many relationships, resulting in closest [illegible]lations between local groups (cf. Kemp 1984). Group conflicts did occur, but the proximate causes appear to have been of a personal rather than economic nature.

Much of Boas' discussion of trade concerns the dramatic influence of European whaling stations on the development or expansion of exchange networks. He notes (Boas 1964:61), for example, that Davis Strait and North Baffin Inuit had access to European trade goods earlier than other areas to the south, and as a result enjoyed certain trade advantages over other groups including Cumberland Sound Inuit. This advantage disappeared, however, as the whaling industry expanded into both Cumberland Sound and Frobisher Bay during the middle and late nineteenth century.

In terms of traditional items of trade, Boas (op. cit.) states that aside from metals, which were always highly valued, wood and soapstone were the most desired commodities. Although the Nugumiut of Frobisher Bay occasionally collected and traded driftwood with Cumberland Sound Inuit it was equally, if not more common, for the latter groups to travel to other regions and simply collect it for themselves. A similar pattern appears to have been associated with obtaining soapstone, the sources of which, though comparatively few in number, appear not to have been in the obvious "control" of any particular group:

> "The visitors come from every part of the country, the soapstone being dug or "traded" from the rocks by depositing some trifles in exchange." (Boas 1964:61)

McGhee (1984:373-374) has pointed to the archaeological evidence of trade networks linking regional variants of Canadian Thule. Metal (meteoric and European iron) and soapstone are included in the inventories, but much of the material is of Norse manufacture originating from Greenland colonies (Schledermann 1980, 1981).

It is also interesting to note that although Bilby (1923) reported that local and/or regional Inuit groups on south Baffin met and engaged in pre-hunt activities, they apparently did not conduct the caribou hunt in a communal fashion. Instead, they appear to have exchanged information or expressed preferences concerning the hunt, reached agreement and then split into family units which hunted independently and did not reassemble at the end of the season (Bilby 1923:240 ff.).

To summarize, the limited amount of information currently available suggests a minor role for exchange as a specific mechanism for mitigating conditions of low caribou abundance. Although it is unlikely that all Inuit groups on south Baffin would have experienced similar levels of caribou reductions at the same time, the evidence suggests that many regional bands were faced with shortages contemporaneously (e.g., Hudson Strait groups). This suggests the possibility that when faced with a short supply of caribou skins, many groups had either no provision or desire for exchange. During the historic period, for example, it was not uncommon for Inuit to refuse to sell (i.e., trade) caribou skins unless their own needs had been met (e.g., Ann. Rep. R.C.M.P. 1925). Interpersonal and group alliances previously established through marriage, hunting partnerships and trade undoubtedly were important mechanisms on local and possibly regional levels. However, Boas (1964:57) suggests that greeting ceremonies amongst Baffin Island groups that were strangers to one another were "...not adapted to facilitate intercourse", and it may be that interregional contacts were neither regular nor important in the present context. Information exchange, on the other hand, may have been very important, particularly since regional groups followed different routes to the interior which provided opportunities to monitor game conditions over several areas. The resulting base of information undoubtedly influenced the organization of the hunt.

Despite the inability to presently assess the precise role of social mechanisms, a fundamental response to caribou shortages on southern Baffin Island apparently involved long journeys into the interior of the island, where during a period of decline, animals could still be found. That these trips were undertaken in the historic period when other forms of assistance were attempted, is significant and attests to the key role of caribou to the traditional Inuit economy. Following the assumption that prehistoric groups occupying southern Baffin Island experienced similar shortages in availability, possibly on the order of every two to three generations (cf. Burch 1972; Minc 1985), the remainder of this thesis explores the implications of these conditions on the organization of terrestrial land use during the Thule period.

CHAPTER EIGHT

INLAND CAMP SYSTEMS ON NETTILLING LAKE

Introduction

In the archaeological analysis which follows, the terminology for inland feature types and camps is that suggested by Grønnow (1986). In this scheme, individual sites are classified according to function(s) using ethnographic and historic information as well as site specific attributes including location, size and feature types present.

Grønnow (1986:78) distinguishes five inland camp types which are linked into camp systems whose functions vary along both spatial and temporal scales. Local function camps are used on an annual basis by smaller numbers of people who normally reside through their annual cycle in the proximity of a particular inlet or fjord. Sites that are used by people from larger geographic areas also function on a regional level, and those used by groups from widely separated areas have interregional functions (Grønnow et al. 1983:37). The function of any particular site is thus subject to change through time as exploitation patterns are altered for whatever reason.

Assembly Camps

Assembly camps are places where local groups meet prior to their departure to the interior, and again at the conclusion of the hunt while en route to the late fall coastal and winter camps. They may also be located inland where regional groups gather for social or economic purposes. Assembly camps will typically be occupied by a large number of people for a short period of time. Coastal assembly camps will be located at specific points adjacent to good access routes to the interior, often river valley systems. Inland gathering camps will tend to be located at or near the intersection of interregional travel routes, and where sufficient resources are available to support larger numbers of people for a brief time.

Travelling Camps

Travelling camps are used as resting or sleeping areas along the route to the interior (cf. Campbell 1968:Type VI; Fitzhugh 1972:Type 5). These may be established anywhere along a particular route, however, it is probable that certain locations were traditionally reoccupied, and possibly separated by roughly equal distances, equivalent, for example, to that travelled during a single day. An important camp near Amadjuak Lake, Aqbeniling, was so named because it took six days on foot to reach it (Boas 1965:15; Stenton 1987c). A small number of traditional camps were probably used while travelling to this site. Travelling camps would be occupied for a single night or possibly a few days if some hunting is done, or inclement weather delays movement. These camps would primarily serve local functions, but may also operate at a regional level if few alternative passages to specific inland locations exist.

Base Camps

Base camps were the focus of activity and occupied by some or all of a group during the entire season. These camps might be occupied by several families during any one season, and located at strategic points where all basic resources are available (food, water, fuel, construction materials). Depending on their location, base camps may function on any of the three spatial scales.

Overnight Camps

Overnight camps are distinguished from travelling or transit camps in that they are used by task groups (typically male) who are absent from the base camp for one or more nights during hunting expeditions. These are essentially similar to Binford's (1980) field camps. Overnight camps are occupied by a small number of individuals, and since they are generated by members of a specific base camp, they will function only on the local level.

Specialized Camps

Fitzhugh (1972:137) distinguished internal (within band territory) and external (outside band territory) specialized function camps. These are roughly equivalent to Campbell's (1968:17) Types IV and V, and Binford's (1980:10) locations. A number of social or economic activities may be carried out in these camps. In Fitzhugh's (1972) view, the internal variety may relate primarily to food or raw material procurement, and be of local or regional importance. External specialized camps may be established for the purpose of visiting or trading, and operate mainly on an interregional level. They are distinguished from assembly camps primarily by their smaller size.

Nettilling Lake Camp Systems

From information provided by Boas (1885), Soper (1928) and Hantzsch (Neatby 1977) three spatial variants of an inland camp system for Nettilling Lake can be reconstructed. This system was used primarily by Cumberland Sound Inuit, and functioned on both local and regional scales. Hudson Strait and Frobisher Bay Inuit occupied sites on Nettilling Lake during the historic period; however, these groups traditionally made greater use of Amadjuak Lake. The Amadjuak Lake systems may have extended as far north as Burwash Bay via the Amadjuak River, and Cumberland Sound Inuit occasionally hunted in the region separating the two lakes.

Of particular relevance to these reconstructions are Inuit drawings of Nettilling Lake reproduced in Boas (1885:49). These vary in their level of detail and are thought to reflect the artist's familiarity with the region. Two of the four sketch maps were drawn by Kekerten Inuit and show only the route from Isoa to Tikeraq Bay. Several of the main stopping points along the shore, and the amount of travel time (i.e., days) between them are also illustrated. The two remaining maps were drawn by Talirpingmiut and provide considerably more detail, including topographic features (e.g., eskers) and the main routes travelled by komatiq and boats (kayak/umiak).

Nettilling Fjord - Isoa

All three variants of the Nettilling camp system overlap between the mouth of Nettilling Fjord and a place known as Isoa, on the eastern shore of Camsell Bay. Isoa was an important component of all inland travel systems originating in Cumberland Sound. It served as an assembly camp for groups travelling to the south and west shores of the lake, and on their return to the coast. Equipment and supplies (including boats) were regularly cached at Isoa for the winter.

As described by Boas (1964:15), what is here referred to as the "Nettilling Fjord-Isoa" variant was used primarily by groups who travelled to the lake by kayak and/or umiak in late July (Figure 14). With travel scheduled at this season, camps might be located anywhere along the coast of the fjord, although there are several narrows (kognung) before the head of the fjord is reached which appear to have been used as stopping points (i.e., travelling camps). In addition, Kangia, at the head of the fjord, would be a likely place for a travelling camp, since from this point onward boats had to be portaged along a series of small lakes before Isoa was reached. Boas (1964) states that this route was well marked by navigation cairns, and suggests that once the lake was reached camps were established in the eastern Camsell Bay area, since families who travelled by boat to Nettilling had to return to the coast prior to freeze-up and thus stayed only for a few weeks. Such short-term residential camps might be set up at or near Isoa, on the islands in Camsell Bay, or perhaps further west in Tern Bay.

Nettilling Fjord-Isoa-Mirage Bay

Between the mouth of Nettilling Fjord and Isoa the same general route was followed by groups intending to spend the summer at the north end of Nettilling Lake. The timing and mode of travel differed, however. Travel to and across the lake commenced in spring and was accomplished by komatiq and boat. As with the Nettilling Fjord-Isoa variant, travelling camps could theoretically be located anywhere within the fjord; however, it is likely that

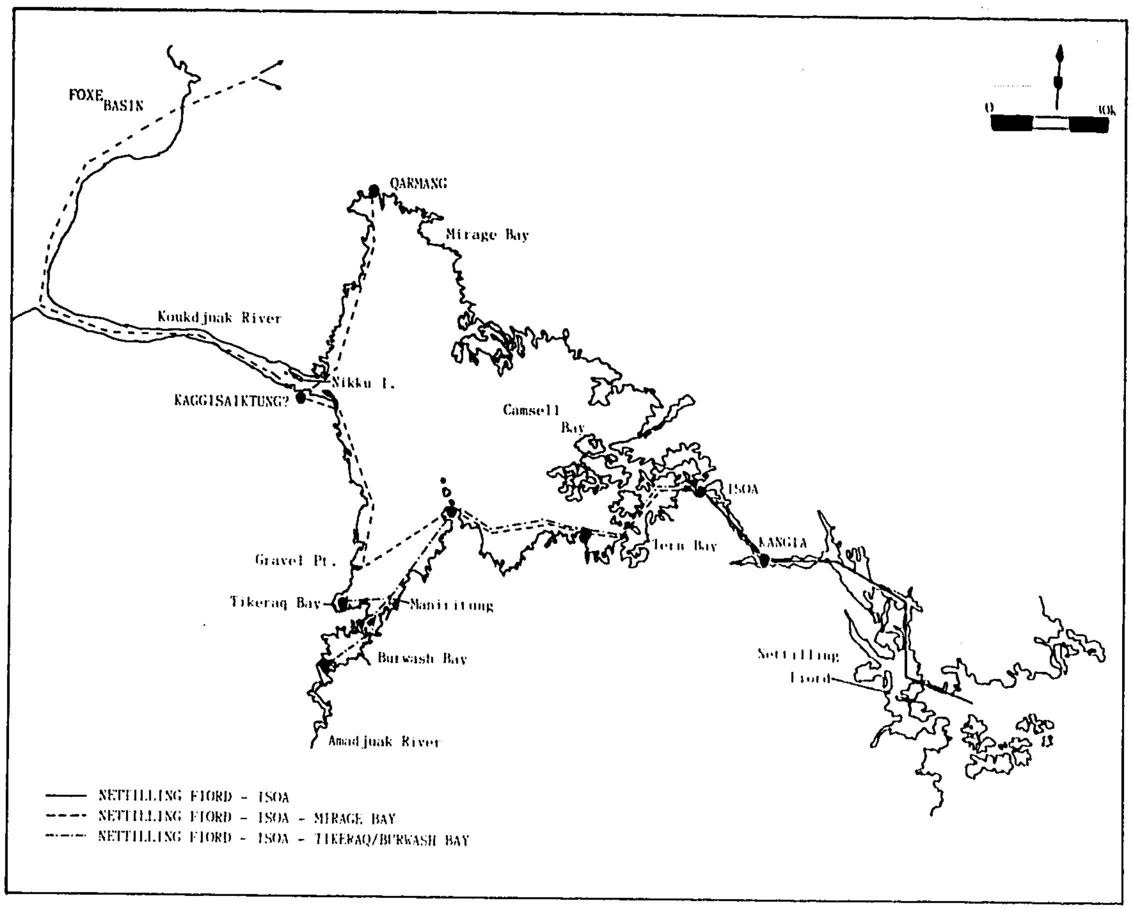

Figure 14. Map of Nettilling Lake illustrating three variants of the Inland Camp System.

snow houses with skin roofs would have been used (Boas 1964:143), leaving little if any visible remains.

Travel between Isoa and Mirage Bay followed a southwesterly route across Tern Bay to the tip of Magnetic Point (Tikerakdjuak)(Figure 14). The distance between these points is approximately 65-70 km, and apparently took a minimum of 2-3 days to complete. An important camp here was Tikerakdjuausirn, marked on three of the four Inuit maps, and located on a small peninsula forming the west side of Tern Bay. This clearly served as a travelling camp, but on occasion may have been used as a residential camp by groups who stayed in the Camsell Bay area. Realistically, travelling camps could be expected to occur at many points along this shoreline. Hantzsch (Neatby 1977), for example, stopped five times while en route to Tundra point, staying between one and four days at each location. The amount of time spent in any given camp was determined by the weather and/or the desire to hunt.

From Magnetic Point a southwest course was followed across the lake to the vicinity of Gravel Point, and then north across Coral Bay, around Anderson Headland to the south shore of the Koukdjuak River. A temporary residential camp, known as Kaggisaiktung was reported to exist on the south bank of the river, opposite Nikku Island. Hantzsch discovered an apparently substantial site approximately 6 km south of the Koukdjuak River, in a lushly vegetated spot and which included "a great quantity of tent rings", seal, whale and walrus bone (Neatby 1977:273). He originally concluded that this was the Kaggisaiktung site, but changed his opinion upon discovering its position to be so far south of the river. As noted earlier, two separate routes were traditionally followed from Kaggisaiktung to the base camp at Qarmang in Mirage Bay. Accordingly, travelling camps can be expected to occur along the Koukdjuak River, between its outlet and the Foxe Basin coast, and along the northwest shore of Nettilling Lake between the river and Mirage Bay. In the latter region camps would probably be located in the small coves that indent the shore and provided protection from the elements.

Nettilling Fjord-Isoa-Tikeraq Bay/Burwash Bay

The third system variant reconstructed for Nettilling Lake is more or less identical with the Mirage Bay version between Nettilling Fjord and Magnetic Point. However, leaving Magnetic Point, a southwest course was followed to an island called Maniritung, situated immediately north of Tundra Point. From here the lake was crossed to Tikiraq Bay. The return trip followed a slightly different course, from Tikeraq Bay across the narrows at Tundra Point, and then along the coast to Magnetic Point (Figure 14). Instead of travelling around Magnetic Point, however, an overland route was taken into Camsell Bay. Stops were made in small bays along the south shore of Camsell Bay, including at Tikerakdjuausirn. Travelling camps were also established on several of the islands in eastern Camsell Bay. With regard to this pattern of travel on the lake, it is interesting to note that all maps depict the Burwash Bay area (Kangidlirn), but there are no indications of travel into the bay or camps located there. As will be discussed, this was one of the most important areas of settlement on the lake, but one which may not have been occupied at the time of Boas' work.

The inland camp system reconstructed for Nettilling Lake from ethnographic and historical accounts is an idealized one, and permutations on the general patterns of land use outlined are to be expected. The available information nevertheless suggests that the main travel routes and traditional residential camps have been identified. Six major locations can be distinguished as component parts of the system. Isoa served as a base and assembly camp, and was the primary arrival/departure point for travel across the lake. Tikerakdjuausirn was an important travelling camp in the Tern Bay area and situated approximately one day's travel from Isoa. Tikerakdjuak (Magnetic Point) served as the "hinge" of the system, with groups adopting either a northwest course to Mirage Bay, or southwest to Tikiraq and Burwash Bay. Tikerakdjuk at Tikeraq Bay, and Qarmang in Mirage Bay appear to have been the main residential bases, and presumably occupied regularly when families summered in those areas of the lake. The temporary residential camp at Kaggisaiktung, near the Koukdjuak River, was a key component of the Nettilling Fjord-Isoa-Mirage Bay variant and would also be expected to have been regularly occupied. Between these prominent locations identified on the nineteenth century maps, a wide range of other site types, particularly travelling camps, are predicted to exist.

It is also evident that with the possible exception of Isoa (if functioning as a base camp), all of the major settlements are located on the west side of the lake. The primary residential camps are located approximately 50 km apart, with the exception of Tikerakdjuk and camps in Burwash Bay, which are only about 20 km apart. This implies frequent re-occupation of these sites, and regular use of other specific camps suggests that there was at least on a general level, redundancy in the patterns of settlement on Nettilling Lake.

CHAPTER NINE

ARCHAEOLOGICAL INVESTIGATIONS ON NETTILLING LAKE

Introduction

Field investigations on Nettilling Lake were undertaken between 1984 and 1986 as part of a multi-disciplinary research program focussing on the interior region of southern Baffin Island. This study was an extension of previous work conducted in coastal areas of Frobisher Bay, and its primary objectives were to investigate the environmental (i.e., topography, biogeography, paleoclimatic) and archaeological records of the Nettilling and Amadjuak lakes region and to develop an understanding of one in relation to the other.

No systematic archaeological surveys or excavations had been conducted in the Nettilling region prior to this study, but information on the general locations of several sites was available from a few sources. Boas journeyed to the east side of the lake in December 1883 (Boas 1885; Millward 1930), and subsequent to his trip a number of scientific and exploratory expeditions were made through the area. A detailed summary of these is presented by Millward (1930). In his travel through the area between 1909-1911, Hantzsch occasionally noted the locations of old sites (e.g., Neatby 1977:273), and Soper (1928) took photographs of several sites between Burwash Bay and the Koukdjuak River. In 1972, Schledermann (1984:pers. comm.) conducted aerial surveys in the vicinity of the Koukdjuak River and Mirage Bay, recording a number of sites in both areas. Verby and Beutow (1974) also recorded sites in the Tikeraq Bay area.

Survey Methods

Based on ethnographic and historic sources, three areas of Nettilling Lake were targeted for detailed archaeological investigation: Mirage Bay, the outlet of the Koukdjuak River and Burwash Bay. Since no detailed archaeological work had been undertaken in the region field surveys focussed on areas which, based on existing information, were judged to contain sites with characteristics suitable for the purposes of the study. Specifically targeted were areas where both informants and historical sources had placed traditional summer and fall settlements. Because these areas appeared to have been preferred camp locations in the Nettilling Lake district, they were expected to have good study potential. At a more general level, areas crossed by the networks of postglacial eskers and moraines were also selected for survey. With much of the west side of Nettilling Lake dominated by low, wet tundra, these landforms tend to concentrate the activities of both man and caribou. In their northward spring migration caribou apparently cross the ice on Camsell Bay, but while on their summer range and in the course of their autumn southward migration, they regularly move along these topographic features (cf. Kelsall 1968:108). Although these features provide relatively little in terms of quality forage, their elevation (ca. 8.0 m above lake level in an otherwise flat topography) offers some relief from insect harassment during July. Human groups would also take advantage of this characteristic; however, several other attributes of the moraines/eskers would have clearly influenced settlement decisions. These included the availability of building materials, good drainage, visibility of surrounding terrain, shelter from the wind and ease of travel between different areas of the lake, particularly in and around Burwash Bay.

Logistical considerations also influenced the survey design. Due to the normally late break up of ice in the main body of the lake, and the fact that our surveys were conducted by boat, it was not possible to survey the important region between Isoa and Magnetic Point. As a result, there was no opportunity to examine sites whose primary functions in the inland camp systems were well-documented ethnographically (e.g., Isoa, an arrival/departure camp; Tikerakdjuaursirn, a travel camp) and whose characteristics might have been used to established criteria against which other sites of unknown function could be evaluated. The site of the commercial test fishery on Nikku Island was selected as a base camp for the 1984 season since it provided a good landing strip and storage facilities. In 1985 and 1986, a base camp was established one kilometre west of the mouth of the Amadjuak River, on the moraine running along the south shore of Burwash Bay.

Standard archaeological field procedures were used in the surveys and excavations. Sites were mapped and photographed, with features recorded by number and type. The location of each site relative to surrounding topography and adjacent food and raw material resources was also recorded. This level of recording was not maintained, however, for several sites in the Padlei Narrows district. While conducting independent research in this area, colleagues recorded a total of fifteen sites. At five of these there was insufficient time for a complete inventory of the number of features present.

A total of eighty-five sites were located in the survey regions. Surface collections were made at three sites, test excavations at eleven and major excavations at five sites. Details of this work are found in Stenton (1987b). In the present study the results of surveys and excavations are summarized by region.

Excavation Methods

Subsurface artifacts and faunal remains were collected from two types of site features: caches and habitation structures. With few exceptions, all features investigated in detail were completely excavated. Stone caches selected for excavation were those which appeared to be undisturbed or minimally disturbed, and which appeared through visual inspection to contain faunal remains or other materials. None of the caches exhibited any signs of recent disturbance or use (e.g., lichen trim lines, modern refuse). Complete provenience information was recorded for the artifacts and faunal remains excavated from the habitation features (i.e., tent rings); however, the contents of the caches were recovered with limited provenience controls. For the narrow crevice-type features the flat capping stones were shifted aside and the contents of the feature removed. In the case of boulder caches, most were not completely dismantled. In order to avoid the possible collapse of the features and damage to the contents, only those rocks necessary to permit the collection of the faunal remains were removed. In some caches, however, bone had accumulated to a considerable depth and it was necessary to dismantle the entire feature in order to recover the remains. Several of these caches contained large assemblages of broken bone, including very small chips. The presence of these small fragments was recorded but the matrix was not screened to recover them.

Habitation features excavated reflect the range of formal variation observed in their structural characteristics (e.g., single or multiple coursed walls, paved or unpaved living areas). Individual dwellings were selected randomly, but excluded from consideration for excavation were those features or components that were of obvious historic or recent age (although surface collections were made at several of these sites), and those which appeared to be of prehistoric age but upon inspection were culturally sterile.

The surveys and excavations at Nettilling Lake yielded three sets of data: faunal remains, site locations/feature types, and artifacts. As a result of considerable variation (of either a quantitative or qualitative nature) between the data sets, for the purposes of this study, they are seen to have decreasing levels of information potential. The primary data are faunal remains excavated or surface collected from sites or features that have been dated by absolute or relative techniques. Faunal remains constitute the largest data set and are considered an appropriate focus since the collector/forager model employed in this study is based on an analysis of the faunal consequences of procurement, processing and consumption strategies in a caribou hunting society (Binford 1978:13).

Secondary data consist of site information recorded through surveys. Included in this category are the location of the site with respect to local topography as well as primary and secondary resources, and the number and type of features present. These allow a provisional construction of camp "systems" and suggest possible functional attributes which can be further assessed using the faunal data. The tertiary or lowest level of information is provided by artifacts. The artifact assemblages are very small and typically non-diagnostic. It is very difficult, therefore, to treat these materials in more than a cursory fashion.

Whenever possible, however, information provided by individual data sets is combined to provide as complete a picture as possible.

Chronology

Included in the range of features that comprise inland settlements on Nettilling Lake are stone structures which lack associated materials needed to establish their age and cultural affiliation. This is true especially for hunting (e.g., shooting blinds, caches, Inuksuit, etc.), and many habitation structures (e.g., "light" tent-rings).

The inability to date sites lacking temporally sensitive materials imposes limitations on the investigation of the organization of Thule exploitation patterns in the Nettilling Lake region. The first limitation involves the reconstruction of inland camp systems. In order to link different types of sites into a settlement "system" some means of establishing contemporaneity is required. In the present study, given the large number of sites/components that lack culturally and/or temporally diagnostic materials, reconstructed intersite relationships are necessarily tentative.

The second form of limitation concerns intrasite variability, and the ability to identify: (i) variation resulting from successive occupations of individual sites, including those by different cultural groups, and (ii) variation resulting from shifts in site function through time as the economic potential of specific locations changes.

The methodological problems posed by these factors cannot be completely resolved with the data presently available. Both forms of variation can, however, be assessed in a preliminary fashion using information recovered through surveys and excavations. Site location and the number and types of features present can be combined to classify sites provisionally according to function. The collection and analysis of artifacts can be used to develop a chronological framework and where faunal remains are present, these can be used to investigate procurement activities as well as evaluate functional classifications derived from other criteria. It is in this context that Binford's (1978, 1980) collector/forager model, as a conceptual tool for understanding hunter-gatherer adaptations, is appropriate to the present study. The principles underlying the collector/forager model are not limited to any specific time period or cultural tradition. Instead, the model predicts that certain forms of human economic (i.e., subsistence) behaviour will manifest themselves archaeologically in the formation of specific types of sites, activities at which generate patterned faunal assemblages (Binford 1978:477 ff.). Thus, in the present context even though it may not be possible to link particular field camps or caches with a specific residential base, the existence of these site types is predicted by the model. Accordingly, faunal and artifactual information collected from the sites can be used to investigate the organization of food procurement and processing.

To address the chronological issues several dating techniques are used to assign sites or components to one or more of the major cultural periods defined for Arctic North America (McGhee 1978; Maxwell 1985). It should be stressed that the objective here is not to monitor changes within a particular cultural tradition, but to develop a basic understanding of the patterns of land use during the late prehistoric period. While more refined chronological control is expected to emerge from future analyses on Nettilling and Amadjuak Lakes, for present purposes a working chronology is developed on the basis of one or more of the following criteria.

1. Radiocarbon Dating

Radiocarbon dates were obtained for four sites in the Burwash Bay area. One of these dates to the middle Pre-Dorset period (Stenton 1986b), while the remaining three all date to the late Classic/early Developed Thule period. Laboratory results for the samples are listed in Table 5.

Table 5. Summary of radiocarbon dates for Nettilling Lake sites.

Site	Sample #	Material	C_{14} Age	Calibrated Age*	Culture
LlDv-10	S-2870	Peat	2815±65	1220-815 BC	Pre-Dorset
LlDv-5	AEVC 537C	Caribou	700±80	1164-1410 AD	Thule
LlDw-7	AEVC 536CR	Caribou	600±70	1280-1440 AD	Thule
MaDv-11	AEVC 728C	Caribou	770 ± 120	1001-1410 AD	Thule

(*after Stuiver and Becker 1986:863-910)

2. Diagnostic Artifacts

Materials recovered through surface collecting, subsurface testing or complete excavation of features are also used to date sites or components. A variety of artifactual materials can be associated with each of the broad cultural periods. Paleoeskimo occupations can be identified by the recovery of specific raw material types used in stone tool production (e.g., cherts, crystal quartz) and/or diagnostic tool forms (e.g., burins, endblades). On this basis sites are designated as Paleoeskimo, Pre-Dorset or Dorset. Where possible, further temporal subdivisions are recorded.

The material culture of the Thule is characterized by the manufacture of an impressive array of diagnostic artifacts, but the most temporally sensitive are harpoon heads (Maxwell 1985). Nevertheless, and despite the presence of seals in Nettilling Lake, given the seasonality of most occupations in the interior, and the economic potential of the region, harpoon heads were not expected to be common in the artifact assemblages. Other elements of Thule material culture are suitably distinctive, however, to allow the classification of sites or features to this period. Potential problems introduced by the fact that many forms of Thule artifacts were replicated in the post-contact era are alleviated by the substitution of metal parts in composite artifacts for those originally manufactured of ground slate, ivory or bone (e.g., slate ulu, harpoon and lance blades replaced by iron). Thus, features yielding stylistically Thule artifact forms, without evidence of contact with Euro-American culture, were assigned to the Thule period.

In a similar fashion, historic period sites are classified as Early Historic (nineteenth century), Late Historic (early twentieth century, ca. 1900-1950) or Recent (containing modern forms of debris). These subdivisions are based on qualitative and quantitative differences in the Euro-American debris present in sites (e.g., calibre of shell casings, trade goods) as well as the type of dwelling features present (traditional qarmat/wood frame structures/canvas tents).

3. Lichen Growth

Stone cultural features constructed in Arctic and alpine regions provide a substrate for various species of lichens, whose growth characteristics can be used to develop either a relative or absolute chronology. Lichenometry was originally developed as a means of aging and correlating glacial moraines (Beschel 1950), and despite other types of applications of the technique it maintains its closest ties with glacial geology. Archaeological interest in lichenometry can be traced to Benedict's (1967) work in the Indian Peaks region of Colorado, yet as Bettinger and Oglesby (1985:206) note, there have been relatively few successful archaeological applications.

Lichenometry is based on the slow growth rate and relatively long life span of certain crustose species, particularly Rhizocarpon sp. These characteristics can be used to construct growth curves by correlating known substrate age with measurements (i.e., diameter) taken on a series of lichen thalli. By correlating substrate age with thalli diameters, growth rates for various stages of lichen development can be established. The resulting data can then be converted into calendar dates and applied to contexts of unknown age. Details of the technique can be found in Beschel (1950, 1961), Carrara and Andrews (1973) and Locke et al. (1979). A less precise form of lichen dating involves estimation of the percent cover of lichen growth on a cultural feature as a means of providing relative dates for a series of features or sites.

Despite its advantages (e.g., low cost, relatively broad application) there are numerous methodological problems associated with lichenometry (cf. Webber and Andrews 1973; Jochimsen 1973), which may partially explain its limited use in archaeological contexts. Arctic archaeologists have rarely used lichenometry, and usually only to make subjective assessments of the relative age of a feature or site on the basis of percent cover. A recent application of this technique is by Savelle (1986) who used estimates of percent cover to establish chronological control for 284 sites in the central Canadian Arctic. However, as applied to Thule culture sites, the technique produced results that only permitted differentiation of two very broad temporal periods of 400-500 years each (Savelle 1986:142).

In the present study, subjective estimates of lichen cover were recorded but as a rule are not expressed as percentages since it was considered unrealistic to expect consistency in estimates given the large number of sites and features, and the different personnel involved in the surveys. Instead, the extent of total vegetation cover (i.e., lichens on rocks, other plant cover in the interior of features) and evidence of disturbance (i.e., as reflected in the existence of trim lines) are reported. Using these criteria it is possible to identify features constructed or modified in the "recent" past (ca. 100 years) from those whose last period of use occurred in the prehistoric period. For example, tent rings and other features utilized during the historic period typically display prominent lichen trim lines, and obvious differences in the degree of lichen cover between the surfaces originally available for colonization and those newly exposed through disturbance or construction.

Survey and Excavation Results

Introduction

The results of the archaeological fieldwork are discussed separately for each of the six areas where surveys and excavations were done. Three areas lie between the Koukdjuak River and Mirage Bay, and three in the Burwash Bay-Tikeraq Bay areas (Figure 15). Approximately eighty percent of the sites recorded were found in the latter district; however, logistical difficulties prevented an extensive reconnaissance in other areas and a greater number of sites than reported are believed to exist, especially in Mirage Bay.

To avoid duplicating information available in field reports, site information is summarized in table form, supplemented by brief descriptions of each site's main characteristics. For those sites that were not excavated, or produced few if any artifacts, detailed site plans are not included. Detailed site maps are presented for all sites where extensive

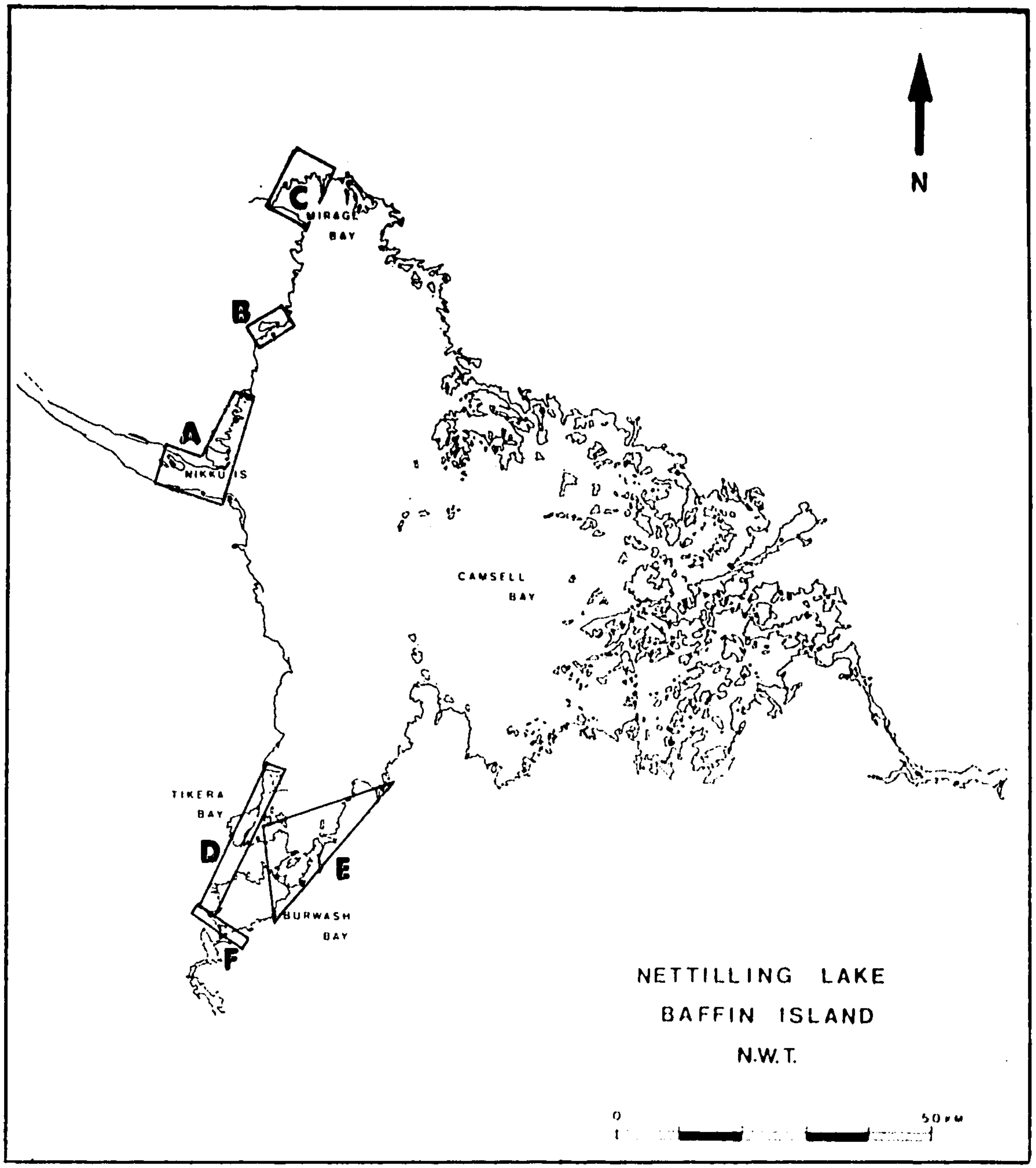

Figure 15. Map of Nettilling Lake showing the locations of the six survey areas.

excavations/collections were made. Following Grønnow (1986, Grønnow et al. 1983) functional classification of sites are defined on the basis of location and types of features present. Grønnow (1986:78) based functional designations on four general assumptions. These are: (i) camps with complex dwellings (e.g., tent houses) have functioned as base camps during some periods of occupation, (ii) camps comprised of tent rings, rock shelters, hunter's "beds", etc., served as travelling, overnight, or special functions, (iii) several dwellings of a single type in a group reflect contemporaneous occupation by several social groups (families), since, ethnographically, existing structures were reused by single families, and (iv) several different dwelling types in a single site reflect functional changes in site use over time. Site size is also a relevant variable which can be used to provisionally classify sites as to function (e.g., Savelle 1986).

The types of inland features described ethnographically or recorded in the course of the present study are described under the headings of habitation and hunting structures (cf. Grønnow 1986).

Habitation Features

Semi-subterranean Houses

This dwelling type occurs in modified form from Alaska to Greenland, and is elaborate in its construction (Maxwell 1985). In the eastern Arctic, such houses are round to oval in shape and constructed from sod, stone and whalebone. In Western Arctic regions wood was an important construction material, and houses were consequently square or subrectangular in shape (e.g., Stanford 1976).

Two forms of semi-subterranean houses have been recorded in the interior of southern Baffin Island. The first is virtually identical to coastal Thule winter houses, with substantial amounts of interior fall rock, walls constructed of heavy boulders, and deep entry passages. No structural whalebone, however, has been found in association with these houses and the design and construction of the roof is thus uncertain. The second form of semi-subterranean dwelling is distinctive in its "lighter" construction. These contain little if any fall rock, have very low exterior walls and shallow interiors. Entry passages are short and also shallow, but do have the cold trap characteristic of the more heavily-built structures.

The more substantial semi-subterranean houses are usually interpreted to be Thule winter base camps, which were occupied more or less permanently through this season. Although the focus of the present study is on the summer and fall occupation of Nettilling Lake, some Cumberland Sound Inuit were reported to have occasionally overwintered on the lake (Boas 1964). At the time of Boas' study, however, snow houses (igloo) would presumably have been the primary form of winter residence. Therefore, any heavily-constructed semi-subterranean ruins are considered to date to the Thule period.

Those dwellings with a simpler form construction are traditionally interpreted to be autumn houses or qarmat (Mathiassen 1927; Boas 1964; Schledermann 1976; Park 1988). Historically, qarmat were above ground features and often constructed in the depression of an abandoned winter semi-subterranean house. According to Mathiassen (1927:133) these had skin roofs and were occupied for approximately one month during the fall until snow conditions were suitable for building snow houses. The features interpreted to be qarmat on Nettilling Lake were not constructed over existing ruins, and are assumed to have been occupied by groups who (i) travelled by komatik to the interior and were forced to wait for freeze-up in order to return to the coast, or (ii) travelling by umiak or kayak who stayed on the lake into the fall, but left prior to freeze-up. In view of the structural differences between historic qarmat, these features are considered to date from the late Thule or possibly early contact period (i.e., ca. 1700 - 1800).

Snow Houses

Snow houses (igloo) were definitely used on Nettilling Lake during the historic period in the course of travelling and hunting in the region. Archaeologically, this form of dwelling is closely associated with the sea-ice environment, although they might also be shore-based

(Bilby 1923). Savelle (1984) has discussed the patterned remains of twentieth-century terrestrial-based snow houses in the Somerset Island region; however, prehistoric remains of such features have yet to be clearly identified.

Tents

The traditional summer tent or tupik, was constructed of sealskins drawn over a frame of composite wood or bone poles. In plan view, the structures are horseshoe-shaped, with the back formed by a semi-circular arrangement of poles (Boas 1964:143). According to Boas (op. cit.) activity areas within the tent (e.g., sleeping and side platforms) were not raised above the main floor level. To secure the structure, heavy stones were placed along the bottom edge or "apron" of the skins. These tents were highly portable and ideally suited for residential mobility during the season of their use.

Within the basic form of the skin tent, there is considerable room for variation in actual construction, and this is reflected in the archaeological remains of tent-based camps. The characteristic ring of stones left when the tents are dismantled may consist of large, tightly-fitted boulders, (typically referred to as "heavy" or "walled" tent rings; cf. Mathiassen 1927; Birket-Smith 1959; McCartney 1977) or smaller and more scattered stones (i.e., "light" tent rings). The internal area of such features may be undifferentiated, partially or completely paved, and with or without demarcated sleeping areas. This range of variability makes it difficult to interpret the functions of tent-based camps when other lines of evidence are unavailable. As a means of provisionally distinguishing tent ring camps according to function on Nettilling Lake, feature size, location and design are considered in terms of a scale of structural complexity. Among the reasons for using such a "scale" is that in the context of collector-forager systems, it may be difficult to distinguish between field camps and temporary residential sites when artifactual and/or faunal data is lacking. While certain sites might be confidently assigned to camp types on the basis of their topographic location (e.g., travelling camps), Savelle (1986:96) has suggested that residential sites can be distinguished on the basis of their size and proximity to secondary resources (water, fuel, etc.). In addition, although special purpose camps and temporary residential camps are occupied for short time periods, the former type may not be reoccupied frequently. Accordingly, Savelle (1986) considered sites consisting of one or two tent ring dwellings to be task group field camps, and sites larger than this to be residential camps. Functional distinctions could also be reflected in the internal variation of sites and their constituent features.

Figure 16 illustrates an idealized range of complexity in tent ring construction. It is by no means exhaustive, but it is empirically based (each has been recorded at sites on Nettilling Lake) and encompasses most forms described in survey reports. At the lower end of the "scale" are tent rings formed by a single row of stones, with no internal differentiation of activity areas. Such tent rings are of variable size, but typically range between 2.0-3.0 m^2. They may consist either of small or large rocks. Variations on this basic form include features in which a single row of flat stones forms the edge of the sleeping platform. This often is slightly elevated above the floor of the main living space. At the opposite or most architecturally "complex" scale, the size of the features increase to between 4.00-5.00 m^2, the interior of the ring becomes partially or completely paved, walls are multiple coursed and storage/cooking areas are incorporated into the structure. In West Greenland sites, Grønnow (1986:68) refers to the most complex structures as "tent houses". These share a number of formal similarities with Thule winter houses (i.e., sleeping platform, cooking areas, entry passage) but are not as substantially constructed.

The principle underlying the use of this "scale" is that small, specialized task groups of male hunters might be expected to devote less energy to the construction of dwellings used(i) for a brief period of time and (ii) re-used only sporadically, or possibly not at all. By contrast, dwellings constructed for extended periods of use by all family members, and at strategic locations where re-occupation is probable, more permanent structures might be

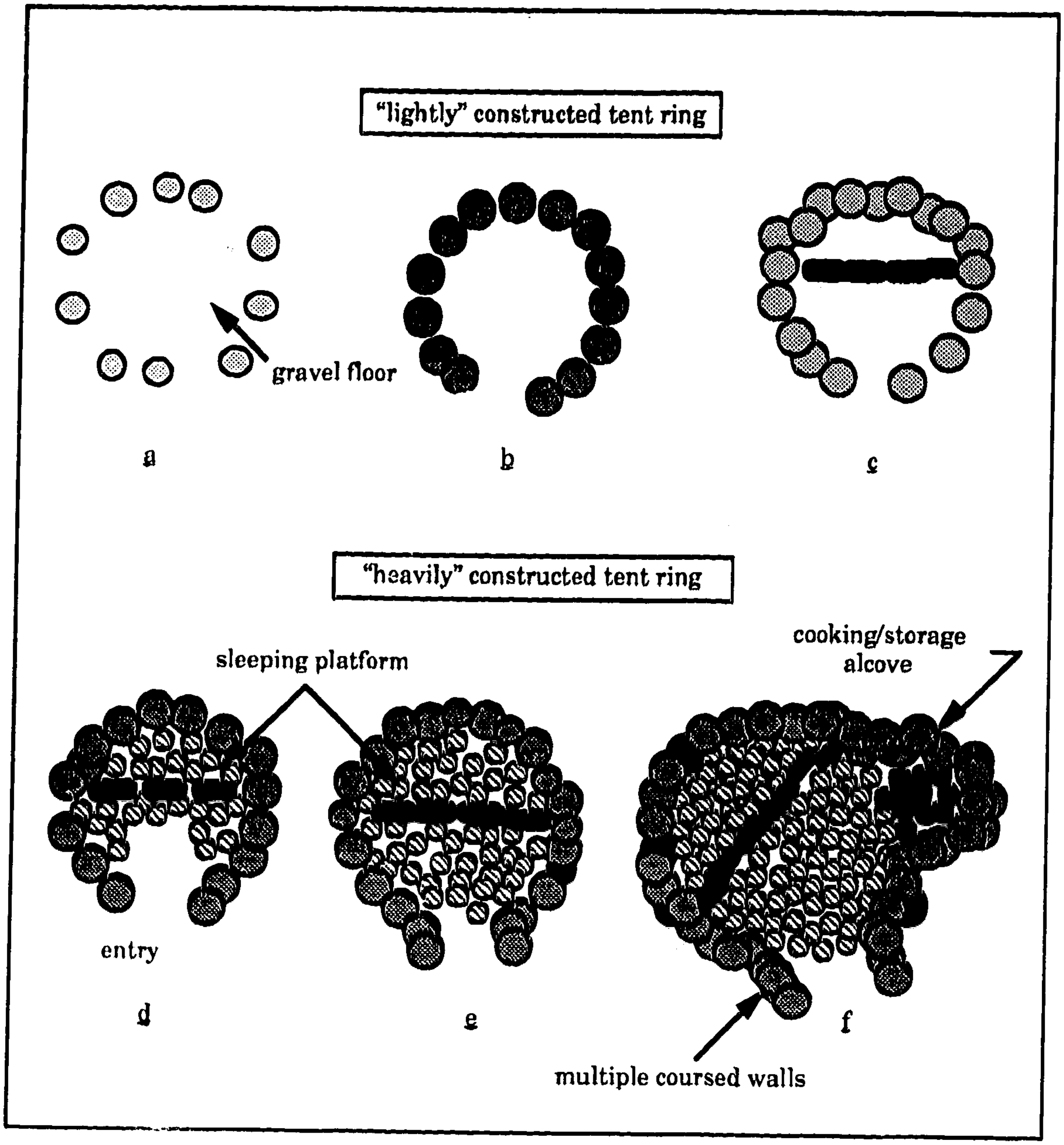

Figure 16. Idealized structural variation in the forms of summer-autumn tent rings.

established or maintained. Historic period tent rings can often be identified by concentric inner and outer rings of stones, the latter being attached to guy ropes.

Hunting Structures

A variety of hunting structures are incorporated into terrestrial settlement systems. Most relate to caribou hunting, but certain features are specific to other resources.

Qaggiq

Qaggiq are stone pens used to capture snow geese during the period of the moult. These features were apparently used only for snow geese (Leah 1986:pers. comm.), which were guided onshore using kayaks and then herded through the single entrance of the feature where they were killed. Soper (Millward 1930:78) described a qaggiq on an island in the Koukdjuak River as a high-walled, bowl-shaped structure measuring 7.5-9.0 m in diameter.

Fox Traps

During the historic period, steel leg-hold traps were the most common method of capturing fox. Fox trapping appears to have played a relatively minor role during the prehistoric period, but both coastal and inland sites occasionally contain features identified as fox traps. In the eastern Arctic there are two basic forms. Stone tower traps were constructed of flat, corbelled stones or tightly-fitted boulders that resemble a large cache with a small entry hole in the top. These traps were baited with caribou or other animal remains, and once a fox enters it cannot escape. A second common form is the stone "box" trap. These consist of two short, parallel rows of tabular stones, covered with flat slabs or boulders. A single stone, or a pile of stones, balanced over the entry was tripped when the bait was taken, sealing the animal inside (e.g., Maxwell 1985:Figure 8.17).

Fish Weirs

Stone weirs are low dams constructed in shallow river beds, and are used to capture large numbers of anadromous char returning from the sea in late summer (Balikci 1970). There are several rivers draining into Nettilling Lake where weirs could be constructed but none were recorded through surveys. Unless regularly maintained, such features would be destroyed by ice during spring break-up.

Shooting Blinds

These are low stone walls, semi-circular in shape and approximately 2.0 metres in length. One or more hunters would crouch behind the wall until passing caribou are within shooting range. These may be associated with ambush hunting strategies in which Inuksuit are used, or possibly at river crossings.

Inuksuit

Inuksuit (Inukshuk, sing.) are stone cairns that simulate the human form and were widely employed as traditional hunting devices used to direct the movement of caribou towards concealed hunters, and/or away from possible avenues of escape (Boas 1964; Gubser 1965; Balikci 1970; Arima 1975). A common form of Inukshuk seen in the Nettilling Lake area consists of upright slabs of shattered glacial erratics. Composite styles are also present.

Cairns

Other types of stone cairns were also important components of inland settlement systems. Historically, they were used by Euro-Americans to record their experiences or achievements for posterity's sake (Stenton 1986a). Traditionally, these features served a variety of more complex functions. Informants described different types of cairns that were used while hunting or travelling on the land. These included forms used to mark the locations of spring and summer camps respectively, some of which also functioned as caribou monitoring positions, since they provided a good brace for telescopes (Alainga 1986:pers. comm.). A common form of navigational cairn has a horizontal capping stone pointing toward the place one came from (i.e., always pointed toward home). Informants stated that these might be erected every 400 to 500 m, and might also convey information about who made them. "Personalized" navigation cairns were also used. If hunters or families had a common destination, but were travelling at different times a series of cairns might be set up with the number of stones indicating the number of days one party had left in advance of the other. For example, if someone left three days ahead of the rest of the group, a series of three-stone cairns would show the route taken.

Caches

Although caches may take a variety of forms the most common type leaving traces in the archaeological record are those constructed of stone. These may be freestanding features constructed of boulders, or built around glacial erratics, or in crevices capped with flat stones.

Caches may be seen to have two primary functions: food and/or equipment storage. Food caches may have a temporary function, (i.e., used for a short time until the hunt has ended, with contents retrieved and used soon after), or as reserves to be drawn upon during a later season (typically winter). They can be expected to occur at or near kill sites, and in or near residential sites particularly when they were established to store equipment. Equipment caches may also occur near traditional kill sites (if weapons used are species specific) and assembly camps.

Identifying cache types is made difficult by the fact that many of these features are found to be empty or badly disturbed. In addition, some tools/weapons may be cached together with food and thus the original or primary function of the feature may not be clear. At a more general level, the term "cache" may be used in a generic sense by Arctic archaeologists to refer to any feature that is not otherwise easily classified. Field reports suggest that piles of stones are often registered as caches without any detailed investigation. Inuit informants stated that most caches encountered in the interior would probably have been used for temporary food storage, although specific sites (e.g., assembly) also contained equipment caches. It was further suggested that food caches could be distinguished as such by the presence of small cobbles lining the interior bottom of the features. These were deliberately placed in food caches to prevent the contents from freezing to the ground.

Kayak Stands/"Pits"

In moving through the Nettilling Lake region, caribou are forced to cross several rivers, which are ideal locations to intercept them. Ethnographically and, presumably, prehistorically, both kayaks and umiaks were used to travel around Nettilling Lake, and many were left there when groups returned to the coast. During the period of the hunt and when not in use, kayaks were set atop stone pillars out of the reach of dogs, fox and wolves. A more elaborate type of construction has also been recorded at Amadjuak Lake. These are stone kayak "pits" (cf. Savelle 1986), measuring between 6.0 and 8.3 m in length, 0.50 and 0.60 m wide and ca. 0.60 m deep. These were probably constructed to prevent the frame from warping, in addition to keeping fox and other animals from damaging the skin cover (Stenton 1987c). Kayak stands may be expected in several site types, including residential, kill and assembly camps.

Burials

Stone burial cairns can also be expected to occur in the interior. Historic and prehistoric burials were recorded at Nettilling Lake in the present study, and Oliver (1986:pers. comm.) observed several burials in the Tikeraq Bay area in 1960. The site context for burials is highly variable. They have been identified, for example, in residential camps and as isolated features. Those discovered by Oliver (1986) were isolated features on a small island opposite Tikeraq Bay.

Hearths

External stone box hearths may be found in any of the five camp types. They are generally small and often found in association with tent rings (internal or external to the dwelling), and occasionally as isolated features. In isolation, they may represent brief stops made while hunting or travelling between camps.

Koukdjuak River Survey

Six sites were located in the vicinity of the outlet of the Koukdjuak River (Figure 17; Table 6). As noted earlier, this river is very wide and relatively shallow. Gravelly areas, suitable for habitation sites occur along both banks of the river. The north bank was surveyed between Nikku Island and the west shore of Nettilling Lake (i.e., approximately 5 km). The south bank was surveyed over a distance of approximately 10 km, from a point opposite Nikku Island to the shore of the lake. The primary objective of this survey was to locate the Kaggisairtung site.

Recent Period.

Two of the sites recorded, MdDw-4 on Nikku Island, and MdDw-5 on the north bank of the river are of recent age. These are presumed to be contemporaneous with the commercial test fishery and caribou tagging projects in the 1970's. Surface debris at these sites is all of very recent origin (e.g., pop cans, clothing, plastics, stove parts, etc.).

Late Historic.

One Late Historic site (MdDw-1) was found on the south bank of the river, eight kilometres southeast of Nikku Island. This site was defined by a small scatter of broken glass, a

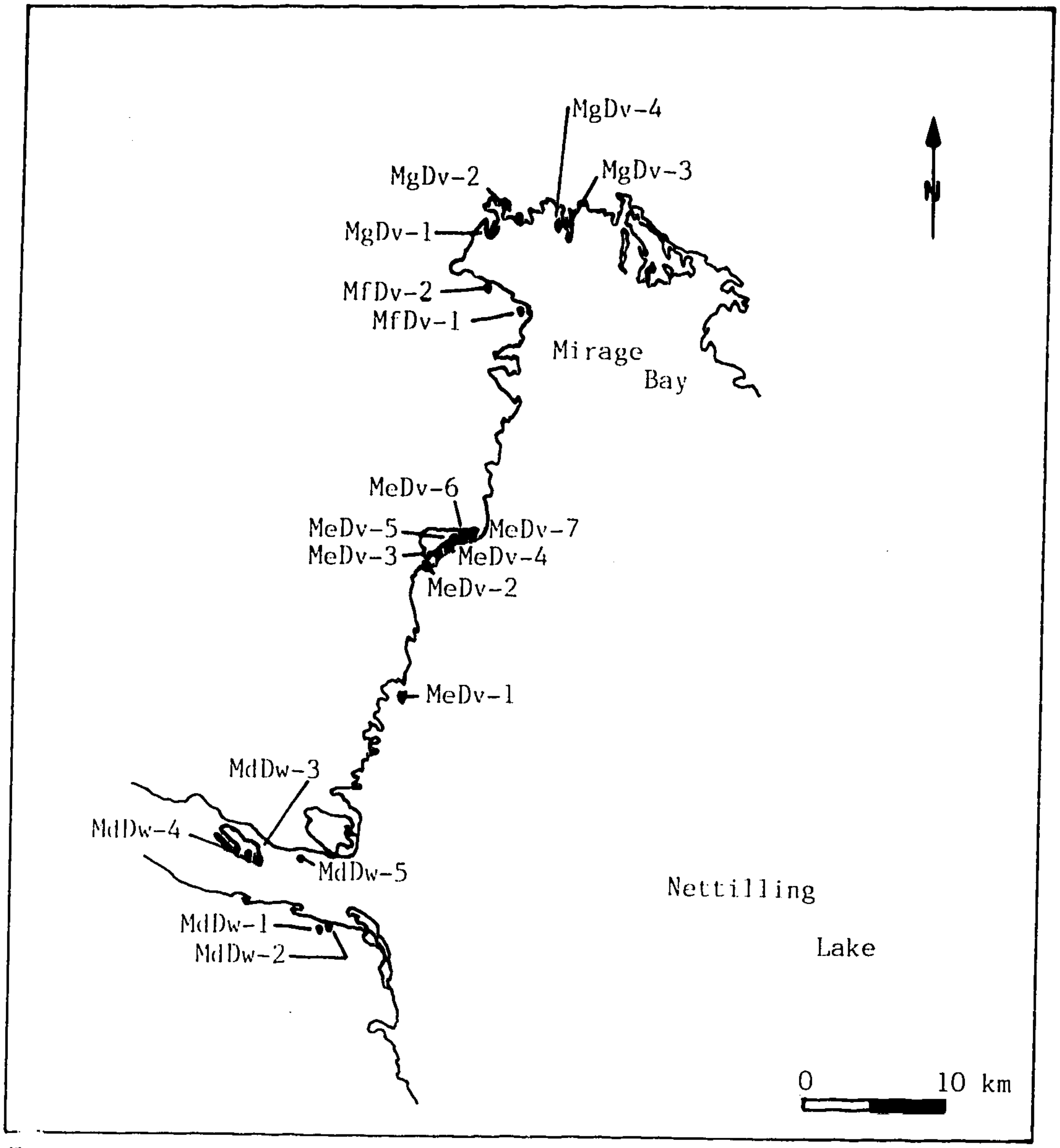

Figure 17. Map showing locations of sites recorded in the Koukdjuak River, Jaegar Cove and Mirage Bay survey areas, Nettilling Lake.

Table 6. Summary of Archaeological Sites: Koukdjuak River Survey.

Site	MdDw-1	MdDw-2	MdDw-3	MdDw-4	MdDw-5	MeDv-1
Component						
TRa*	-	-	-	2	10e	-
TRb	-	3	-	-	-	3
TRc	-	-	-	-	-	-
TRd	-	-	-	-	-	-
TRe	-	-	2	-	-	-
TRf	-	-	-	-	-	-
Hearth	-	-	-	-	-	-
Semi-Sub.	-	-	-	-	-	-
Qarmat	-	-	-	2	-	-
Burial	-	-	-	-	-	-
S. Fox Trap	-	-	-	-	-	-
M. Fox Trap	-	-	-	-	-	-
H. Blind	-	-	-	-	-	-
Kayak Stand	-	-	-	-	-	1
Cache	-	1	-	4	-	-
Inukshuk	-	-	-	-	-	-
Cairn	-	-	-	-	-	-
Total	0	4	2	8	10	4
Cultural Affiliation	I	?	?	I	I	?

* see Figure 16
p - present
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
? - Unknown

wood/metal skin scraper or softener and a small steel saw. No structural remains were found.

Thule.

Two sites presumed to be of Thule age were recorded. MdDw-2 consists of three tent rings located on the south bank of the river not far from MdDw-1. The tent rings are approximately 4.5 m in diameter, and constructed of single rows of boulders which have extensive lichen overgrowth. The interiors of the structures are covered with a thick layer of sod and moss. The site originally contained a number of lichen covered bowhead whale ribs (Popko 1985: pers. comm.) which were collected prior to our investigation and manufactured into komatik parts.

The second site considered to be of Thule age is MdDw-3. This is located on Nikku Island, whose name is an abbreviated form of Nikosiving or Nikkusivik meaning place of dried meat (Williamson 1981:133). This site consists of two oval tent rings situated on the southeast corner of the island. They measure approximately 4.0 x 4.0 m and the interiors covered by a thick mat of vegetation. Limited testing yielded no artifacts or faunal material, but did reveal paved sleeping platforms and dark staining suggestive of cooking areas.

Prehistoric.

The final site recorded in this area (MeDv-1) is located on a small islet 12 km north of the Koukdjuak River. It consists of three tent rings and one stone kayak stand. The perimeter stones of the tent rings are deeply set into the ground surface. Mosses and lichens completely cover the tent rings and no artifacts were found in or near any of the features. There is no evidence of a recent (i.e., historic) origin for this site and it is assigned to the prehistoric period. It may, however, date from either the Paleoeskimo or Neoeskimo periods.

Jaegar Cove Survey

Jaegar Cove is situated midway between the Koukdjuak River and Mirage Bay, and on recent topographic maps is referred to as "Paakitok Lagoon". The cove provides excellent protection from the elements and is formed by a short moraine which parallels the shore of the lake. Erosion has cut a narrow and very shallow entry into the cove.

Six sites were recorded in Jaegar Cove, five of which are located on the surface of the moraine (Figure 18; Table 7).

Recent.

Site MeDv-3 is located 1.5 km north of MeDv-2 and contains the ruins of 2 large rectangular structures originally constructed of stone and wood. A substantial amount of recent garbage litters the site, including broken glass, tin cans, shell casings, etc. The estimated date of the occupation here is sometime during the 1950's, as the site location corresponds well with informant data collected in Iqaluit about a summer/fall camp here. The site was not tested.

Late Historic.

Site MeDv-2 consists of 5 components spaced around a small cove immediately south of Jaegar Cove. Component A dates to the Late Historic period and consists of 1 modern tent ring and 1 steel fox trap.

Thule.

The remaining components of MeDv-2 each contain between 2 and 3 tent rings. These are all approximately 2.5 - 3.0 m in diameter and have substantial overgrowth. Most also have well-defined hearths, usually external to the tent ring. Limited testing was done in all components but none yielded artifacts or faunal remains. Two ringed seal (Phoca hispida)

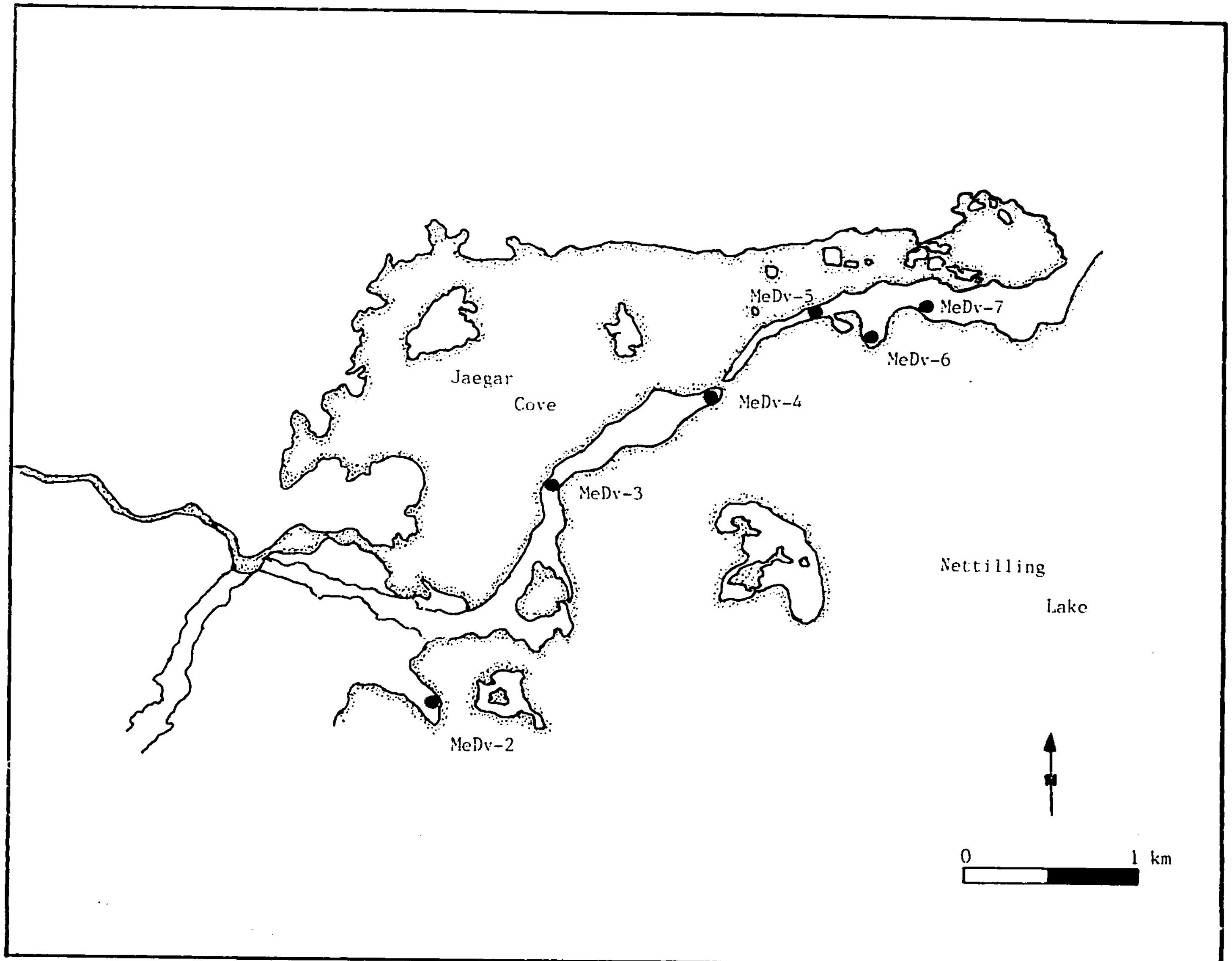

Figure 18. Map of site locations in the vicinity of Jaegar Cove, Nettilling Lake.

Table 7. Summary of Archaeological Sites: Jaegar Cove Survey.

Site	MeDv-2					MeDv-3	MeDv-4	MeDv-5	MeDv-6		MeDv-7	
Component	a	b	c	d	e				a	b	a	b
TRa*	-	-	-	-	-	-	-	-	-	-	-	-
TRb	1	2	3	2	3	-	5	4	-	-	-	-
TRc	-	-	-	-	-	-	-	-	1	-	3	4
TRd	-	-	-	-	-	-	-	-	-	-	1	-
TRe	-	-	-	-	-	-	-	-	-	-	-	-
TRf	-	-	-	-	-	-	-	-	-	-	-	-
Hearth	-	2	3	2	3	-	-	-	-	-	-	-
Semi-Sub.	-	-	-	-	-	-	-	-	-	-	-	-
Qarmat	-	-	-	-	-	2	-	-	-	-	-	-
Burial	-	-	-	-	-	-	-	1	-	-	-	-
S. Fox Trap	1	-	-	-	-	-	-	-	-	-	-	-
M. Fox Trap	-	-	-	-	-	-	-	-	-	-	-	-
H. Blind	-	-	-	-	-	-	-	-	-	-	-	-
Kayak Stand	-	-	-	-	-	-	-	-	-	-	-	-
Cache	-	-	-	-	-	-	1	-	-	1	-	2
Inukshuk	-	-	-	-	-	-	3	-	-	-	-	-
Cairn	-	-	-	-	-	-	-	-	-	-	-	-
Total	2	4	6	4	6	2	9	5	2	1	4	6
Cultural Affiliation	I	T	T	T	T	I	?P	?P	?P	?P	?P	?P

*see Figure 16.
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

pelves were found on the beach near Component E. Based on subjective criteria discussed earlier these features are assigned to the Thule period.

Prehistoric.

Four sites were recorded that cannot be confidently assigned to a particular time period, but which are clearly of prehistoric age. MeDv-4 is located at the eastern tip of the peninsula forming the southern arm of Jaegar Cove. The site consists of 5 light tent rings, 1 cache and several Inuksuit. Two of the tent rings are eroding into the lake due to wave action and ice push. A small amount of faunal material, including seal bone was visible in the eroded bank, but no artifacts were noted.

MeDv-5 extends along the northern arm of Jaegar Cove for a distance of approximately 1.0 km. It has 5 features: 4 tent rings and 1 burial. The tent rings placed toward the southeastern end of the site are dissected by a well-travelled caribou trail. Small trowel tests in these features failed to reveal any artifacts or faunal remains. The burial cairn was not disturbed.

MeDv-6 is located near the tip of the short "peninsula" jutting southward from the Jaegar Cove Moraine into Nettilling Lake. It has 2 components. The first (Figure 19) consists of a large oval tent ring ca. 5.9 m x 5.5 m with some internal arrangement of flat stones and a large exterior hearth. The perimeter stones are covered with lichen and the interior supports a variety of wildflowers. Extensive testing of the interior and hearth produced only a single chert flake. The second component is located 200 m to the south and is a large pile of flat stones bearing a resemblance to a Thule winter structure, but tentatively identified as a collapsed cache or possibly even a burial given the number of flat stones. No artifacts or faunal material was recovered through limited testing of the feature.

Site MeDv-7 contains eight tent rings located 500 m west of MeDv-6, adjacent to a small stretch of sandy beach. Two arbitrary components were identified. The first contains 4 small, oval tent rings including a "miniature" form barely 1.0 m in diameter, yet having an

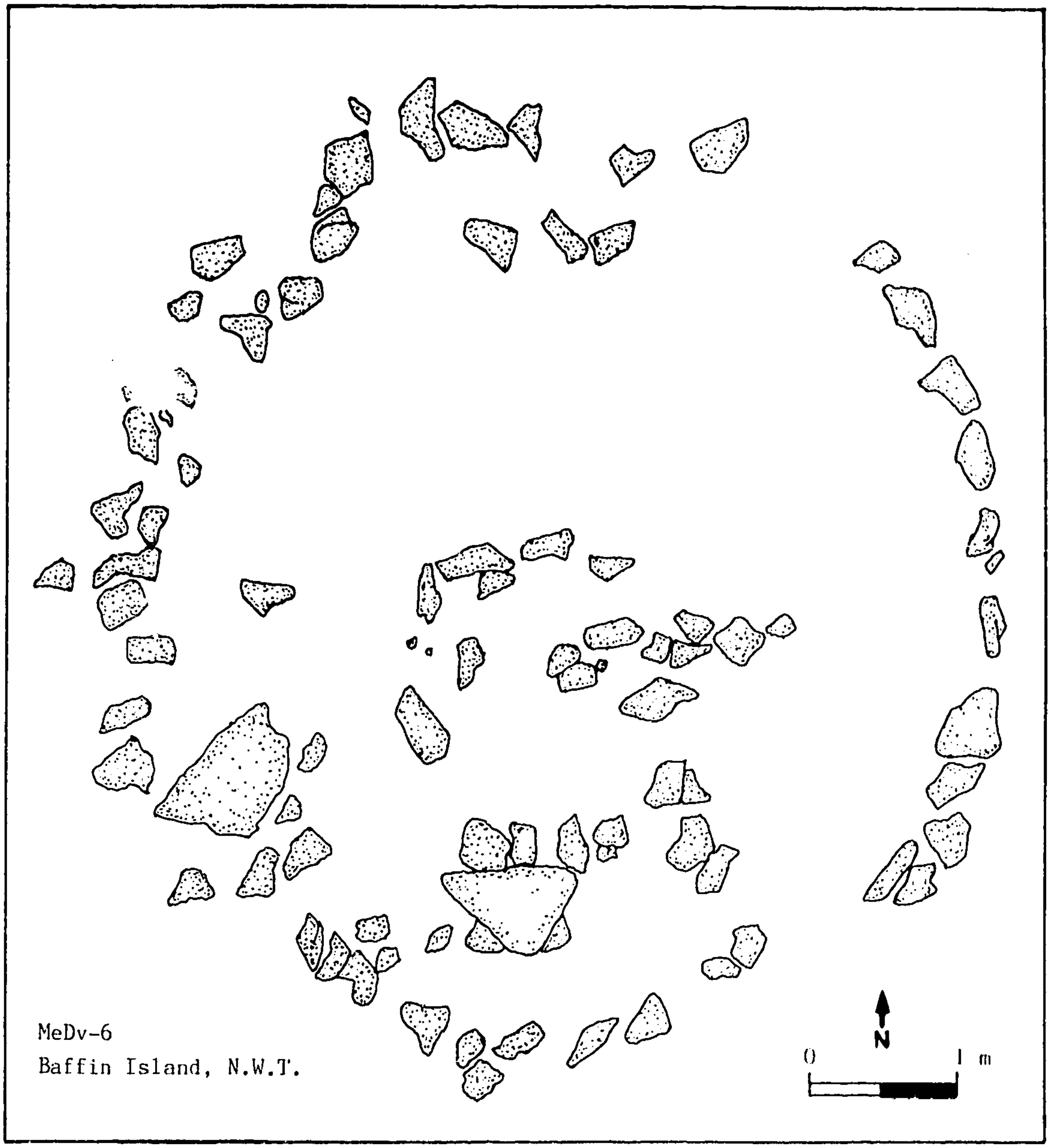

Figure 19. Plan view of tent ring at site MeDv-6, Nettilling Lake.

interior filled with tightly fitted paving stones. The perimeter stones of all features are deeply set into the surface and limited testing of both sites produced no cultural materials.

Given the general uniformity of the Jaegar Cove sites (i.e., small groups of light tent rings, few storage facilities, lack of artifactual/faunal materials), and with the exception of the modern camp at MeDv-3, the area appears to have functioned primarily as a setting for travelling camps used by groups en route between Mirage Bay and the Koukdjuak River and perhaps areas further south (Burwash Bay).

Mirage Bay Survey

Mirage Bay forms the northern extremity of Nettilling Lake and according to ethnographic accounts was a primary region for summer and fall residential camps. The best known of these is "Qarmang", reported as located on the north side of the bay (Boas 1964). Given its apparent importance, a principal objective of the Mirage Bay survey was to locate and excavate this site. It is evident from the survey, however, and information provided by Schledermann (1984:pers. comm.) that we did not locate this important site. The term "qarmang" is thought to refer to a qarmat or autumn house, and on this basis the site was anticipated to contain sod/stone walled structures. Schledermann (1984: pers. comm.) observed such features from the air on the west side of Mirage Bay in 1972, but we were unable to relocate them.

Of the six sites recorded in Mirage Bay, one dates to the modern era (MfDv-1), two to the Late Historic period (MfDv-2, MgDv-2), two to the Early Historic (MgDv-1, MgDv-3) and one to the Thule period (MgDv-4)(Figure 17; Table 8).

Recent.

Site MfDv-1 is located at the eastern tip of a point of land separating Nettilling Lake proper from Mirage Bay. It is on the north shore of the promontory overlooking the bay.

Table 8. Summary of Archaeological Sites: Mirage Bay Survey.

Site	MfDv-2		MgDv-1	MgDv-2	MgDv-3	MgDv-4
Component	a	b				
TRa*	-	-	-	-	2	6
TRb	8	3	3	-	-	2
TRc	-	-	-	1	-	-
TRd	-	-	-	-	-	-
TRe	-	-	-	-	-	-
TRf	-	-	-	-	-	-
Hearth	2	-	-	-	-	-
Semi-Sub.	-	-	-	-	-	-
Qarmat	-	-	-	-	-	-
Burial	-	-	-	-	-	-
S. Fox Trap	-	-	-	-	-	-
M. Fox Trap	-	-	-	-	-	-
H. Blind	-	-	-	-	-	-
Kayak Stand	-	-	-	-	-	-
Cache	-	-	-	-	3	6
Inukshuk	-	-	-	-	1	-
Cairn	-	-	1	-	-	-
Total	10	3	4	1	6	14
Cultural Affiliation	?P	I	?P	?P	?P	?P

* see Figure 16.
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

It appears to be the remains of a military installation, possibly part of an advance DEW line operation and consists of the remains of at least one building (floor and wall panels at site and below embankment on beach), 25 forty-five gallon fuel drums and other surface debris including tin cans, broken glass, metal fragments, etc. One piece of a wooden crate bore a partial stamp: "U.S. Air Force, Electronic Equipment, Fox 2". The site was photographed but no collections were made.

Late Historic.

Site MfDv-2 is located at the western extremity of Mirage Bay, on the south shore and approximately 1.5 km east of the mouth of the main river draining into the bay. In total there are 13 tent rings/caches/hearths distributed over a distance of some 250 m along the lake shore. Several of the tent rings may be of fairly recent vintage (i.e., < 50 years) based on informant data and their structural characteristics (concentric inner and outer rings). Others appear to be slightly older. Two of the rings are quite small and very similar to one at MeDv-6. Testing of the various components produced no artifacts or faunal remains.

MgDv-2 is located on a small promontory in the northwest corner of Mirage Bay and directly north of Lion's Head Cove. It consists of a stone record cairn and a single tent ring adjacent to a bedrock outcrop several metres to the east. The tent ring measures 3.2 m^2, has moderate vegetation cover and no associated surface cultural materials. It was not tested.

A record deposited by J. Dewey Soper in February 1926 was discovered near the stone cairn. It contained two records: Soper's and an Inuktitut note presumably deposited sometime after the original (see Stenton 1986a).

Early Historic.

The MgDv-1 site is at the tip of a small peninsula jutting southward from the northwest corner of Mirage Bay. Our attention was drawn to this point by a large Inukshuk and the rest of the site consists of 3 small tent rings with a moderate degree of vegetation cover and no surface materials. The site features were not tested.

MgDv-3 is located on a narrow peninsula jutting southward from central Mirage Bay. Six individual site features are scattered along the peninsula: 3 caches, 2 tent rings and 1 navigational cairn. Both tent rings are small, ca. 2.5 m^2 and have single rows of stones which have a moderate degree of lichen cover. No surface materials are present at any feature and limited testing of the tent rings yielded negative results. On subjective criteria these sites have been provisionally assigned to the early historic period.

Thule.

Situated immediately offshore of the northwest side of the peninsula where MgDv-3 is situated is a small island on which 14 features (MgDv-4) were located (Figure 20). Six of the features are heavy tent rings with lichen encrusted perimeter stones and very heavily vegetated interiors; in one case the overlying moss had attained a thickness of 14.5 cm. Testing of the features yielded no artifacts or faunal remains; however, these features are very similar to ones excavated elsewhere on the lake that contained Thule artifacts, and on this basis those at MgDv-4 are assigned to the Thule period.

Padlei Narrows Survey

The Padlei Narrows survey area is triangular is shape and includes the region between Meadow Bay, the southwest side of Burwash Bay and the peninsula separating Burwash and Tikeraq bays (Figure 21; Table 9). Surveys revealed fourteen sites in this area, all of which were reported by other members of the project field teams. Only two of these were revisited for detailed mapping and excavation. For the remaining twelve sites age and functional classification are based on general site characteristics.

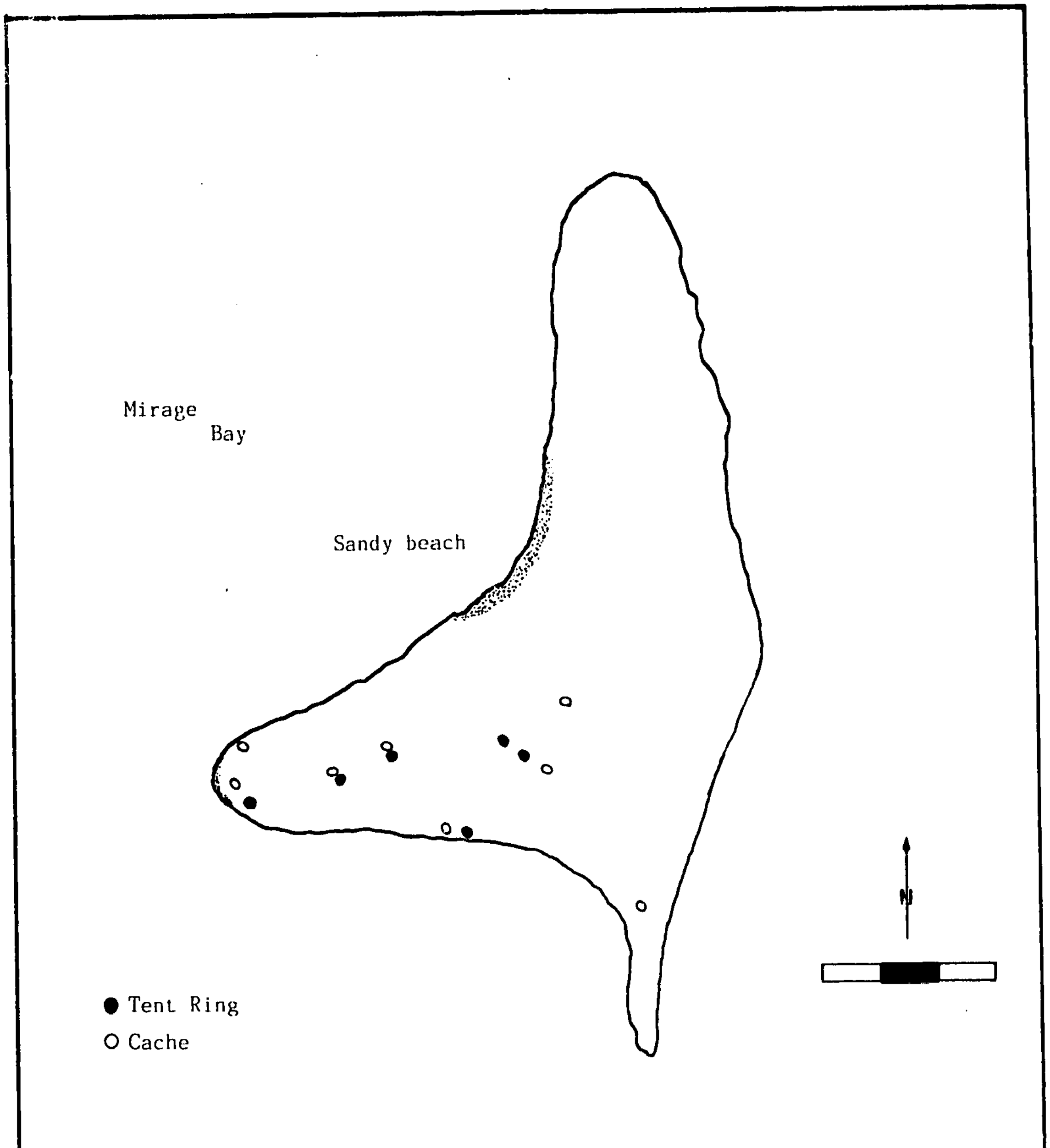

Figure 20. Map of site MgDv-4, Mirage Bay, Nettilling Lake.

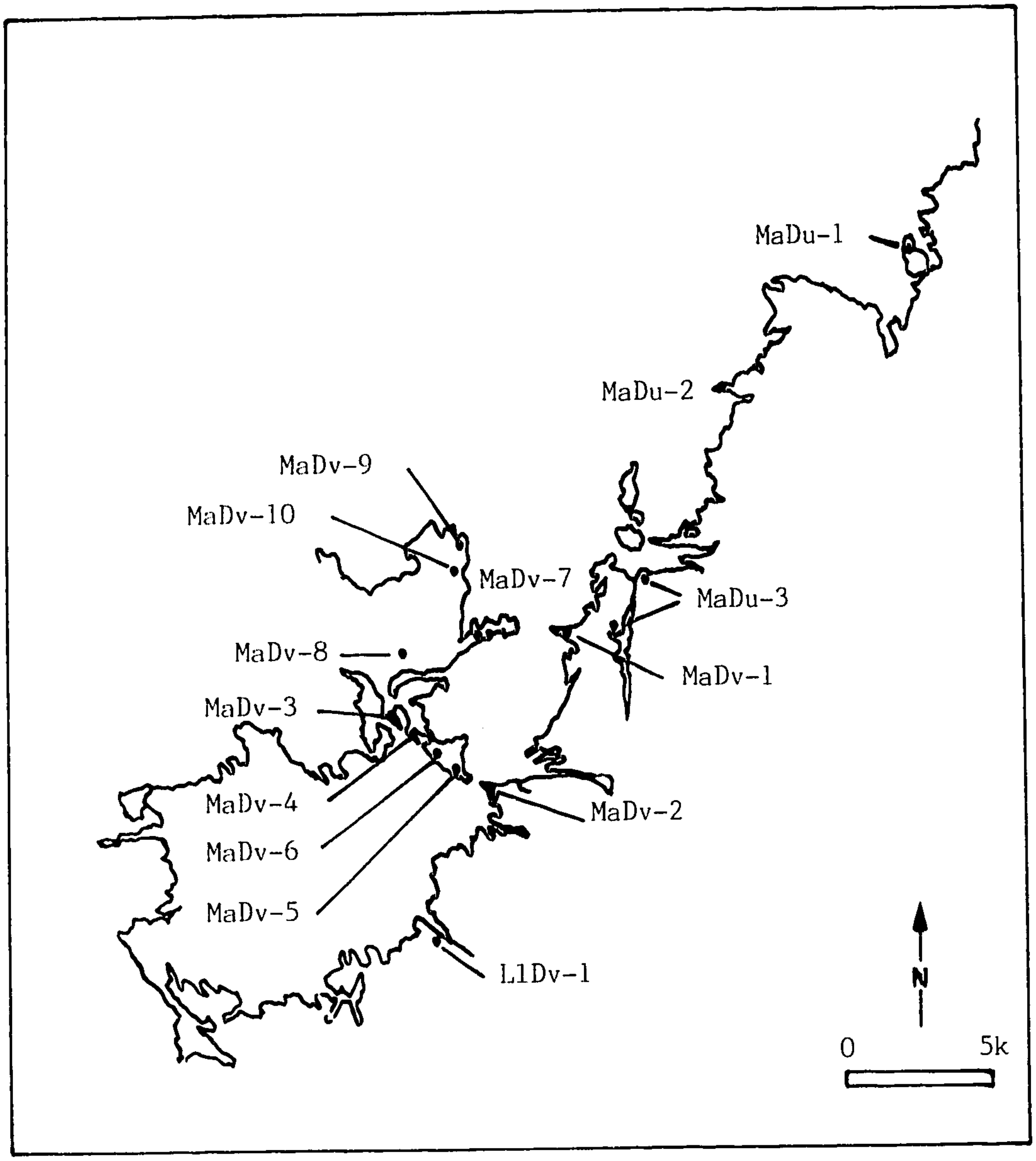

Figure 21. Map showing location of sites recorded in the Padlei Narrows survey area.

Table 9. Summary of Archaeological Sites: Padlei Narrows Survey.

Site	LlDv-1	MaDu-1	MaDu-2	MaDu-3	MaDv-1	MaDv-2
Component						
TRa*	3	-	-	-	p	p
TRb	-	-	-	-	-	-
TRc	-	-	7	-	-	-
TRd	-	-	-	-	-	-
TRe	2	-	-	-	-	-
TRf	1	-	-	-	-	-
Hearth	-	-	-	-	-	-
Semi-Sub.	-	-	-	-	-	-
Qarmat	-	-	-	-	-	-
Burial	-	-	-	-	-	-
S. Fox Trap	-	-	-	-	p	-
M. Fox Trap	-	-	-	-	-	-
H. Blind	-	-	-	-	-	-
Kayak Stand	-	-	-	-	-	-
Cache	4	1	5	-	p	p
Inukshuk	-	-	5	-	-	-
Cairn	-	-	-	2	1	-
Total	10	1	18	2	?	?
Cultural Affiliation	T	?P	T	T	I	I

* see Figure 16.
p - present
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

Table 9 continued. Summary of Archaeological Sites: Padlei Narrows Survey.

Site	MaDv-3		MaDv-4	MaDv-6	MaDv-7
Component	a	b			
TRa*	-	-	2	1	6
TRb	-	-	-	-	-
TRc	-	-	-	-	-
TRd	-	-	-	-	-
TRe	5	-	-	-	-
TRf	-	-	-	-	-
Hearth	-	-	-	-	-
Semi-Sub.	3	-	-	-	-
Qarmat	-	-	-	-	-
Burial	-	1	-	-	-
S. Fox Trap	-	-	-	-	-
M. Fox Trap	-	-	-	-	-
H. Blind	-	-	-	-	-
Kayak Stand	-	-	-	1	-
Cache	5	-	p	1	6
Inukshuk	-	-	-	-	-
Cairn	-	-	-	-	-
Total	13	1	?	3	12
Cultural Affiliation	T	I	?P	?P	I

*see Figure 16.
p - present
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

Table 9 continued. Summary of Archaeological Sites: Padlei Narrows Survey.

Site	MaDv-8	MaDv-9	MaDv-10
Component			
TRa*	p	1	2
TRb	-	-	-
TRc	-	-	-
TRd	-	-	-
TRe	-	-	-
TRf	-	-	-
Hearth	-	-	-
Semi-Sub.	-	-	-
Qarmat	-	-	-
Burial	-	-	-
S. Fox Trap	1	-	-
M. Fox Trap	-	-	-
H. Blind	-	-	-
Kayak Stand	-	-	-
Cache	-	-	-
Inukshuk	-	-	-
Cairn	-	-	-
Total	?	1	2
Cultural Affiliation	I	?P	I

*see Figure 16.
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

Recent.

Three sites date from the modern era: MaDv-2, MaDv-5 and MaDv-7. The Padlei Narrows site (MaDv-2) is located on the south shore of Nettilling Lake at the entrance to Burwash Bay. It contains an indeterminate number of tent rings and caches of recent age. This conclusion is based on the character of surface debris at the site which includes Coca-Cola™ cans, a wine bottle and a rusty steel hand-axe.

Site MaDv-5 is located near the northern tip of the entrance to Padlei Narrows, near the eastern limit of the West Burwash Moraine. This site is related to the Department of National Defense (DND) camp (Stenton 1987b) and contains 20+ oil drums, oil stove parts,pieces of parcolls and skidoo parts. A number of more recent tent rings (i.e., post-dating the DND activities) and a few apparently older structures are also present.

Site MaDv-7 is comprised of six tent rings and 6 caches were located approximately 2 km west of Tundra Point, on the southeast shore of Nettilling Lake. Surface debris included a number of antler racks and a 4 litre fuel drum (1/2 full). The site is also close to a snow geese nesting area and probably is a modern caribou hunting camp, dating back no more than a decade or two.

Late Historic.

Four Late Historic sites were identified: MaDv-1, MaDv-3, MaDv-8 and MaDv-10. The Tundra Point site (MaDv-1) is located at the tip of the geographical landmark of the same name on the southeast shore of Nettilling Lake. It has as its most prominent feature a large, undisturbed cache, referred to by Inuit informants as the "R.C.M.P." cache. This location was a stopover point used frequently by police patrols during the 1920's and 1930's and by other expeditions to Nettilling Lake. It also contains steel fox traps and an indeterminate number of caches and tent rings. The tent rings appear to be of "recent" origin and have very little surface cover. This site has tentatively been dated to ca. 1930.

The Ashoona site (MaDv-3) is located at the entrance to a large embayment northwest of Padlei Narrows. It consists of 5 tent rings covered with a thick vegetation mat covering interior paving stones, 1 burial, 5 collapsed boulder caches and 3 semi-subterranean Thule houses (Figure 22). The historical component consists of the burial thought to be that of a Cape Dorset Inuk. The body was interred beneath a casket fashioned from a wooden box 1.9 m in length and 0.65 m at its widest point. The outer perimeter of the box is surrounded by medium size boulders, but no stones remained on the top of the feature. The burial has been disturbed, with several of the boards removed from the top of the box and scattered over several metres. Lying immediately beside the grave and between two large rocks is part of the pelvic girdle and some vertebrae. The skeleton, visible through the damaged end of the casket, is in an extended position and all of the elements except the cranium are covered by thick grass. This feature, dated to ca. 1940, was photographed but otherwise not disturbed.

Site MaDv-8 is situated 5 km west of Tundra Point, and consists of an indeterminate number of recent tent rings and a small stone tower fox trap containing a steel leg-hold trap. Apart from a small amount of caribou bone on the surface the site is sterile. MaDv-10 is located 5.0 km south of MaDv-9, on the crest of the same glacial landform. It consists of 2 recent tent rings and one 170 litre fuel drum. No other materials are present. This site is in an area completely exposed to the elements and is not a good choice for a long-term camp.

Early Historic.

Two sites believed to date from the early historic period are MaDv-4 and MaDv-6. MaDv-4 is located near the water's edge, southeast of MaDv-3. It consists of 2 lightly constructed tent rings and an indeterminate number of caches. MaDv-6 is situated near the north corner of the promontory facing Padlei Narrows, southeast of MaDv-4. It consists of a single tent ring, cache and boat stand. No surface materials were noted and the site was not tested. All of features are of unknown age,but have arbitrarily been assigned to this time period since none

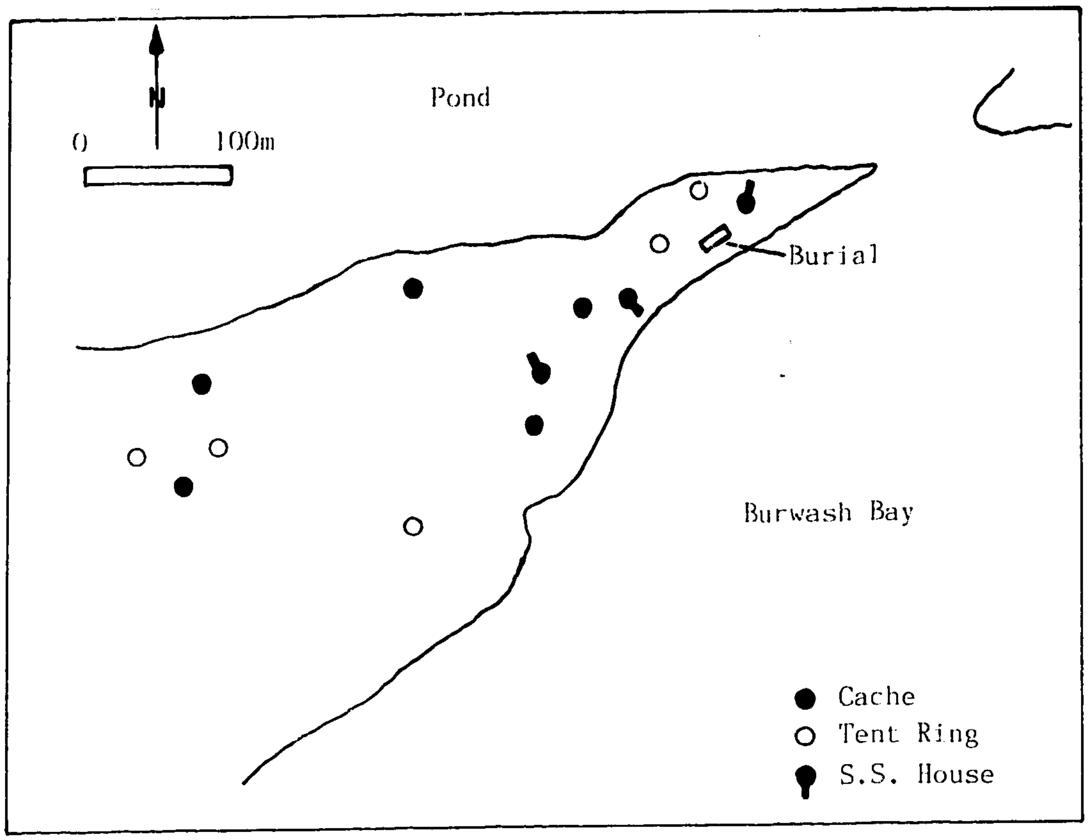

Figure 22. Map of the Ashoona Site (MeDv-3), Padlei Narrows, Nettilling Lake.

provides any clear evidence for occupation during either the the recent historic or prehistoric periods.

Thule.

Three Thule age sites were recorded: LlDv-1, MaDu-2, and MaDv-3. These contain both summer and winter habitation ruins. The LlDv-1 site is located on the south margin of a deep and narrow inlet which cuts into the southeast shore of Burwash Bay. It consists of 9 features in three components: 2 stone-walled habitation structures similar to "tent houses", 3 lighter tent rings and 4 caches (Figure 23). One of the heavier stone features (House 2) has exterior walls up to 5 courses high (maximum height 0.89 m), a clearly marked sleeping platform and entry passage, paving stones in the interior and extensive vegetation cover. It measures 2.7 X 2.9 m. House 1 has two lobes measuring 1.5 and 2.3 m in width respectively. The highest standing wall is 0.91 m, and there are no obvious hearths or sleeping areas. The unusual curvature of one exterior wall of the house suggests the original feature has been remodelled into an overnight shelter or perhaps a shooting blind.

The lighter tent rings are oval in shape with average dimensions of 2.0 m^2. One has a small associated hearth, but none have interior paving or surface artifacts/faunal materials. Lichen cover is extensive. The caches are of moderate size and of the boulder type. External lichen cover is extensive, with a maximum thallus measurement (Rhizocarpon sp.) taken on Cache 1 of 0.80 m.

The Ptarmigan Point site (MaDu-2) is located at the tip of Ptarmigan Point, which is located on southeast shore of Nettilling Lake. It contains 8 tent rings and an indeterminate number of caches and cairns. The tent rings are of the "walled" variety and are covered with a thick sod overburden. No other information is available regarding this site, but based on the structural characteristics and degree of vegetation cover, it has been assigned to the Thule period. Excavation of similar features at other sites consistently produced Thule artifacts.

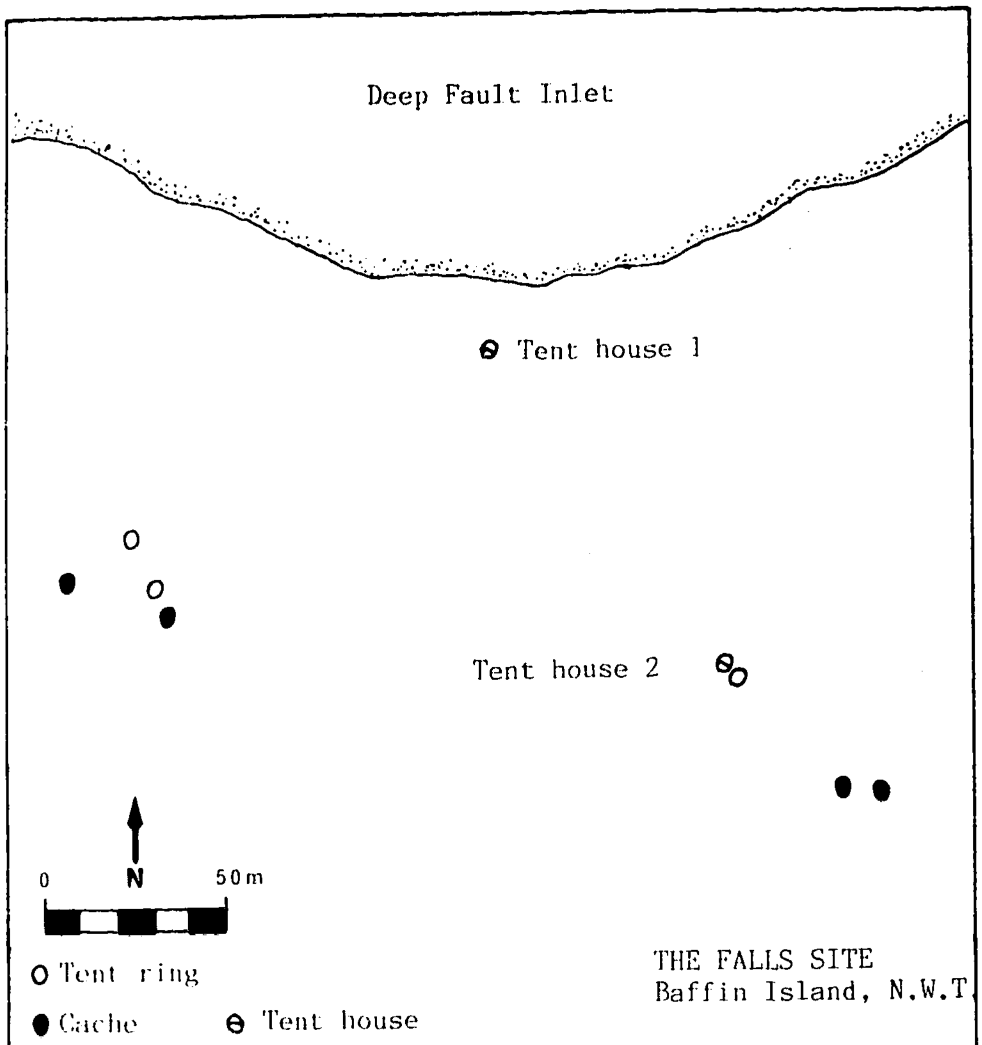

Figure 23. Map of site L1Dv-1, Padlei Narrows area, Nettilling Lake.

The Thule component at MaDv-3 consists of five heavy tent rings with multiple coursed walls and interior paving that is completely overgrown with vegetation. In addition, there are three Thule semi-subterranean houses with entry passages and clearly defined sleeping platforms. Small test pits were excavated in two of the tent rings, but these produced no artifactual material. Excavations were also conducted in semi-subterranean houses 1 and 2. House 1 (Figure 24) was completely excavated, exclusive of the entryway which was filled with large boulders locked in permafrost. The house measures 3.0 X 5.0 m and contained a thick soil overburden, averaging 8 to 10 cm in thickness. The living area of the house was paved with limestone slabs at a depth below datum of between 0.55 and 0.60 m. Most of the sleeping platform was dismantled, but it appears to have been raised only a few centimetres above the floor paving. No lamp/cooking areas were identified. House 1 yielded 15 artifacts and a small sample of faunal remains (almost exclusively caribou). Chert, slate and quartzite fragments dominate the assemblage, which also included a piece of notched whalebone and an oval slate disc with 5 double-drilled holes and a number of random striations and drill scars on its dorsal and ventral faces. The chert fragments are believed to predate the structure, and may have been embedded in blocks of sod cut from a Paleoeskimo midden.

House 2 abuts onto the south bank of the narrow point of land on which the site is situated, with the entry partially slumped downslope as a result of undercutting by wave action. The house measures 2.5 x 1.9 m and has a thick surface vegetation cover. Two test pits were partially excavated in this feature, one in the area of the sleeping platform and another in the entryway. These also yielded chert and slate fragments and a small faunal sample. Although the age and contemporaneity of these features cannot be determined from the available evidence, neither feature produced any contact material and both are thought to pre-date the nineteenth century.

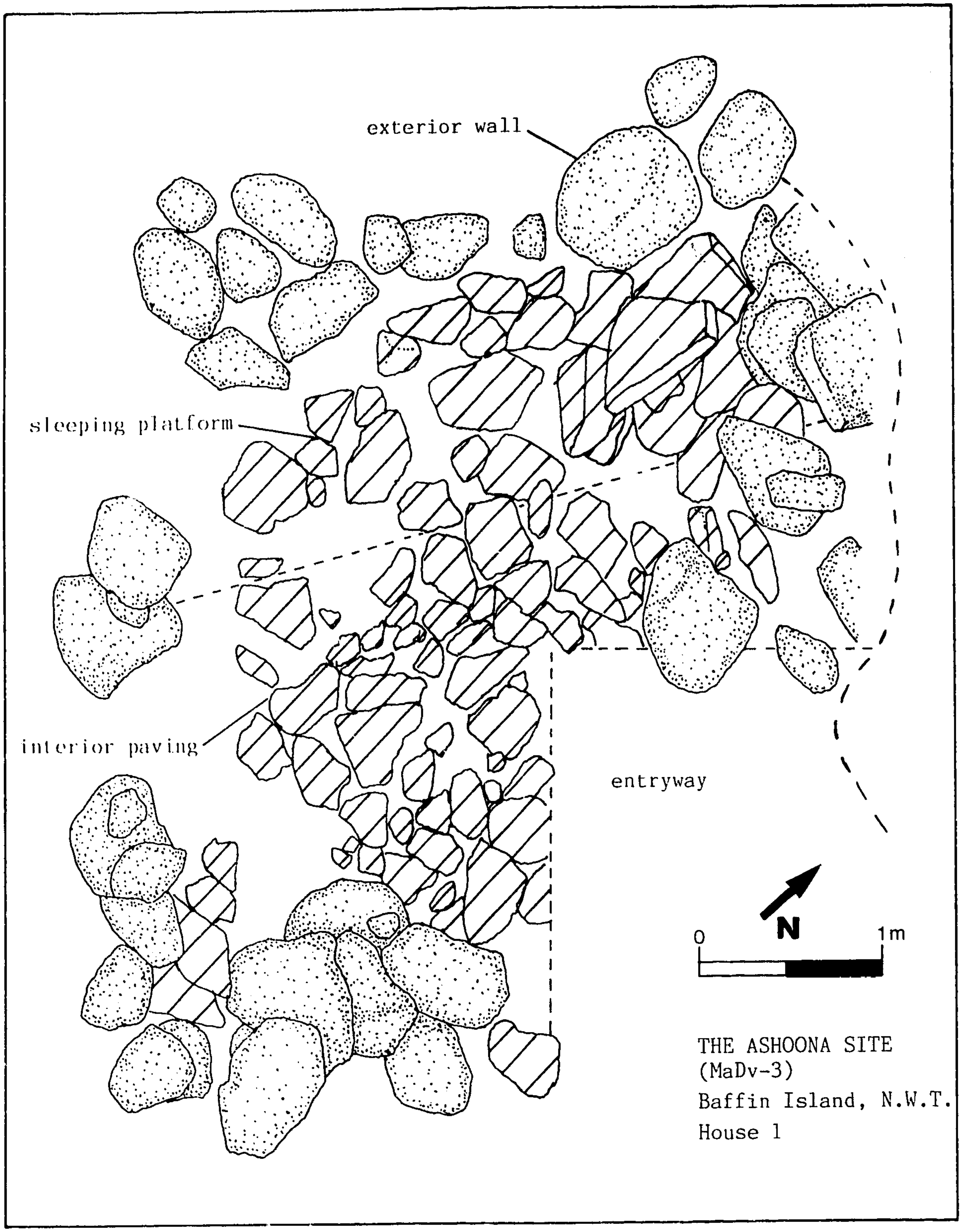

Figure 24. Plan view of House 1, Ashoona site (MeDv-3).

Prehistoric.

Three sites are of indeterminate age, but considered to be prehistoric. The Meadow Bay site (MaDu-1) is located on the west side of Meadow Bay on the top of a large promontory which juts into the same bay. It consists of a single boulder cache constructed against a shattered glacial erratic. The cache contained no artifacts or faunal remains and there is no other evidence of a camp here. Site MaDu-3 consists of two route cairns marking the entrance and head of a narrow fault running SSW approximately 2.5 km east of Tundra Point. The entrance cairn is located on the east side of the fault, and on the west at the head of the fault. No evidence of a camp was found in the vicinity, but it is interesting to note that this topographic feature appears on one of the Inuit maps drawn for Boas (1885). MaDv-9 is situated at the northern tip of a north-south oriented moraine 3 km west of Tundra Point. It consists of a single, very old tent ring deeply settled into the ground surface and with slight to moderate vegetation cover. No surface materials were noted and no testing was done.

West Burwash Moraine Survey

Surveys along the west side of Burwash Bay extended along the West Burwash Moraine from a point near its southern end where it is cut by a small river, to the southern end of Tikeraq Bay (Figures 25, 26; Table 10). This moraine, and one further to the west, form natural highways linking different parts of western Burwash Bay, and also form the eastern border of Tikeraq Bay. The extensive wet lowlands below the moraines are easily monitored for game, and provide well-vegetated range for caribou and nesting areas for snow geese. A total of 20 sites were located covering a time period of approximately 3000 years.

Recent.

The modern period is represented by three sites: LlDw-4, LlDw-5 and LlDw-6. These sites all relate to Department of National Defense aerial mapping activities during the 1970's. The LlDw-4 site consists of 16 tent rings, 3 fire pits, a low rock "wall" and one cairn. The

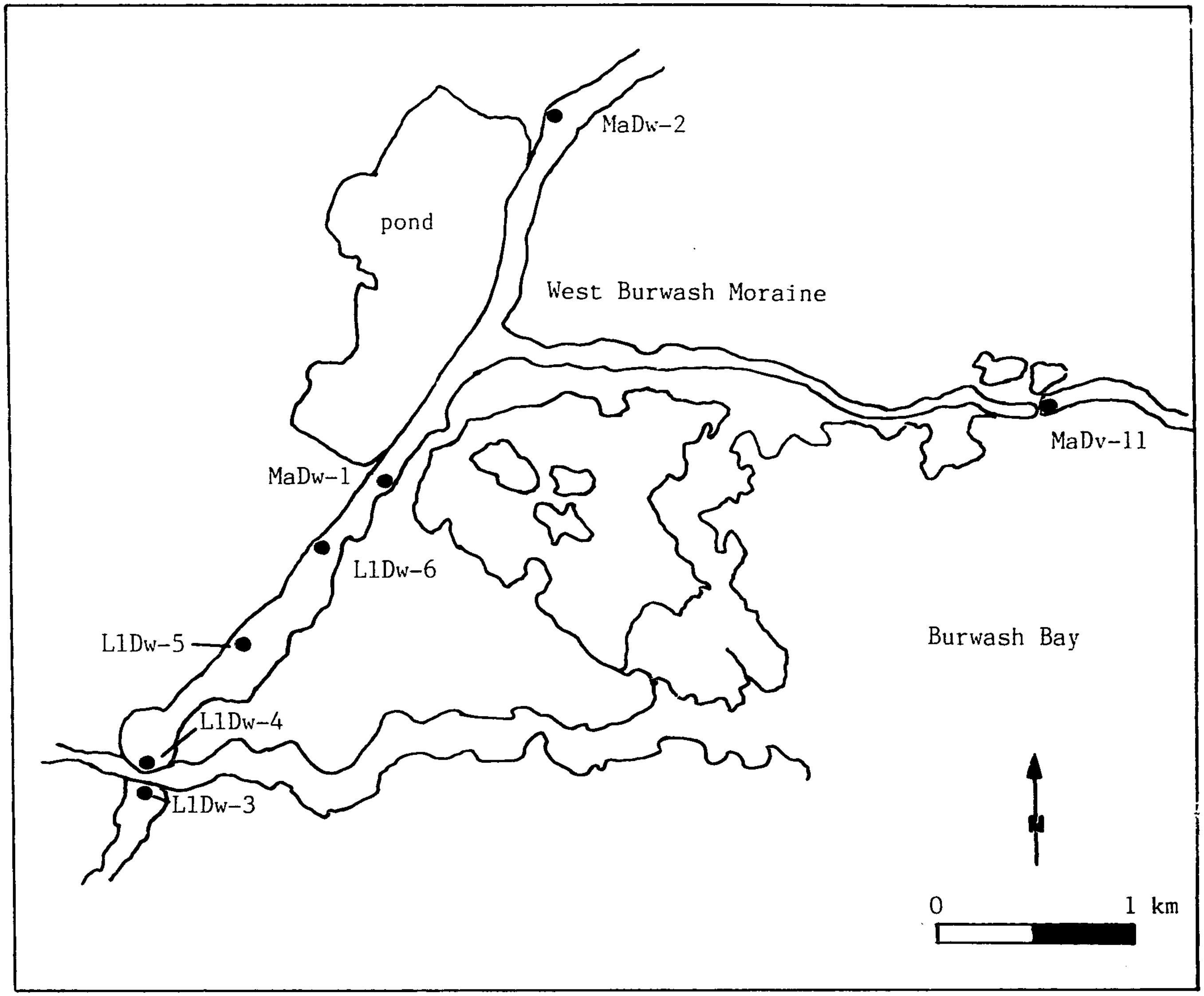

Figure 25. Map showing location of sites recorded in the southern portion of the West Burwash Moraine survey area, Nettilling Lake.

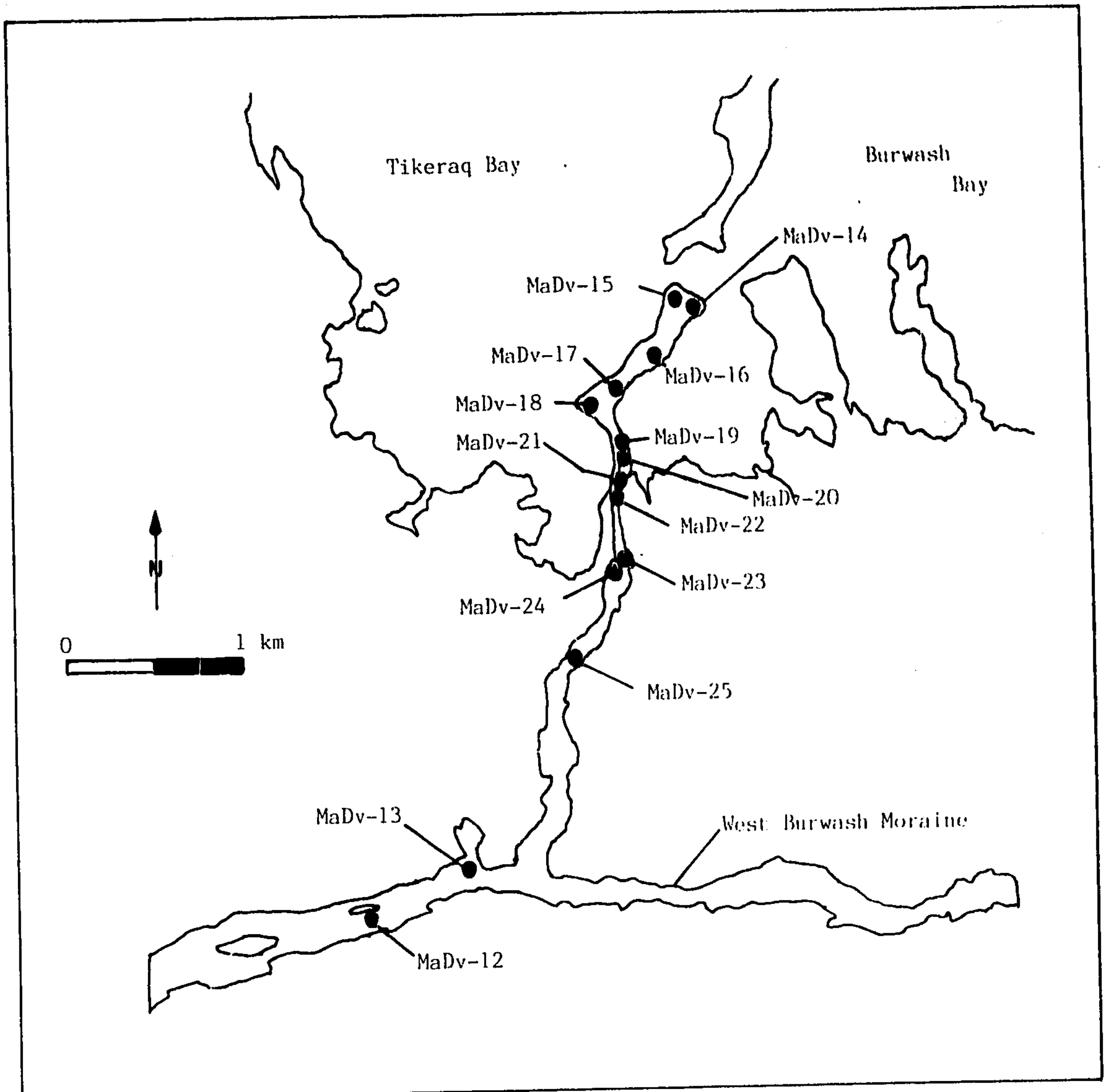

Figure 26. Map showing location of sites recorded in the northern portion of the West Burwash Moraine survey area, Nettilling Lake.

Table 10. Summary of Archaeological Sites: West Burwash Moraine Survey.

Site	MaDv-11				MaDv-12	MaDv-13	MaDv-14	MaDv-15
Component	a	b	c	d				
TRa*	-	-	2	-	-	3	1	-
TRb	-	-	-	-	-	-	-	-
TRc	-	-	-	-	2	1	-	3
TRd	-	-	-	14	-	-	-	-
TRe	-	-	-	-	-	-	-	-
TRf	-	-	-	-	-	-	-	-
Hearth	-	-	-	-	1	2	-	2
Semi-Sub.	1	-	-	-	-	1	-	-
Qarmat	-	8	-	-	-	-	-	-
Burial	-	-	-	-	-	-	-	-
S. Fox Trap	-	-	-	-	-	-	-	-
M. Fox Trap	-	-	-	-	-	-	-	-
H. Blind	-	-	-	-	-	-	-	-
Kayak Stand	-	-	-	-	-	-	-	-
Cache	-	-	-	-	-	2	1	-
Inukshuk	-	-	-	-	6	-	-	-
Cairn	-	-	-	-	-	-	-	-
Total	1	8	2	14	9	9	2	5
Cultural Affiliation	T	I	PD	I	I	?P	?P	I

* see Figure 16.
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

Table 10 continued. Summary of Archaeological Sites: West Burwash Moraine Survey.

Site	MaDv-16	MaDv-17	MaDv-18	MaDv-19	MaDv-20
Component					
TRa*	-	-	3	-	2
TRb	-	-	3	-	-
TRc	-	-	1	-	-
TRd	-	5	-	-	-
TRe	-	-	-	-	-
TRf	-	-	-	-	-
Hearth	-	2	-	-	-
Semi-Sub.	-	-	-	-	-
Qarmat	-	-	6	1	-
Burial	-	-	3	1	-
S. Fox Trap	-	-	-	-	-
M. Fox Trap	-	-	-	-	-
H. Blind	-	-	-	-	-
Kayak Stand	-	-	-	-	-
Cache	-	-	-	-	1
Inukshuk	-	-	1	-	-
Cairn	1	-	-	-	-
Total	1	7	17	2	3
Cultural Affiliation	?P	I	T/I/?P	T	?P

* see Figure 16.
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

Table 10 continued. Summary of Archaeological Sites: West Burwash Moraine Survey.

Site	MaDv-21	MaDv-22	MaDv-23	MaDv-24	MaDv-25	MbDv-1
Component						
TRa*	1	-	2	-	-	1
TRb	-	-	-	-	1	-
TRc	-	-	-	-	1	-
TRd	-	-	-	-	-	-
TRe	-	-	-	-	-	-
TRf	-	-	-	-	-	-
Hearth	-	-	-	-	-	-
Semi-Sub.	-	-	-	-	-	-
Qarmat	-	-	-	-	-	-
Burial	-	-	-	-	-	-
S. Fox Trap	-	-	-	-	-	-
M. Fox Trap	-	-	-	-	-	-
H. Blind	-	-	-	-	-	-
Kayak Stand	-	-	-	-	-	-
Cache	-	-	-	1	-	-
Inukshuk	-	1	-	-	-	-
Cairn	1	-	-	-	-	-
Total	2	1	2	1	2	1
Cultural Affiliation	?P	?P	?P	?P	?P	?P

*see Figure 16.
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

tent rings are of variable form; some are rectangular and so large that they must represent stones used to secure the apron of a parcoll-style building. Others appear related to smaller sized tents. Lichen trim lines visible on all of the boulders indicate their use during the recent past. Surface debris is abundant at the site and assumes a variety of forms, including five 45 gallon fuel drums, nylon rope, burned wood, tin cans, spikes, bits of clothing and cutlery, plastic pails, cigarette butts, lead pipe, buried trash cans, broken glass, etc. This site also contains a government Survey Bench Mark (National Defense Canada #779510).

The LlDw-5 site is located approximately 400 m northeast of LlDw-4 and contains one small oval tent ring measuring 2.0 x 3.0 m, and an associated small boulder pile interpreted to be a cache. Surface debris similar to that from LlDw-4 was found in the tent ring (tin cans lids) and based on this evidence the site assigned tentatively to the same time period.

Site LlDw-6 is located 220 m further north along the moraine and consists of five generally small and light tent rings, the largest of which measures 5.0 x 5.5 m. All of the stones used in the rings have prominent lichen trim lines indicating their recent use, and although no artifacts were found on the surface of any features this site is also thought to relate to the National Defense Project and is assigned to the modern era.

Late Historic.

Three Late Historic sites were identified. The Oasis site (MaDv-12) (Figure 27) is located on the southern edge of a small pond in the center section of the moraine, just west of the point where the moraine turns toward Tikeraq Bay. The site has nine features: 2 lightly constructed tent rings, 6 Inuksuit and 1 stone box hearth. Surface debris here (not collected) includes small fragments of cloth and canvas and a small amount of caribou bone (< 20 elements). On the basis of the surface material the site is estimated to date to the last 50 to 60 years.

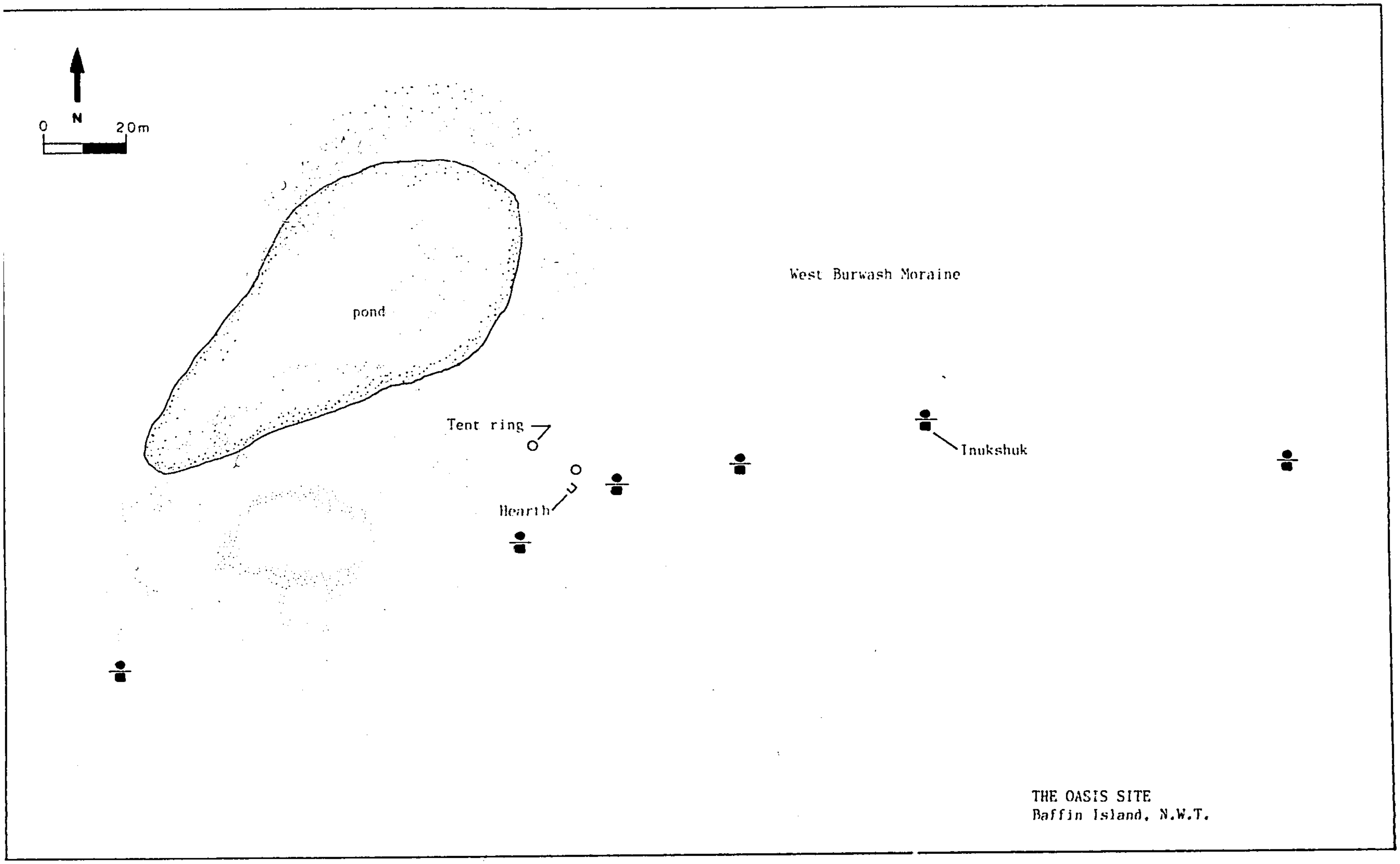

Figure 27. Map of the Oasis site (MaDv-12), Nettilling Lake.

The Spit site (MaDv-13) (Figure 28) is located at the intersection of a small, northward projecting segment of the West Burwash Moraine with its main axis. It consists of 4 tent rings (average dimensions 4.0 X 3.0 m), 1 cache and 1 Thule semi-subterranean-style house.

Site MaDv-17 is located near the northern end of the Tikeraq Moraine. There are 5 tent rings in this site all of which have interior stone box hearths and paved sleeping areas. Their average measurements are 5.0 X 3.8 m, and all were associated with "modern" wood and metal fragments. These have tentatively been dated to the past 50 to 75 years.

Early Historic.

Four sites from this period were recorded. The Mosquito Ridge site (MaDv-11)(Figure 29) is a multi-component site situated near the midpoint of a 2 km long esker extending from the west shore of Burwash Bay. It is located at the point of the first major division of the esker, near two small ponds. The main site component consists of 30 features of variable form and antiquity, but which can be broadly divided into tent rings and semi-subterranean types. All of the tent rings are situated along the crest of the esker, and all semi-subterranean forms are located along the southern perimeter of the feature, at the water's edge. The highest elevation of the esker above lake level is 3.1 m. Except for scattered areas of exposed limestone gravel, the surface of the site is well vegetated. The esker is bordered on the the north by two large tundra ponds, and to the south by Burwash Bay. The southern margin is fronted by a relatively narrow beach zone and steep banks, portions of which are actively eroding into the bay. Several cultural features are being seriously damaged by these erosional processes.

The historic components at Mosquito Ridge consist of 14 tent rings, and 8 semi-subterranean houses with low exterior walls, shallow interiors and short entry passages all of which are completely covered by surface vegetation. In several of the semi-subterranean features the entries have been partially eroded by wave action. Six of the houses occur in

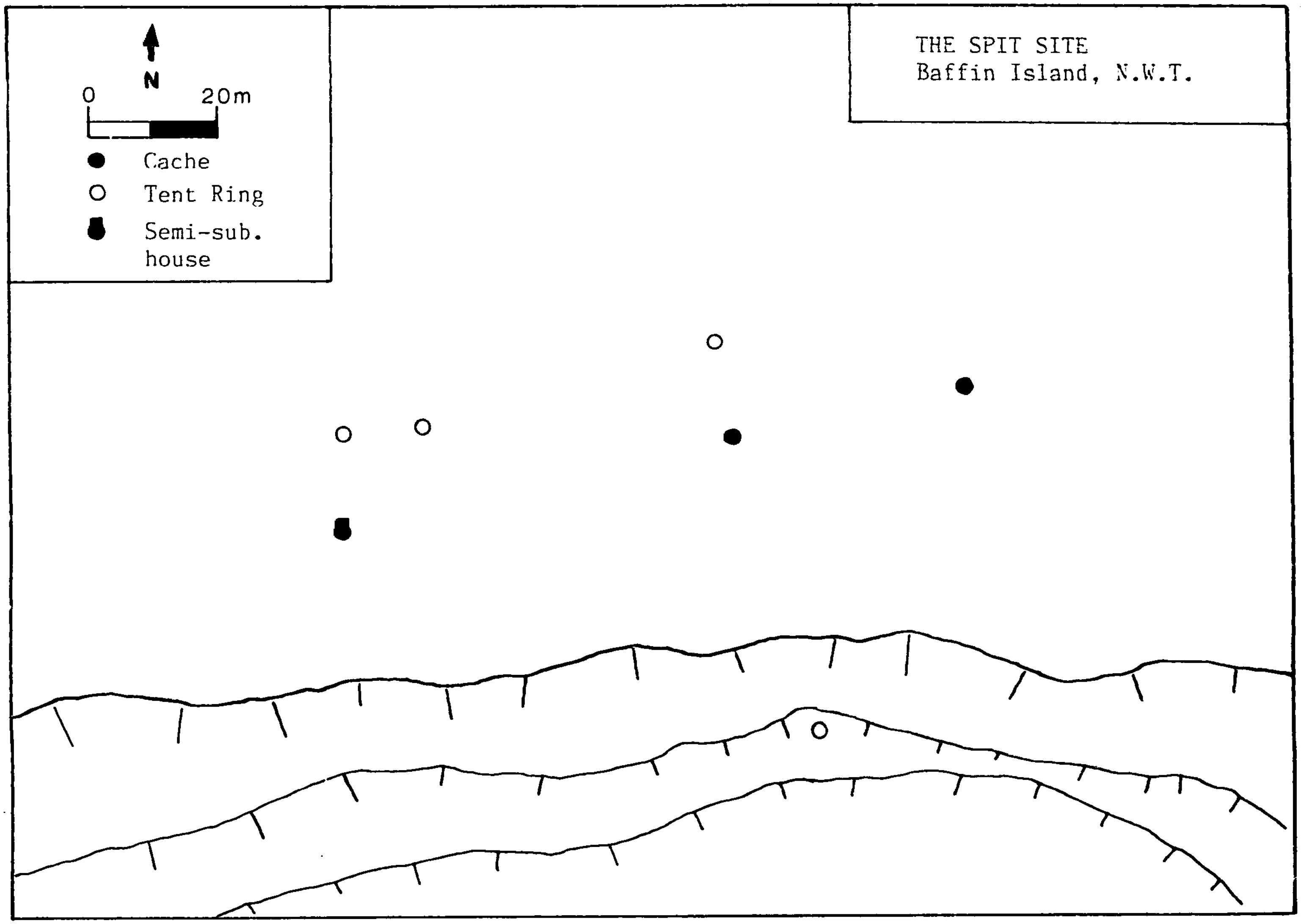

Figure 28. Map of the Spit site (MaDv-13), Nettilling Lake.

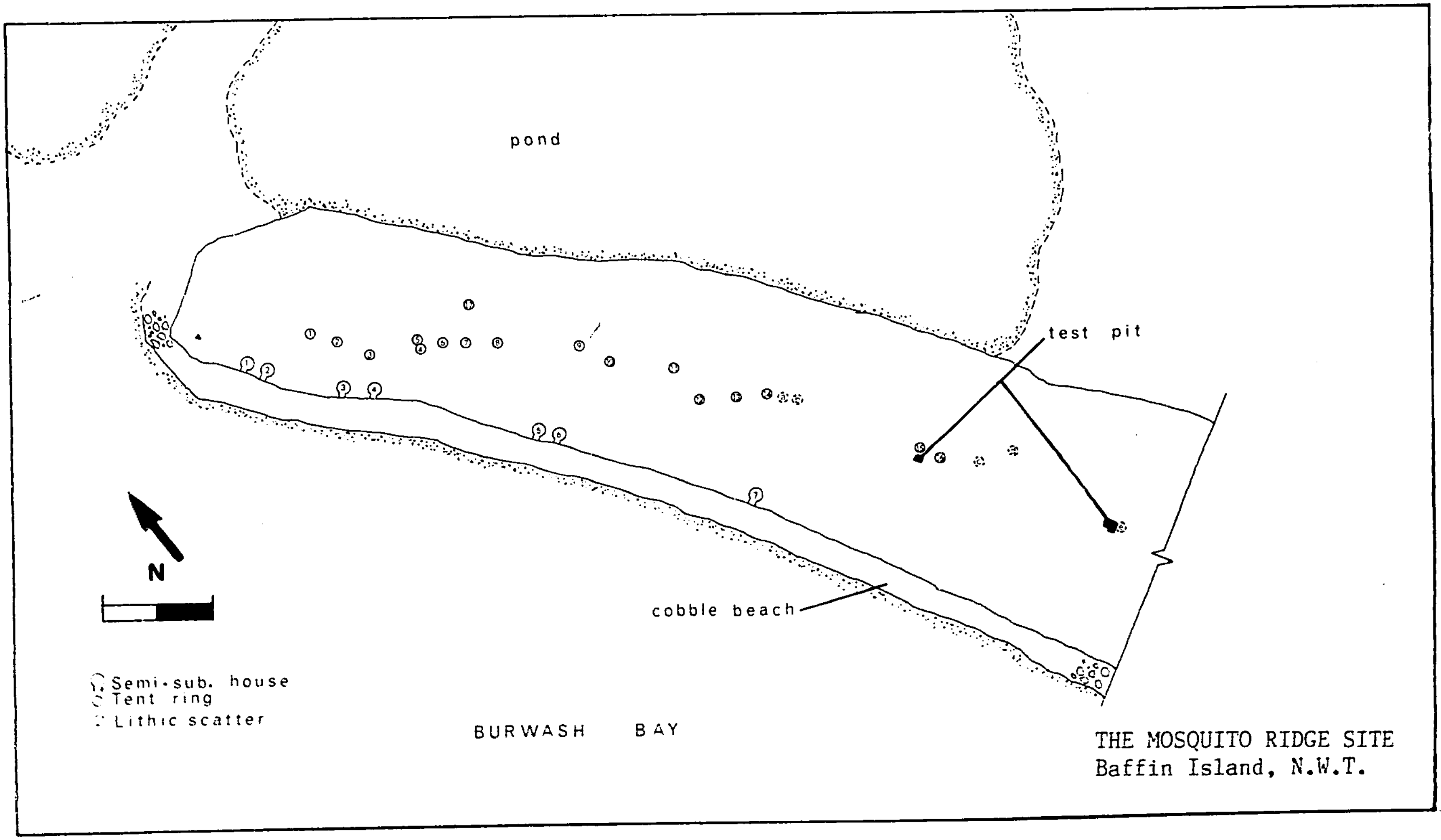

Figure 29. Map of the Mosquito Ridge site (MaDv-11), Nettilling Lake.

three pairs, and two are isolated. All of these features are situated on the southern margin of the esker.

Test excavations were conducted in two tent rings and one semi-subterranean house. Tent Ring 11 (Figure 30) is an oval form with well-defined walls, sleeping platform/pavement and stone box hearth. It measures approximately 4.0 X 4.0 m. Four 1.0 X 1.0 m units were excavated. Surface material was limited to one retouched chert flake found on an exposed area of the overburden which consisted of a thin layer (0.05 - 0.08 m) of sod overlying a dark sandy/gravel matrix. All units were excavated to sterile gravel, occurring at depths of between 0.15 and 0.20 m. A single fragment of wood and some faunal remains were found, but the rest of the artifact collection consists of chert detritus recovered between 0.05 and 0.20 m depth below datum (DBD). This material is believed to originate from the Pre-Dorset occupation of the site and the tent ring is not considered to be of similar age.

Tent Ring 9 (Figure 31) is similar in form to number 11 and measures approximately 5.0 x 4.0 m. Four test units were also excavated in this feature. The overburden here consist of patchy moss and sod to a depth below surface of approximately 0.08 m. Beneath this is a gravel base excavated in each unit to a depth of 0.20 m. The upper levels, (between 0.05 and 0.07 m below surface) of the units produced small amounts of contact material including a metal tobacco label, old shotgun shell (with a copper[?] jacket) and a square iron (spike?) fragment. These suggest an early historic date for the feature. As was the case in tent ring 11, the artifact assemblage is dominated by chert detritus including retouched flakes and a spalled burin. Neither feature displays any structural characteristics typical of Pre-Dorset sites reported from other parts of the eastern Arctic (e.g., mid-passage) These tent rings (and others not tested) are similar in form to historic era sites observed elsewhere on Nettilling Lake and in the Frobisher Bay and Cape Dorset areas. Based on the limited amount of information available, they are assigned to an occupation late in the 19th or possibly early in the 20th century. The recovery context of the chert artifacts suggests these are not

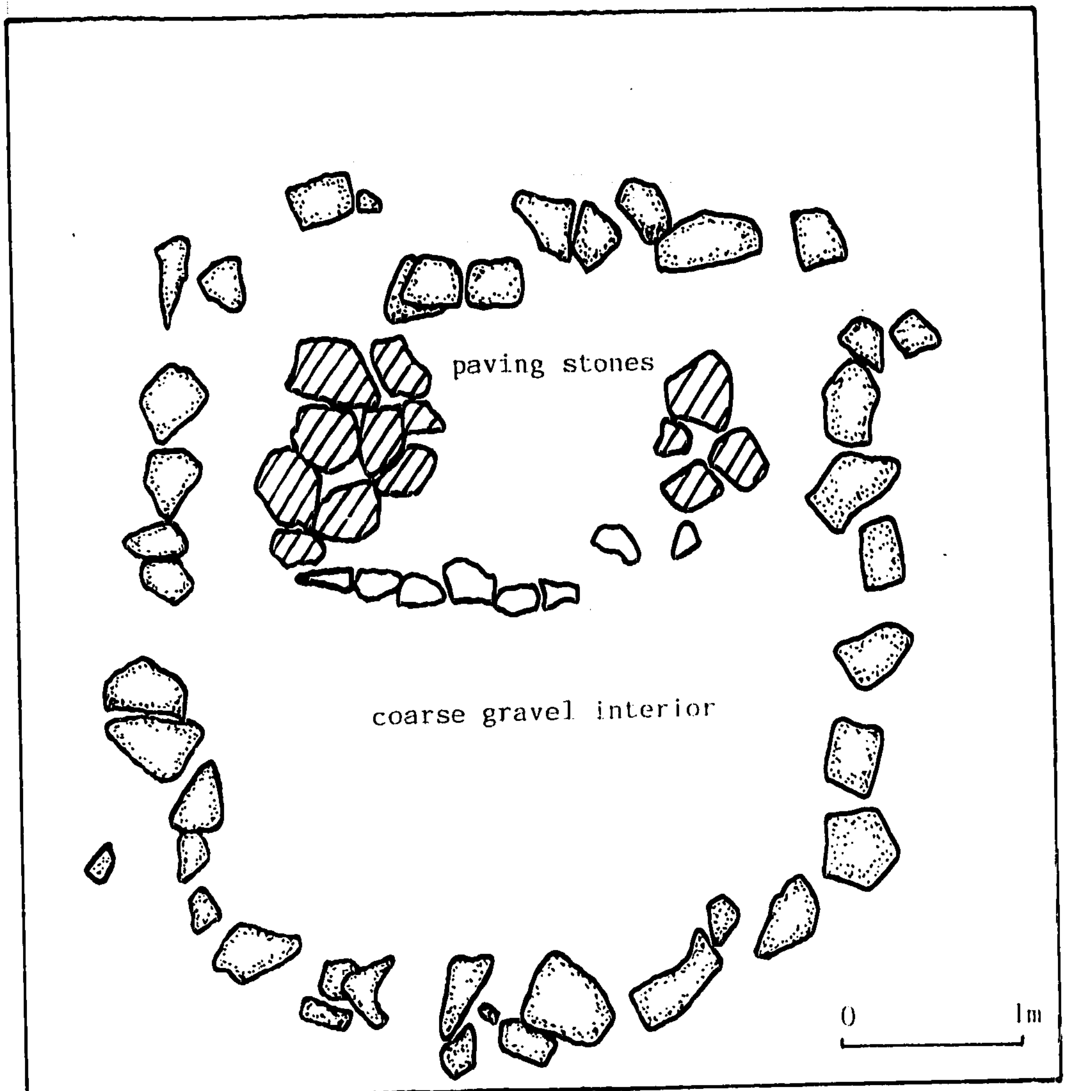

Figure 30. Plan view of Tent Ring 11, Mosquito Ridge site.

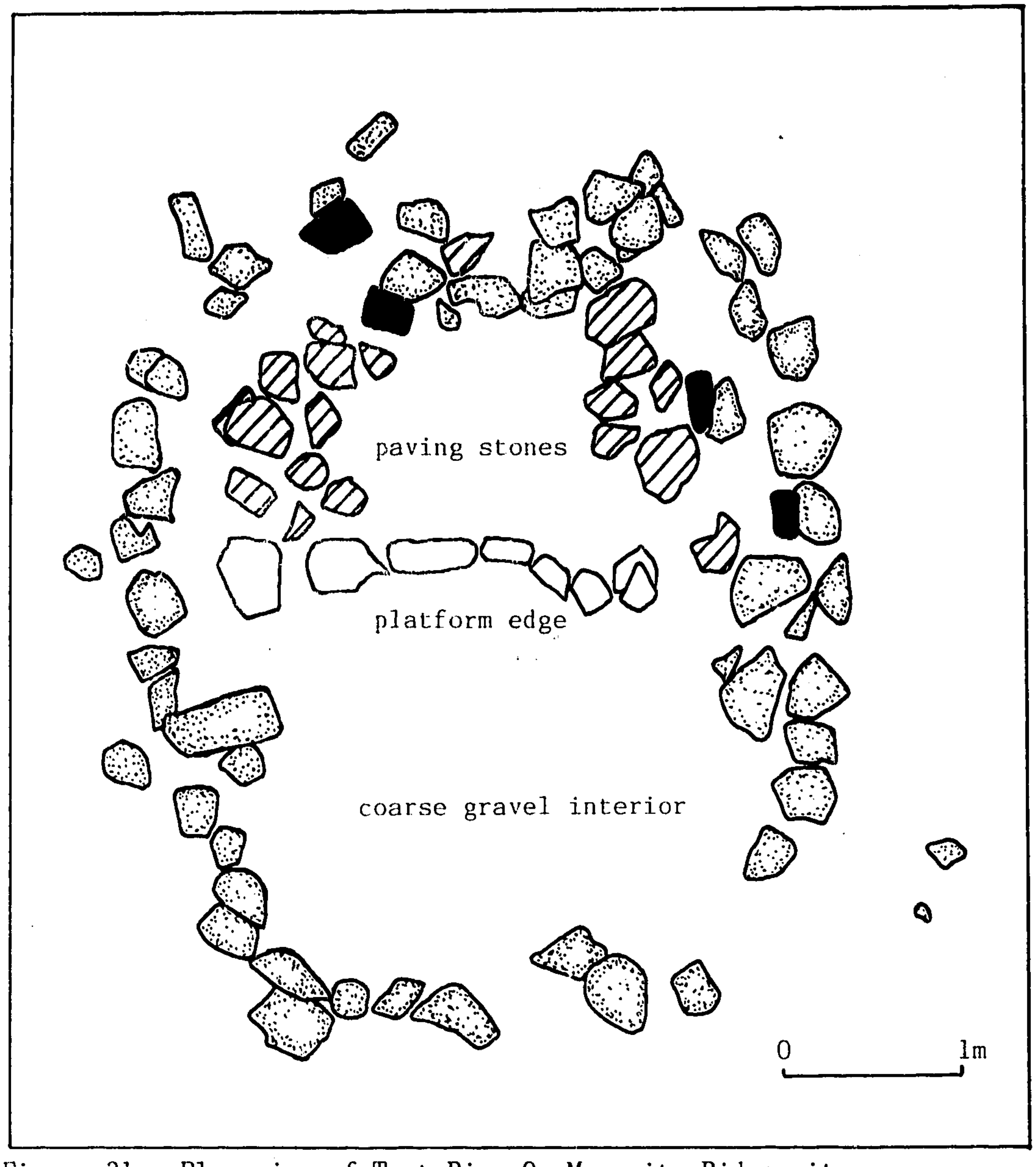

Figure 31. Plan view of Tent Ring 9, Mosquito Ridge site.

associated with the tent rings, but relate to an earlier, and clearly extensive Pre-Dorset component at this site.

Three test units were excavated in semi-subterranean House 2. Two units in the entryway were covered with a dense mat of prickly saxifrage (S. tricuspidata) and contained a large volume of faunal material dominated by bird bone (Chen hyperboreas), but including some seal and caribou. A large lintel stone was revealed, the top of which rested at a DBD of 0.95 m. Entry paving was reached at a depth below datum of 1.26 m. The only artifacts recovered from these units were some wooden shaft fragments in very poor condition, and a large chert flake with partial distal retouch. Most of the original entry appears to have slumped downslope, with the remaining portion being barely 1.0 m in length and 0.75 m in width.

A single 1.0 x 1.0 m unit was excavated in the central portion of the house. This was covered with a thick sod overburden (0.14 m) consisting of a tough mat of willow (Salix sp.) and other shrubs. Several large stones were encountered immediately below the sod,but these were resting above faunal material and appear to have either slumped down from the sleeping platform or were re-arranged prior to final abandonment. There were no other indications of stratification in this feature. As in the entryway, a thin layer of gravel overlay the interior paving which was reached at a DBD of 0.91 m. A small faunal sample was recovered, and the only artifacts were a worked wood fragment and a piece of a soapstone vessel neither of which could be recovered due to their waterlogged and extremely fragile condition.

Based on the available evidence, these house features would appear to be qarmat which possibly date from the late Thule/Early Historic period, perhaps even the eighteenth century. Certainly the extensive vegetation cover over all of the features suggests they have not been occupied for a considerable period of time, and not in the recent (i.e., 20th century) past.

Site MaDv-15 is situated on the northwest corner of the survey tract on the crest of the terminal point of the moraine in Tikeraq Bay. It is comprised of 3 tent rings having average dimensions of 4.0 x 4.0 m. Two of the rings have external stone box hearths and a small number of bone fragments (not collected) associated with them. Vegetation cover is light on these features, and in the absence of obvious indications of recent use it has been assigned to the early historic period.

MaDv-18 is is a multi-component site which extends southward from the prominent bend in the Tikeraq Moraine for a distance of about 400 m. It contains 17 individual features: 3 burials, 7 tent rings, 1 Inukshuk and 6 semi-subterranean houses (Figure 32). All of the burials appeared to contain a small amount of human skeletal material. As at the Mosquito Ridge site, the tent rings are concentrated along the centerline or crest of the moraine, and the semi-subterranean houses are situated along the southern (i.e., Tikeraq Bay side) edge of the landform. The tent rings are generally similar to others already described in the area. Most appear to be very old based on subjective estimates of lichen and vegetation cover, with some almost completely buried by surface vegetation. No surface artifacts or faunal materials were associated with any of the features. As at Mosquito Ridge, several of semi-subterranean houses are partially eroded into Tikeraq Bay. In fact, in nearly all respects these houses mirror those at the Mosquito Ridge site. Unfortunately, we were unable to test any of the features in the short time available, but it is probable that they relate to a late Thule/early historic autumn occupation of the southern part of Tikeraq Bay.

The final historic site is located at Gravel Point (MbDv-1). It consists of two tent rings located on the crest of the esker that terminates at Gravel Point, on the southwest shore of Nettilling Lake north of Tikeraq Bay. The features are 100 m apart and have sparse vegetation cover. On this admittedly subjective basis the site is tentatively assigned to the early historic period.

Thule.

Four Thule period sites/components were recorded. The Rack site (MaDw-2) (Figure 33) is located at the northeastern corner of a large rectangular pond bordering the north side of the

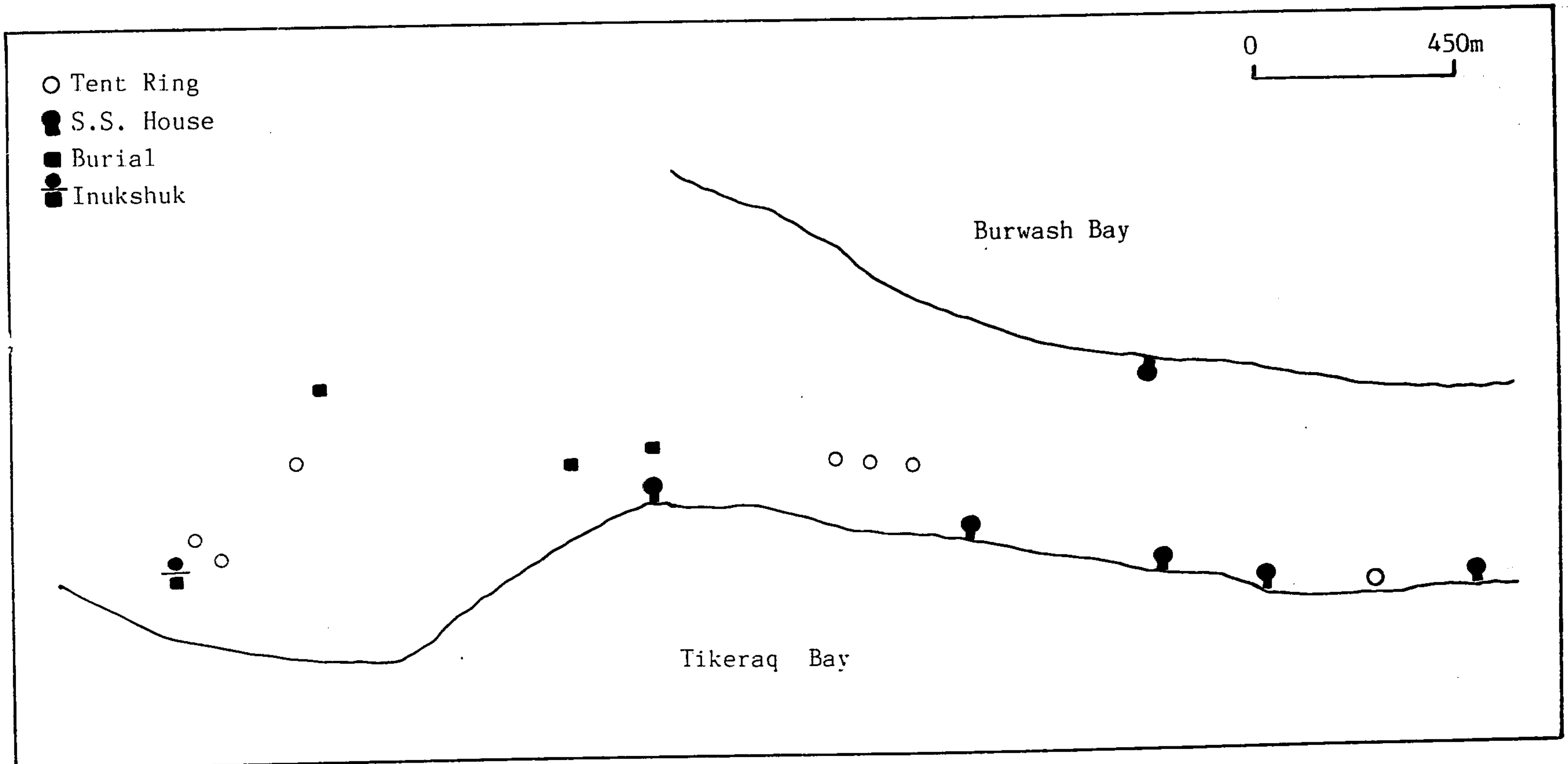

Figure 32. Map of the site MaDv-18, Tikeraq Bay district, Nettilling Lake.

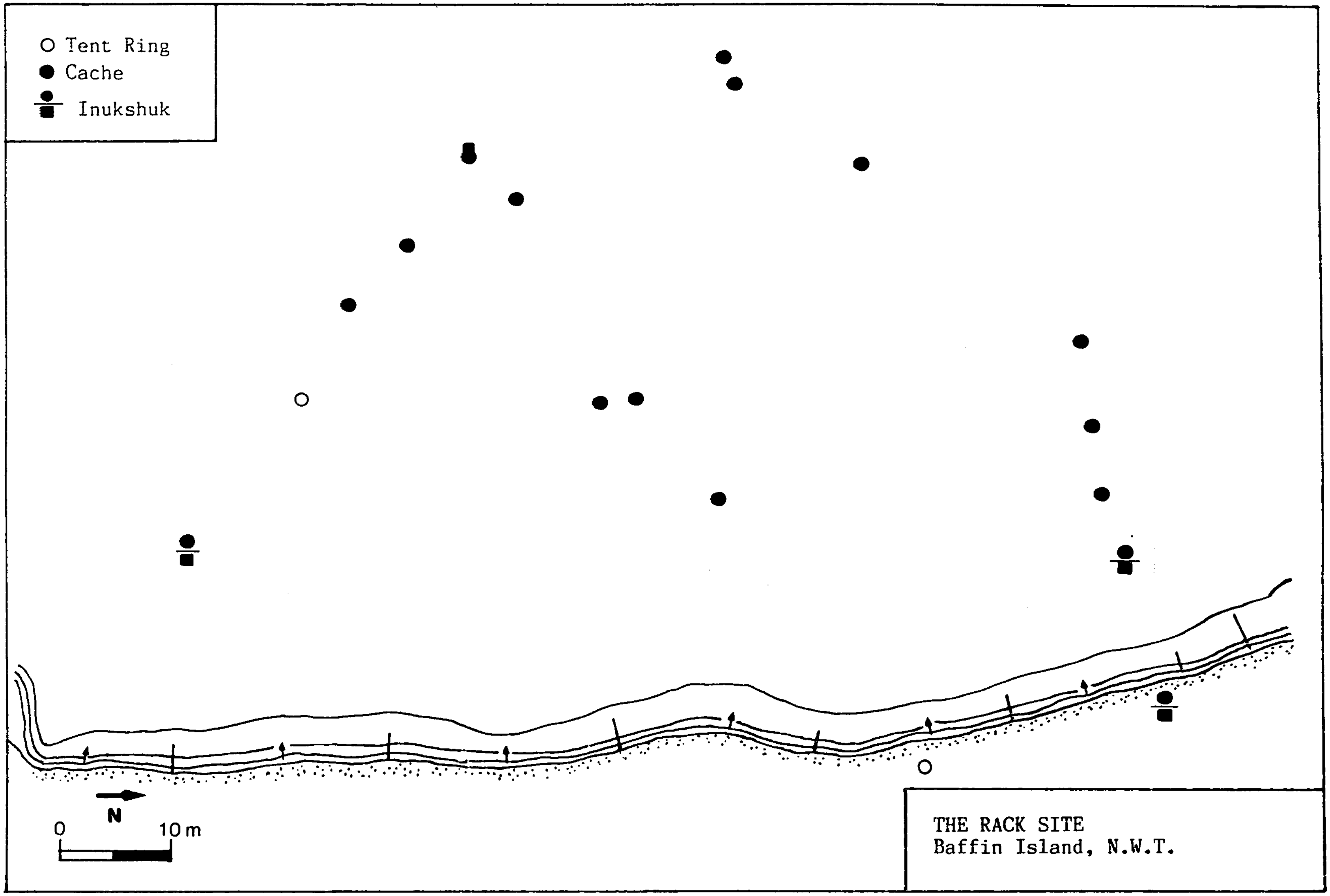

Figure 33. Map of the Rack Site (MaDw-2), Tikeraq Bay, Nettilling Lake.

West Burwash moraine. The site has two components. The first is situated on the northern edge of the moraine and consists of a single tent ring with perimeter stones set deeply set into the ground surface and covered by patchy vegetation (primarily mosses), and an Inukshuk 25 m further north. This feature had a nearly complete cover of lichens. The tent ring was not excavated; however, surface collecting yielded several bone fragments and two pieces of a weathered ivory trace buckle. The second component, which is the main part of the site, is situated below the north side of the moraine. Fifteen features were identified here: 3 tent rings, 2 Inuksuit and 10 caches. No cultural materials were recovered,but all features appear to be quite old based on the extensive lichen cover on the boulders used to construct the features. One of the tent rings is of substantial size and has a well-defined sleeping platform and entry passage. This features measures 6.0 x 6.0 m and is constructed of large and heavy stones. It has a thick cover of interior vegetation (mainly grasses) and Alectoria minuscula lichen blankets the perimeter stones. Based on the similarity of this structure to ones of Thule age excavated elsewhere on the lake, and its presumed contemporaneity with the remaining features, this site is considered to be of Thule age.

At the Mosquito Ridge site (MaDv-11) the Thule occupation is represented by House 9. This winter house measures approximately 4.0 x 5.0 m, and its interior is completely filled with fall rock from the original walls. The fall rock is approximately 90% covered with orange and black crustose lichens. The entry passage of the house has collapsed downslope due to wave erosion. Three test units were excavated in House 9. The remaining portion of the entryway was clearly defined by wall rocks and large flat slabs of limestone. This unit yielded a large volume of faunal material, primarily caribou, and its final use may have been as a cache. This function is suggested by the volume and type of faunal material and the presence of several layers of paving stones in the entry. The upper pavement, reached at a DBD of 1.36 m, was covered with a thick layer of caribou bone as well as some rotten wood fragments and what appeared to be tiny fragments of metal. Beneath this paving were three additional entry "floors", each of which was separated by barely a centimetre of cultural debris. The lowest pavement was reached at a depth of 1.7 m. The small amount of material associated with the lower pavements includes non-diagnostic fragments of worked bone and soapstone.

Two units were also excavated in the central living area of the house. The overburden here consists of a dark peaty soil including small lenses of gravel, overlying a floor pavement lying at a DBD of between 1.07 and 1.15 m. The upper surface of the sleeping platform is situated at a DBD of 0.85 m. These units produced little beyond some ground slate fragments and additional faunal remains. The formal characteristics of this feature which place it in the Thule period are confirmed by a radiocarbon age estimate of 1160-1376 AD.

Site MaDv-13 contains a semi-subterranean-style feature measuring 4.0 x 5.5 m. It has a large boulder perimeter and entry passage walls and its interior is completely filled with large stones. The surfaces of all stones are heavily encrusted with lichen (primarily Rhizocarpon sp.), and prickly saxifrage (S. tricuspidata) dominates plant growth in the interior of the structure.

The fourth Thule site (MaDv-19) is located at the narrowest point in the Tikeraq Moraine. It is on the west side of the moraine and contains 1 semi-subterranean house and 1 burial. The house measures 7.0 x 4.0 m and is completely covered by a thick sod mantle. Many of the entryway and exterior wall boulders have washed into the lake. The burial is approximately 2.0 x 1.0 m and is located 10 m southeast of the house. Neither feature was tested.

Paleoeskimo:Pre-Dorset.

A single Paleoeskimo site was located at MaDv-11. Two of the tent rings at the site are considered to be of Pre-Dorset age based on their small size and light construction (i.e., markedly different from the other tent rings), as well as their close proximity to five concentrations of chert debitage. Surface collections from these scatters produced 1 spalled burin, and subsurface tests adjacent Tent Ring 15 and Scatter "E" yielded additional detritus and 1 concave sidescraper.

A subsurface Pre-Dorset component was also identified as a result of the site erosion discussed earlier. Included with several chert flakes and bird and caribou faunal remains exposed on the south bank, approximately 2.5 m west of semi-subterranean House 1, was a spalled chert burin. Based on the degree of bleaching of exposed portions of associated faunal elements protruding from the overburden this artifact appears to have eroded from its original context some time ago. In an attempt to determine if this was an isolated find, a 0.70 X 0.25 m test cut was made 4.0 m west of House 1. This unit produced 19 chert artifacts (primarily detritus) and one antler artifact. It includes a biface fragment and another spalled chert burin. Also recovered was a small faunal sample, primarily caribou. As previously discussed, Pre-Dorset artifacts were also recovered from test excavations in the historic era tent rings. Based on the formal similarity of these artifacts with those from LlDv-10, radiocarbon dated to 2815 ±65 BP (Stenton 1986b), the Mosquito Ridge Pre-Dorset component is considered to be of approximately the same age.

Prehistoric.

Ten sites of unknown, but considered of prehistoric age were located. The Little River Site (LlDw-3) is situated on the surface of the West Burwash Moraine above the point where a small river has cut through the landform. It consists of three tent rings and an indeterminate number of caches. The perimeter stones of the tent rings have sunk into the moraine surface several centimetres, suggesting the features are of considerable age.

MaDw-1 is located near the southern end of a large rectangular pond bordering the north side of the West Burwash moraine. It is situated on the south face of the moraine and consists of a single oval tent ring measuring 3.5 x 2.5 m. The feature has considerable surface vegetation in its interior and the perimeter stones have extensive lichen cover and are deeply set into the ground surface. No surface artifacts were associated with the tent ring, however, it is considered to be of Thule age.

Site MaDv-14 is located on the northeast corner of the survey tract in Tikeraq Bay. It consists of one tent ring and associated boulder cache. The tent ring measures 5.0 x 5.0 m and is situated very close to the water line and slopes into Burwash Bay. The cache measures approximately 2.5 x 2.5 m, and like the tent ring contains no surface artifacts.

MaDv-16 is located approximately 600 m south of MaDv-14 and consists of a single, dismantled Inukshuk which was originally constructed on a large glacial erratic. There is extensive lichen cover on the fallen stones as well as the erratic,but the plant growth appears to have been accelerated by bird manure.

MaDv-20 is located approximately 150 m south of MaDv-19, on the crest of the Tikeraq Moraine. It contains 2 tent rings measuring 3.0 m^2 and 4.0 X 3.0 m, and a large pile of boulders covering an area of 5 m^2.

MaDv-21 is a small site is located 450 m south of MaDv-19 and contains two features: a tent ring measuring 6.0 X 4.0 m, and a small cairn. Both have extensive lichen cover over their surfaces, but neither had any associated cultural materials.

MaDv-22, lying south of MaDv-21 is a single Inukshuk constructed of three stones piled on top of one another. This is a typical Baffin "digit" cairn, which, judging by the extent of lichen cover was constructed long ago.

MaDv-23 is located 500 m south of the Inukshuk at MaDv-22, and consists of 2 tent rings with gravel and moss-covered interior surfaces. The tent rings measure 4.0 m^2 and 5.0 x 4.0 m respectively. No surface debris of any kind was associated with these features.

Site MaDv-24 is located 69 m west of MaDv-23 and contains a large pile of boulders interpreted to be a collapsed cache. Lichen cover is extensive on the feature.

The last site located in the Tikeraq survey is MaDv-25. situated 600 m north of the intersection of the West Burwash Moraine and the Tikeraq Bay Moraine. It consists of 2 habitation features: a large stone walled house with 4 small interior chambers, and a smaller rectangular tent ring a few metres to the west. The larger feature measures 10.0 x 8.5 m and is completely covered with orange lichen. The smaller tent ring is paved on the west side with flat limestone slabs and measure 3.0 x 3.5 m. No surface artifacts were found in either structure.

Summary

The West Burwash/Tikeraq Bay region was clearly important to inland summer and fall settlement during the Thule and early historic periods, and evidently during the Paleoeskimo era as well. The sites are situated close to the nesting grounds of snow geese (Chen hyperboreas) and other waterfowl, good fishing grounds, and are on a caribou migration route leading southward from the calving grounds to the winter range south and west of Amadjuak Lake. The discovery of semi-subterranean houses suggests periods of longer-term occupation here, with some groups possibly caching food surpluses during peak resource availability for extended fall or occasionally winter long occupations.

South Burwash Moraine

The South Burwash moraine runs in an northwest-southeast direction across the bottom of Burwash Bay, perpendicular to the Amadjuak River which enters Nettilling Lake here. The moraine extends for several kilometers to the southeast, and terminates in the northwest at the point where it intersects with the West Burwash Moraine (Figure 34; Table 11).

A total of 33 sites were located along this feature, primarily in three areas: (i) at the southeastern tip of the moraine, where it is cut by the Amadjuak River, (ii) in the central part of the moraine and (iii) where it intersects with the West Burwash moraine. Unfortunately, a large number of these sites cannot be accurately dated owing to a lack of associated artifacts and faunal material. However, excavations carried out at several sites provide clear evidence for occupations spanning the past 3000 years.

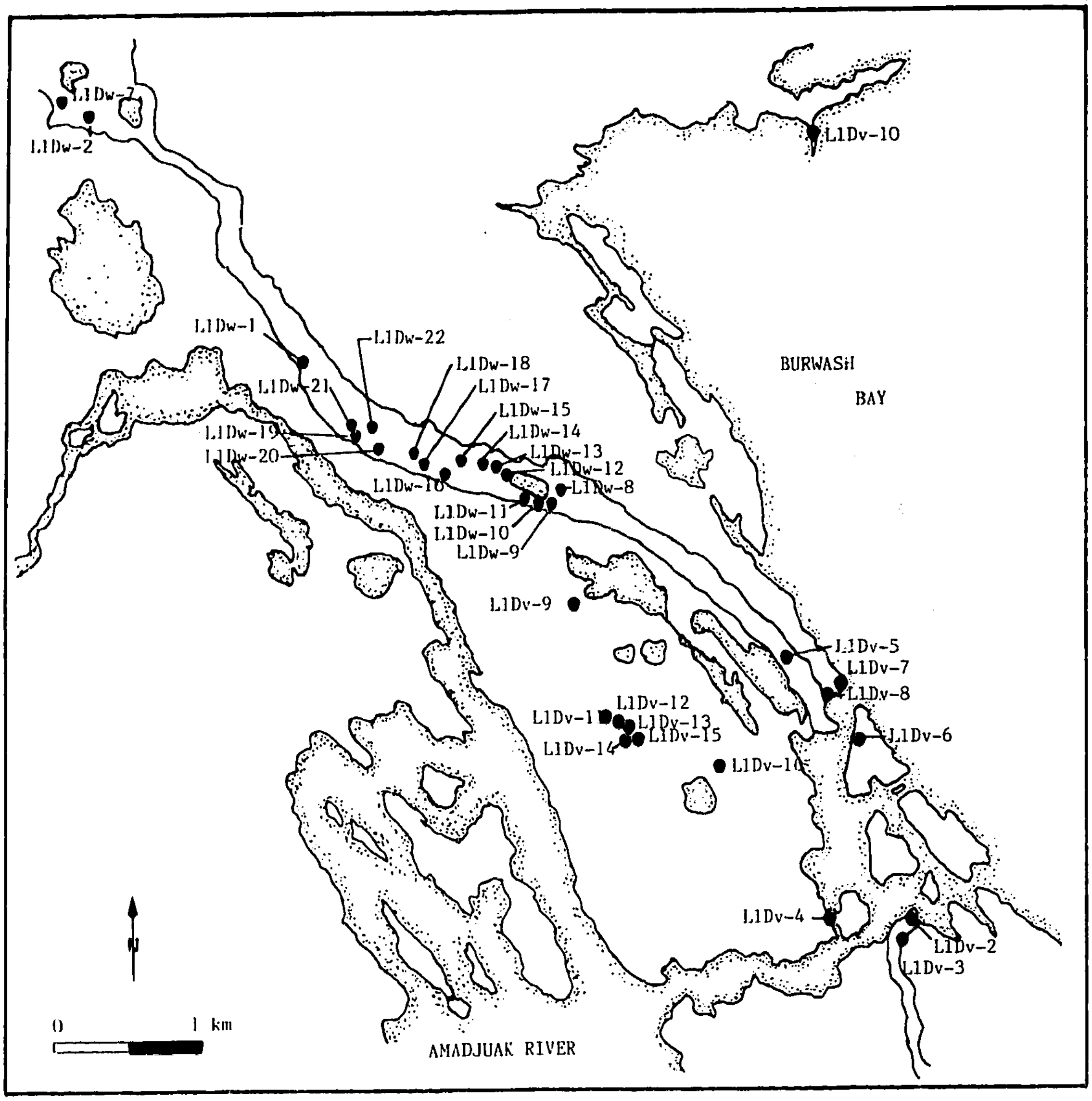

Figure 34. Map showing location of sites recorded in the South Burwash Moraine survey area, Nettilling Lake.

Table 11. Summary of Archaeological Sites: South Burwash Moraine Survey.

Site	LlDv-2		LlDv-3	LlDv-4		LlDv-5								LlDv-6	
Component	a	b		a	b	a	b	c	d	e	f	g	h	a	b
TRa*	-	-	-	2	2	3	6	-	-	-	-	4	6	-	4
TRb	-	-	2	-	-	-	1	-	1	-	-	-	-	-	-
TRc	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRd	3	1	-	-	-	-	3	3	-	13	10	-	-	-	-
TRe	-	-	-	-	-	-	3	1	-	12	-	-	-	-	-
TRf	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-
Hearth	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Semi-Sub.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Qarmat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Burial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. Fox Trap	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. Fox Trap	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. Blind	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Kayak Stand	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Cache	-	2	-	-	-	-	49	8	5	19	1	-	1	1	-
Inukshuk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cairn	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	3	4	2	2	2	3	65	12	7	45	11	4	8	1	4
Cultural Affiliation	?P	D?	I	D	D?	I	T	T	T	T	T?	I	I	?P	?P

*see Figure 16.
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

Table 11 continued. Summary of Archaeological Sites: South Burwash Moraine Survey.

Site	LlDv-12	LlDv-13	LlDv-14	LlDv-15	LlDv-16
Component					
TRa*	-	-	-	-	2
TRb	-	-	-	-	-
TRc	-	-	-	-	-
TRd	-	-	-	-	-
TRe	-	-	-	-	-
TRf	-	-	-	-	-
Hearth	-	-	-	-	-
Semi-Sub.	-	-	-	-	-
Qarmat	-	-	-	-	-
Burial	-	-	-	-	-
S. Fox Trap	-	-	-	-	-
M. Fox Trap	-	-	-	-	-
H. Blind	-	-	-	-	-
Kayak Stand	-	-	-	-	-
Cache	1	1	2	2	6
Inukshuk	-	-	-	-	2
Cairn					
Total	1	1	2	2	10
Cultural Affiliation	?P	?P	?P	?P	?P

*see Figure 16.
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

Table 11 continued. Summary of Archaeological Sites: South Burwash Moraine Survey.

Site	LlDw-9	LlDw-10	LlDw-11	LlDw-12	LlDw-13
Component					
TRa*	-	-	-	1	2
TRb	-	1	-	-	-
TRc	-	-	-	-	-
TRd	-	-	-	-	-
TRe	-	-	-	-	-
TRf	-	-	-	-	-
Hearth	-	-	-	1	-
Semi-Sub.	-	-	-	-	-
Qarmat	-	-	-	-	-
Burial	-	-	-	-	-
S. Fox Trap	-	-	-	-	-
M. Fox Trap	-	-	-	-	-
H. Blind	-	-	-	-	-
Kayak Stand	-	-	-	-	-
Cache	-	-	-	-	3
Inukshuk	1	-	1	-	-
Cairn	-	-	-	-	-
Total	1	1	1	2	5
Cultural Affiliation	?P	?P	?P	?P	?P

*see Figure 16.
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

Table 11 continued. Summary of Archaeological Sites: South Burwash Moraine Survey.

Site	LlDw-19	LlDw-20	LlDw-21	LlDw-22
Component				
TRa*	-	-	2	1
TRb	2	-	-	-
TRc	-	-	-	-
TRd	-	-	-	-
TRe	-	-	-	-
TRf	-	-	-	-
Hearth	-	-	-	-
Semi-Sub.	-	-	-	-
Qarmat	-	-	-	-
Burial	-	-	-	-
S. Fox Trap	-	-	-	-
M. Fox Trap	-	-	-	-
H. Blind	-	-	-	-
Kayak Stand	-	-	-	-
Cache	-	1	2	-
Inukshuk	-	-	-	-
Cairn	-	-	-	-
Total	2	1	4	1
Cultural Affiliation	?P	?P	?P	?P

*see Figure 16.
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

Table 11 continued. Summary of Archaeological Sites: South Burwash Moraine Survey.

Site	LlDw-14	LlDw-15	LlDw-16	LlDw-17	LlDw-18
Component					
TRa*	2	1	-	1	1
TRb	-	-	-	-	-
TRc	-	-	-	-	-
TRd	-	-	-	-	-
TRe	-	-	-	-	-
TRf	-	-	-	-	-
Hearth	-	-	-	-	-
Semi-Sub.	-	-	-	-	-
Qarmat	-	-	-	-	-
Burial	-	-	-	-	-
S. Fox Trap	-	-	-	-	-
M. Fox Trap	-	-	-	-	-
H. Blind	-	-	-	-	1
Kayak Stand	-	-	-	-	-
Cache	-	-	-	-	-
Inukshuk	-	-	3	-	-
Cairn	-	-	-	-	-
Total	2	1	3	1	2
Cultural Affiliation	?P	?P	?P	?P	?P

*see Figure 16.
e - estimate
I - Inuit
T - Thule
D - Dorset
PD - Pre-Dorset
?P - Unknown Prehistoric

Recent.

Two sites date from the modern era. The Tuktumoon Site (LlDv-5) is a large site with eight components stretching along the crest of the South Burwash moraine. The surface of the moraine sits at an elevation of approximately 7.5 m above lake level, and the site extends west from the mouth of the Amadjuak River for 1.5 km.

Included among the features are three groups of tent rings of comparatively recent age. Component A (Figure 35) consists of three light tent rings with prominent lichen trim lines and surface debris including shell casings, paper and plastic fragments, cigarette butts, etc. The general site area is occasionally used for recreational purposes by residents of Iqaluit and these features may have resulted from such use. Component G consists of four tent rings of similar form, and associated with debris similar to that found in Component A, as well as fragments of wood and .22 calibre and .303 calibre shell casings. Component H consists of six light tent rings, one external stone box hearth and a small pile of boulders interpreted to be a cache. These tent rings also contained fragments of rope, plastic, shell casings of similar calibre, and small pieces of wood and metal.

Late Historic.

The Late Historic period is represented by three sites. The Junction A site (LlDw-2) is located near the intersection of the South and West Burwash Moraines (Figure 36) on the west slope of the landform. It overlooks an extensive wet tundra meadow and is an excellent vantage point from which to both monitor and hunt caribou. The site contains 6 tent rings, 6 caches and 2 cairns, all considered to be of 20th century age. There is considerable surface debris at the site including metal scrapers with wooden handles as well as wood, metal and tarp(?) fragments. Fragments of caribou bone also litter the surface. No subsurface excavations were performed, however, missing in the surface assemblages from these features are plastics, cigarette filters, and other products widely available during the past

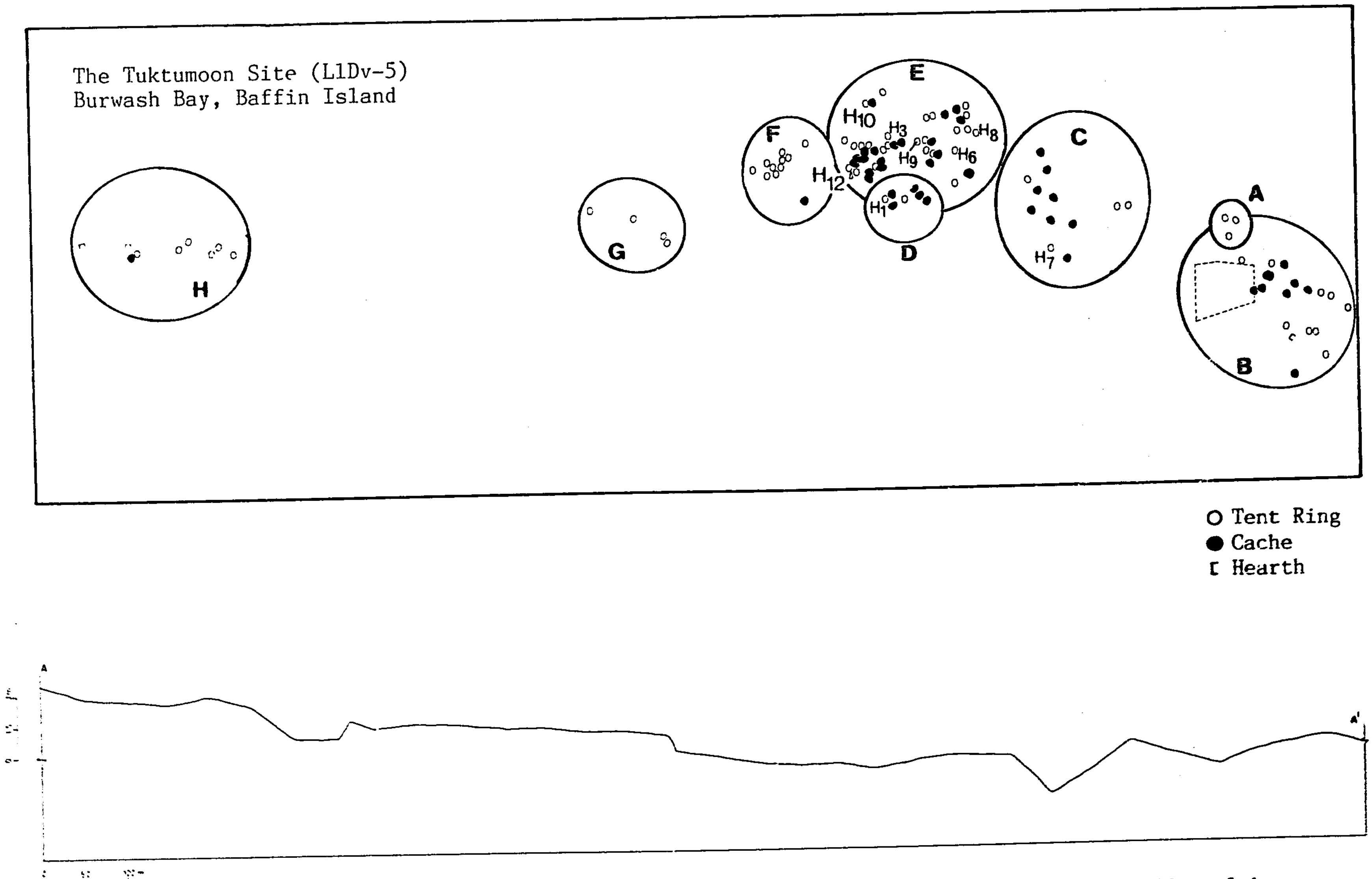

Figure 35. Map showing components of the Tuktumoon site (L1Dv-5), Burwash Bay area, Nettilling Lake.

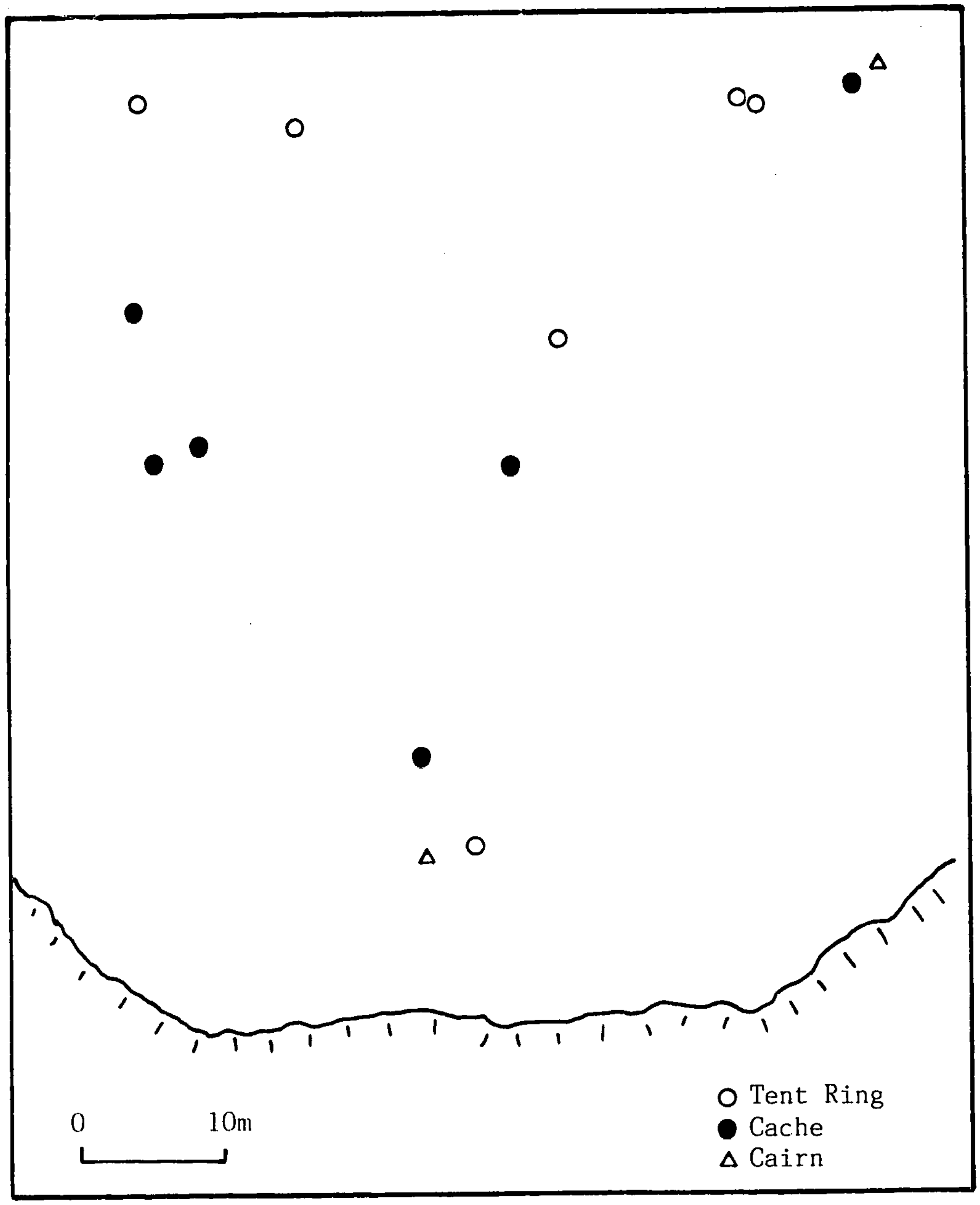

Figure 36. Map of the Junction A site (L1Dw-2), Burwash Bay area, Nettilling Lake.

few decades. On the basis this negative evidence the site has been assigned to the period spanning the decades between 1925 - 1950.

The Junction B site (Figure 37) is located approximately 400 m west of Junction A, and near the center of the intersection of the South and West Burwash moraines. It consists of seven tent rings and one cache constructed around a large glacial erratic. Considerable surface debris was recovered in and around the tent rings, and includes pieces of sawn wood, cloth, shell casings of various calibres (including reloaded .303 British and Savage), a pipe bowl, nails and a small sample of faunal material, almost exclusively caribou. The cache was excavated and contained a large volume of faunal material, again nearly all of caribou. The contents were completely covered with a soil overburden and the depth of faunal accumulation reached 0.20 m. No artifacts were found in the cache, but a sample of the caribou bone was radiocarbon dated to the Developed Thule period indicating the faunal assemblage is not contemporaneous with the habitation features. The faunal material from the Junction B cache is discussed in detail in a later section of the thesis. On the basis of the surface artifacts, the tent rings are thought to date from the last four to six decades.

The third Late Historic site is Amadjuak-2 (LlDv-3). It is situated on the south side of the Amadjuak River, and on the east slope of the South Burwash moraine (Figure 34). The site contains two tent rings constructed of large, tightly-fitting boulders. Both features are approximately 3.5 m^2 in size. Excavations were not conducted here, but there is abundant surface debris including metal can fragments, various caliber shell casings (including .44 Cal.), wooden shaft fragments and a small amount of caribou bone. This site is considered on this evidence to date from the period between 1920 and 1940.

Early Historic.

Evidence for use of the area during the Early Historic period comes from a surface find made near our base camp in the central part of the moraine. It consists of a 16 gauge pinfire shotgun shell manufactured by Eley Bros., London.

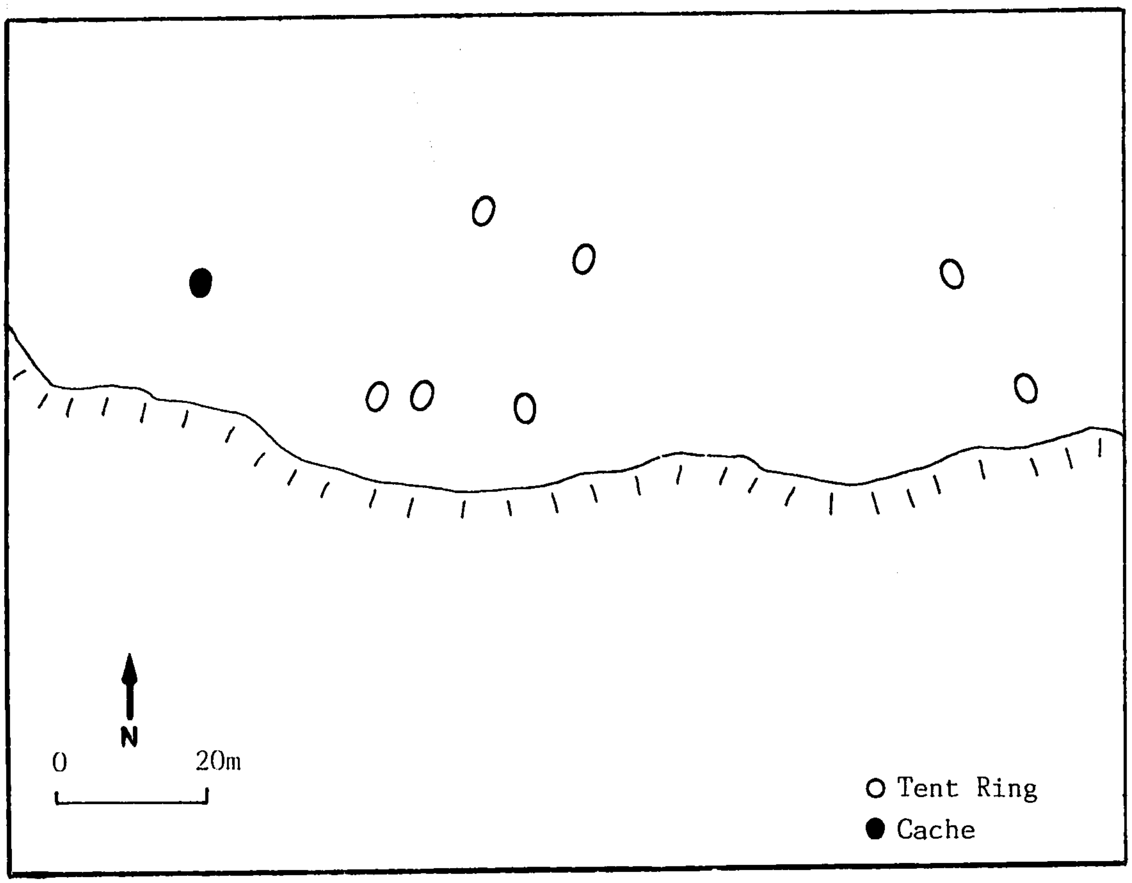

Figure 37. Map of the Junction B site (LlDw-7), Burwash Bay area, Nettilling Lake.

Thule.

Three sites date to the Thule period. The bone cache at the Junction B (LlDw-7) site has already been mentioned. The second site is Amadjuak-1 (LlDv-2), located 150 m north of LlDv-3 on the crest of the same moraine (Figure 34). The site is at an elevation of approximately 15 m above river level and is divided into two components. The Thule component is located a few metres from the edge of the steep embankment and consists of 3 oval tent rings measuring approximately 3.0 m^2. The interior of each ring is completely overgrown with lush vegetation and limited testing in one of the features revealed a stone paving but no artifacts. This component assigned to the Thule period on the basis of the close similarity of the features to those completely excavated at the Tuktumoon site (LlDv-5).

The Tuktumoon site (LlDv-5) is the largest and most complex of all the sites recorded on Nettilling Lake. Its eight components contain 155 features of various forms and antiquity summarized in Table 11. Component B (Figure 38) at Tuktumoon was the focus of the 1985 field season, when, in addition to surveys conducted in the vicinity of the Amadjuak River, eleven habitation features and ten caches were completely excavated. These excavations produced the largest artifact and faunal assemblages from the survey region, and provide the basis for assigning similar structures from other sites into the Thule era.

Three of the site components dating from the recent period have already been discussed. The remaining five, based on the results of excavations, all appear to date from the Thule and late Paleoeskimo (Dorset) period. The results of excavations of the Thule habitation features are discussed below.

House 2

House 2 (Figure 39) is located in Component B , on the north side of the moraine opposite the center of a small embayment carved out by the Amadjuak River. The house is constructed of large tabular boulders and measures 4.0 m^2 . Prior to excavation it appeared to follow the traditional design of a Thule winter dwelling, however, after excavation several

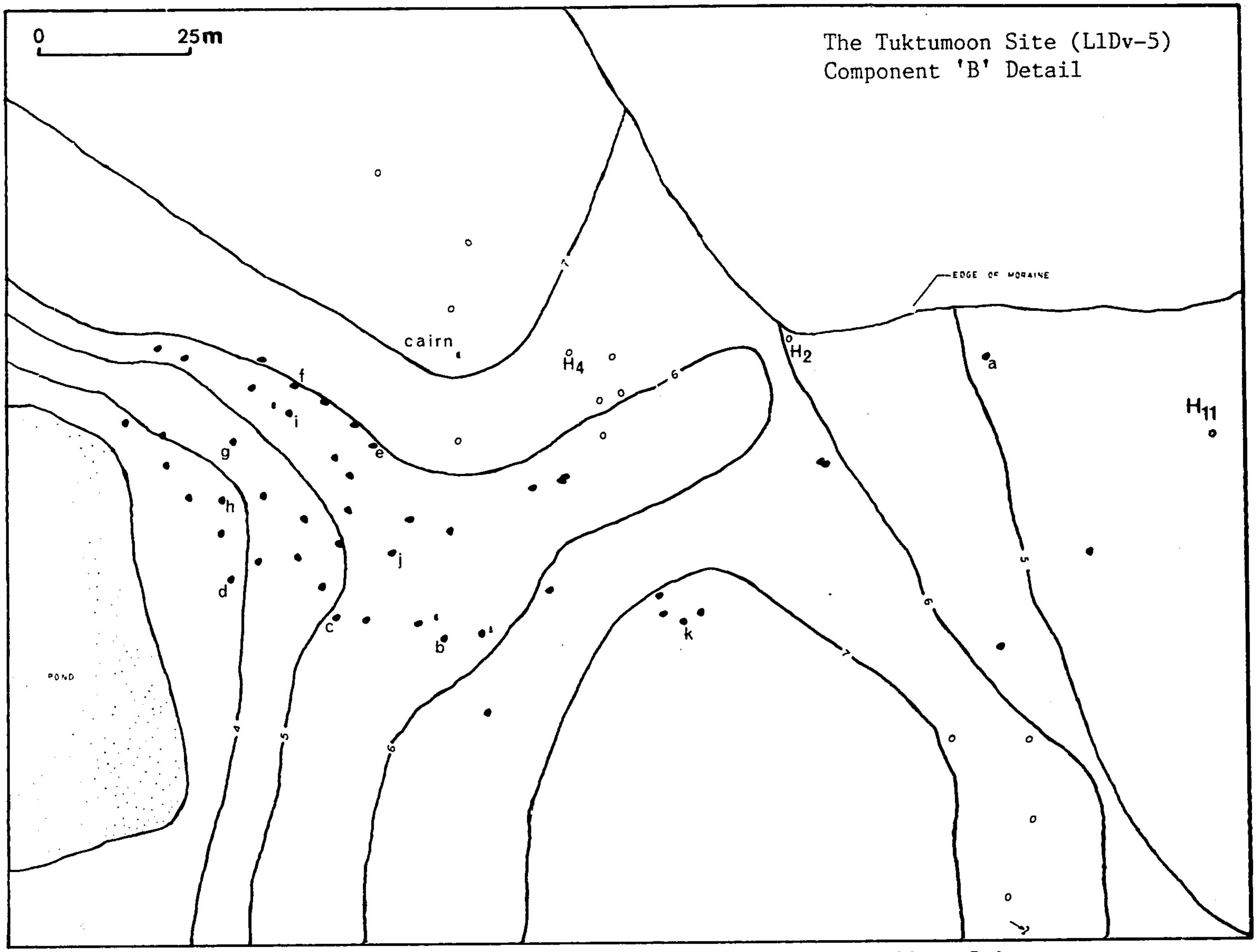

Figure 38. Map of Component B, site L1Dv-5, Burwash Bay area, Nettilling Lake.

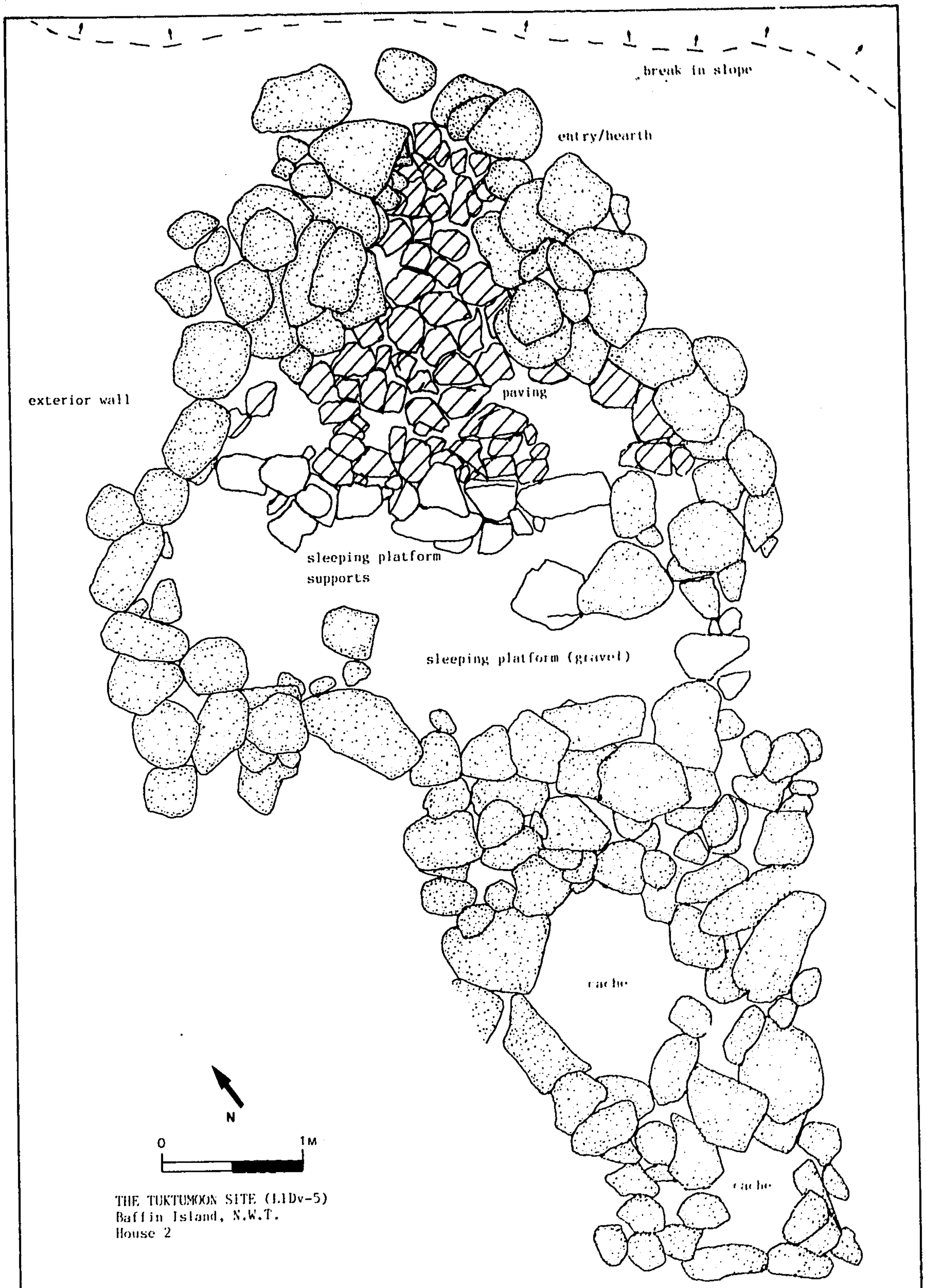

Figure 39. Plan view of House 2, site LlDv-5, Burwash Bay area, Nettilling Lake.

important differences were apparent. The area which appeared tc be an entry passage, for example, was actually used as a cooking alcove. The locus is 1.4 m long and 0.7 m wide, and paved at a depth below datum of 0.65 m. A layer of grey ash, 2 cm thick, and charred faunal remains covered the paving stones. The fact that this part of the house sits virtually on the edge of the moraine, where the slope is approximately 60°, also suggests that it was not designed to serve as an entry. There is no evidence for a lintel stone or cold-trap entrance which are also characteristic of coastal Thule houses.

Only a few stones remain in what would have been the sleeping area, measuring 0.49 X 2.3 m. Other stones may have been removed by later occupants of the site, but the sleeping platform may also have been constructed of gravel overlain with plant material. The depth below datum of the gravel is between 0.64 and 0.66 m, slightly above that of the interior paving (0.60 DBD).

In general, House 2 shares a number of characteristics with the tent houses described by Grønnow (1986) for sites in West Greenland. It is well constructed, with the paving and internal cooking area suggesting more than a brief occupation.

Attached to the south wall of the main structure are two small oval caches, measuring approximately 1.0 m^3 and 0.5 m^3. The interiors of these features support a thick layer of vegetation, and the exterior rocks have extensive lichen cover. However, the recovery of a metal lid fragment and cork net float clearly place their last use during the twentieth century.

House 2 produced a total of 26 artifacts of Paleoeskimo, Thule and recent (metal and net float) origin. The Paleoeskimo material consists of 11 white and beige chert flakes. These were recovered from the lower gravels and, and beneath paving stones indicating they belong to an earlier occupation and pre-date the house. The Thule artifacts were recovered on the surface of the interior paving and include a Type 2 harpoon head with drilled lashing holes (Mathiassen 1927), an ivory trace buckle, bow drill mouthpiece, leister parts, soapstone and thin strips of baleen. The harpoon head is of a type commonly found in assemblages dating between AD 1300-1600.

House 3

House 3 is located in the center of Component E. It is a small feature measuring 1.7 X 1.2 m, with an "entry" 0.57 m wide and 2.0 m long (Figure 40). The exterior walls stand 0.47 m high and are constructed of large stones. The interior surface of the feature was covered with a thin layer of vegetation, underlain by sterile gravel at a DBD of 0.86 m. Excavation of the structure produced no artifacts or faunal remains, but based on subjective criteria (lichen cover, structural characteristics) is thought of be of Thule age.

House 4

House 4 is located in Component B, several metres west of House 2. It is very similar in form to the latter feature and measures 4.0 x 3.0 m (Figure 41). The exterior walls are constructed of large boulders that are now completely covered with lichen. The house entry is on the northeast side of the feature. The eastern two-thirds of the interior are paved with tightly-fitted stones at a DBD of 0.73-0.75 m. As in House 2, the northwestern part of the feature, which appeared to be an entryway, contained only charred bones and a thin layer of ash and served as a food preparation area. There is no evidence of a lintel or threshold stone to indicate it ever functioned as an entrance to the house. The sleeping area was located in the western one-third of the feature, but only a few support stones remained *in situ*.

House 4 produced a total of 43 artifacts, most of which date to the Paleoeskimo era. These were excavated below the level of the floor paving and in the gravel beneath the sleeping platform. Diagnostic forms include a triangular quartzite biface, and a beige chert flared endscraper. These, together with 26 pieces of detritus are tentatively assigned to the Dorset period. A small fragment of drilled bone, slate and quartzite fragments, and pieces of crumbled soapstone found on the floor of the house presumably relate to a Thule era

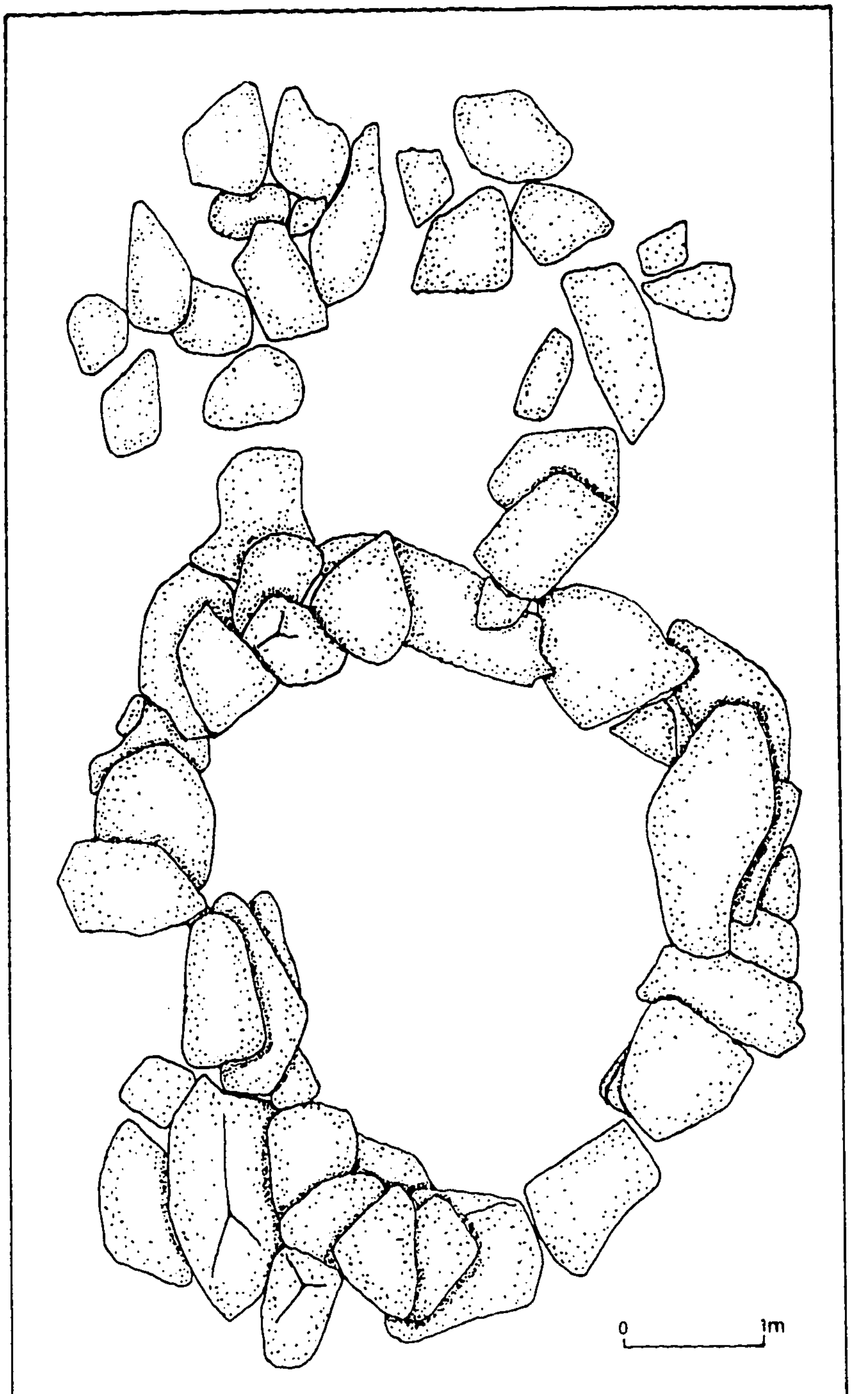

Figure 40. Plan view of House 3, site L1Dv-5), Burwash Bay area, Nettilling Lake.

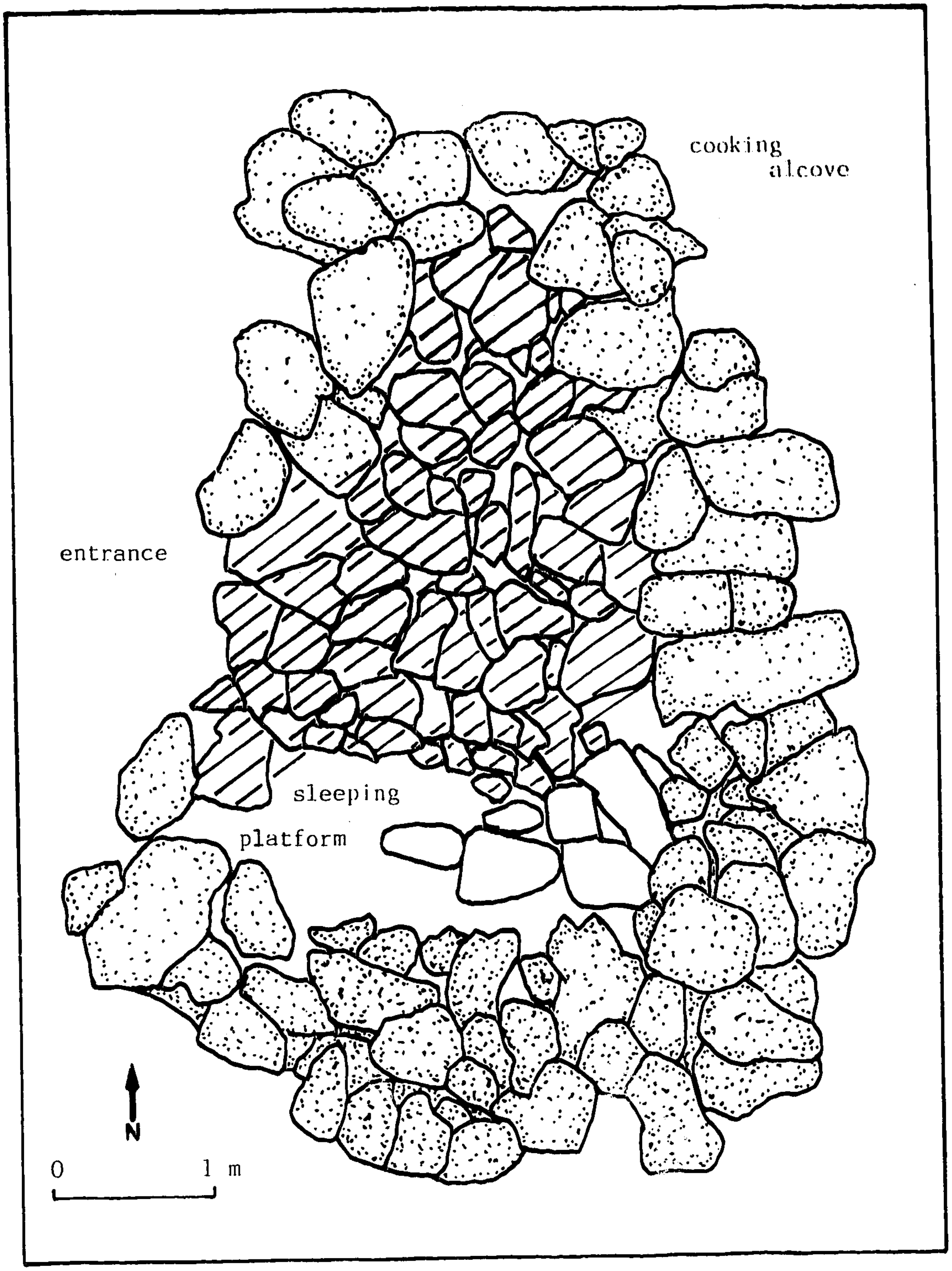

Figure 41. Plan view of House 4, site LlDv-5, Burwash Bay area, Nettilling Lake.

occupation. As in House 2, no contact material of any type was produced by excavations in this feature.

House 6

House 6 (Figure 42) is a small, oval structure located in Component E. It measures 3.1 x 3.9 m, and was covered with a sod layer between 6 and 7 cm thick. As with most of the tent rings excavated, this feature had no clearly defined entry. What is interpreted as a small boulder cache is built into the east side of the structure. The complete excavation of this feature yielded a small number of artifacts (n=29). Diagnostic forms include a slate endblade with pronounced edge bevelling, two slate ulu(?) blade fragments, several soapstone vessel sherds, a fish spear side-barb fragment and chert and quartz detritus.

House 7

House 7 is a large structure located on the south side of the moraine in Component C (Figure 43). The interior of the house measured 4.0 m^2 and contained a large amount of rock from collapsed exterior walls. The soil overburden in this house was comparatively thin (ca. 3-4 cm) and covered a matrix of coarse gravel. All of the structural rocks were heavily encrusted with lichens.

The complete excavation of this feature produced a very small collection of artifacts (n=9) and faunal remains. The artifact inventory includes unworked slate, quartzite and chert fragments, and despite the lack of diagnostic material House 7 is considered to date to the Thule period.

House 8

House 8 (Figure 44) faces the Amadjuak River and is located at the eastern edge of Component E, and the northern edge of the moraine. It measures 1.5 m^2 and has a small "cache" (0.8 X 0.5 m) built into its eastern side. The living area was covered with patches of

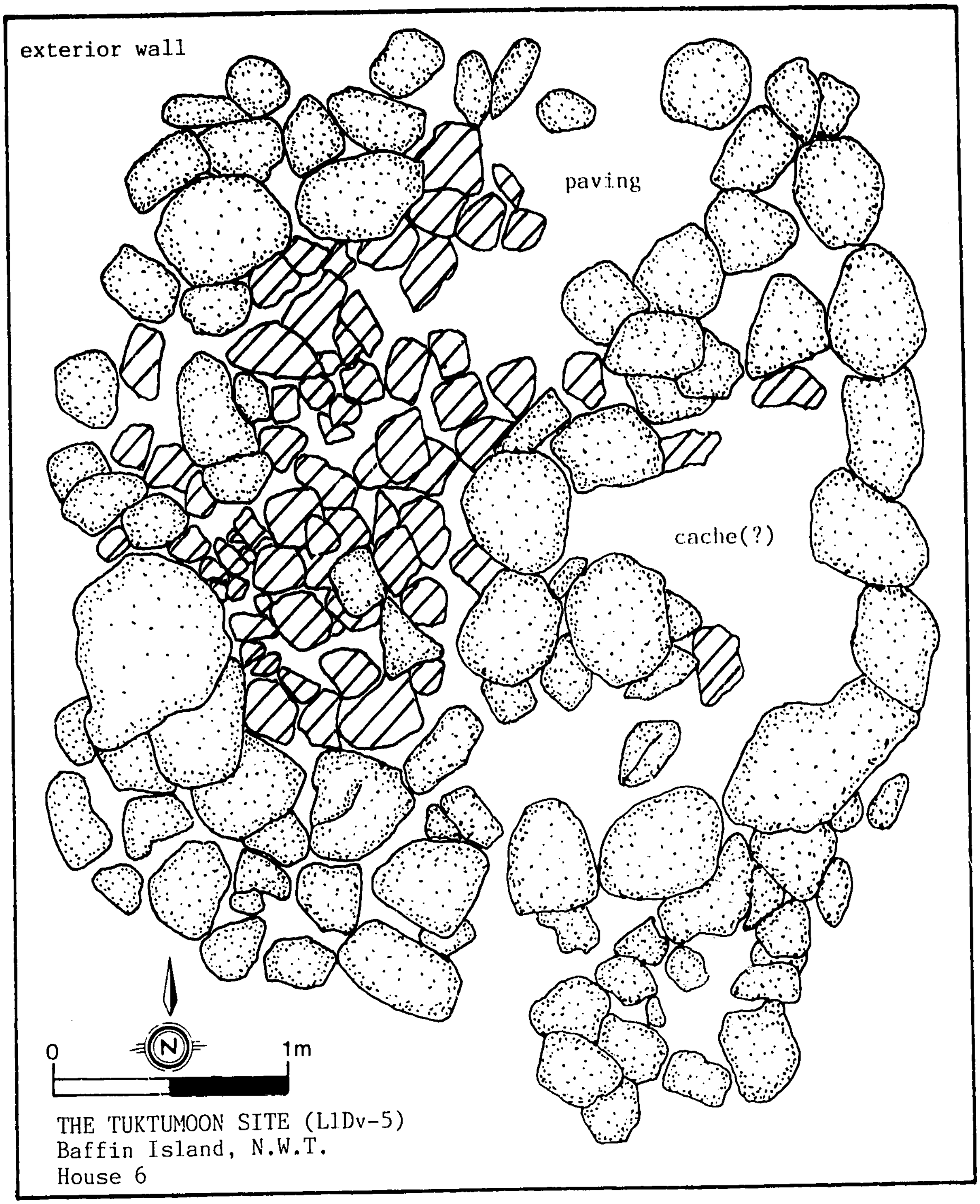

Figure 42. Plan view of House 6, site L1Dv-5, Burwash Bay area, Nettilling Lake.

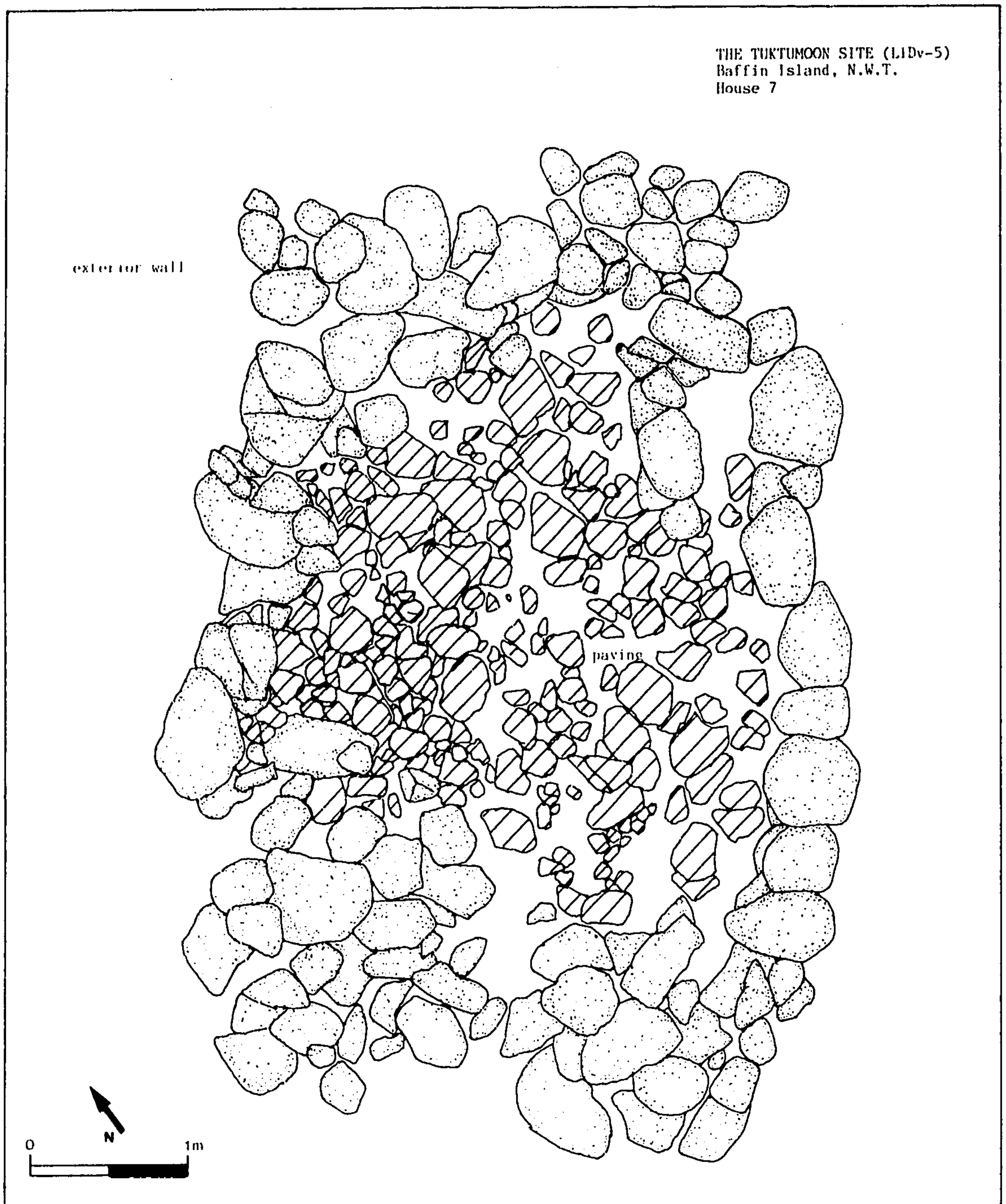

Figure 43. Plan view of House 7, site 11Dv-5, Burwash Bay area, Nettilling Lake.

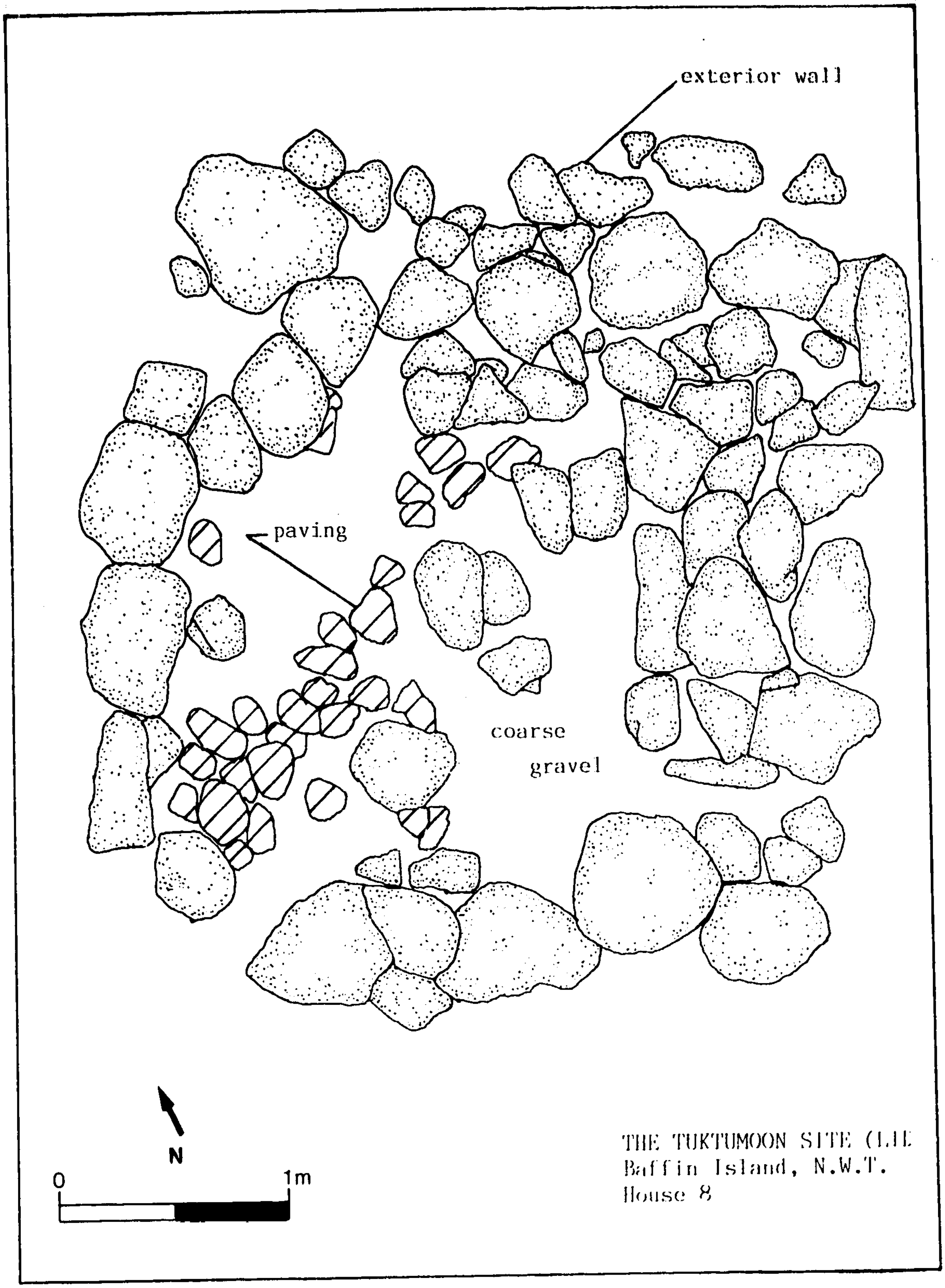

Figure 44. Plan view of House 8, site LlDv-5, Burwash Bay area, Nettilling Lake.

thick sod and moss, with heavy lichen growth on exposed stones. In the southwest corner of the house a small amount of charred bone was found, possibly indicating the location of a hearth. Sterile gravel was reached at a depth of 0.50-0.55 m DBD.

The small artifact inventory from this house is dominated by quartzite flakes and cobbles (n=36), but a drilled bone object and worked ivory fragment were also recovered.

House 9

House 9 is a large, rectangular tent ring measuring 5.0 x 4.0 m, and with its long axis oriented northeast-southwest (Figure 45). A remarkably thick moss layer covered much of the house interior, underlain by a sterile coarse gravel. Excavation produced small faunal and artifact (n=39) samples. Nondiagnostic quartzite and chert flakes are most common, but the artifact sample also includes fragments of worked slate, a rectangular whetstone, bowdrill mouthpiece, slate endblade fragments, drilled whalebone sledshoe fragment and narrow strips of baleen. No contact material was found.

House 10

House 10 is a stone walled structure measuring 6.5 x 6.0 m (Figure 46). The exterior walls are constructed of large boulders completely covered with lichen. Interior vegetation cover was 8 cm thick, and overlay a paving of flat stones broken by patches of coarse gravel. The paving was reached at a depth of 0.35 m, the gravel at approximately 0.40 m. The original entry could not be distinguished,but the pattern of paving stones suggests the feature may have been entered at its northeast corner.

The house yielded a small artifact collection and faunal sample. Diagnostic forms include three Thule ground slate endblades with drilled line holes and a broken Late Dorset chert endblade. The recovery context of the latter artifact (embedded in underlying gravel) indicates it is not contemporaneous with the tent ring.

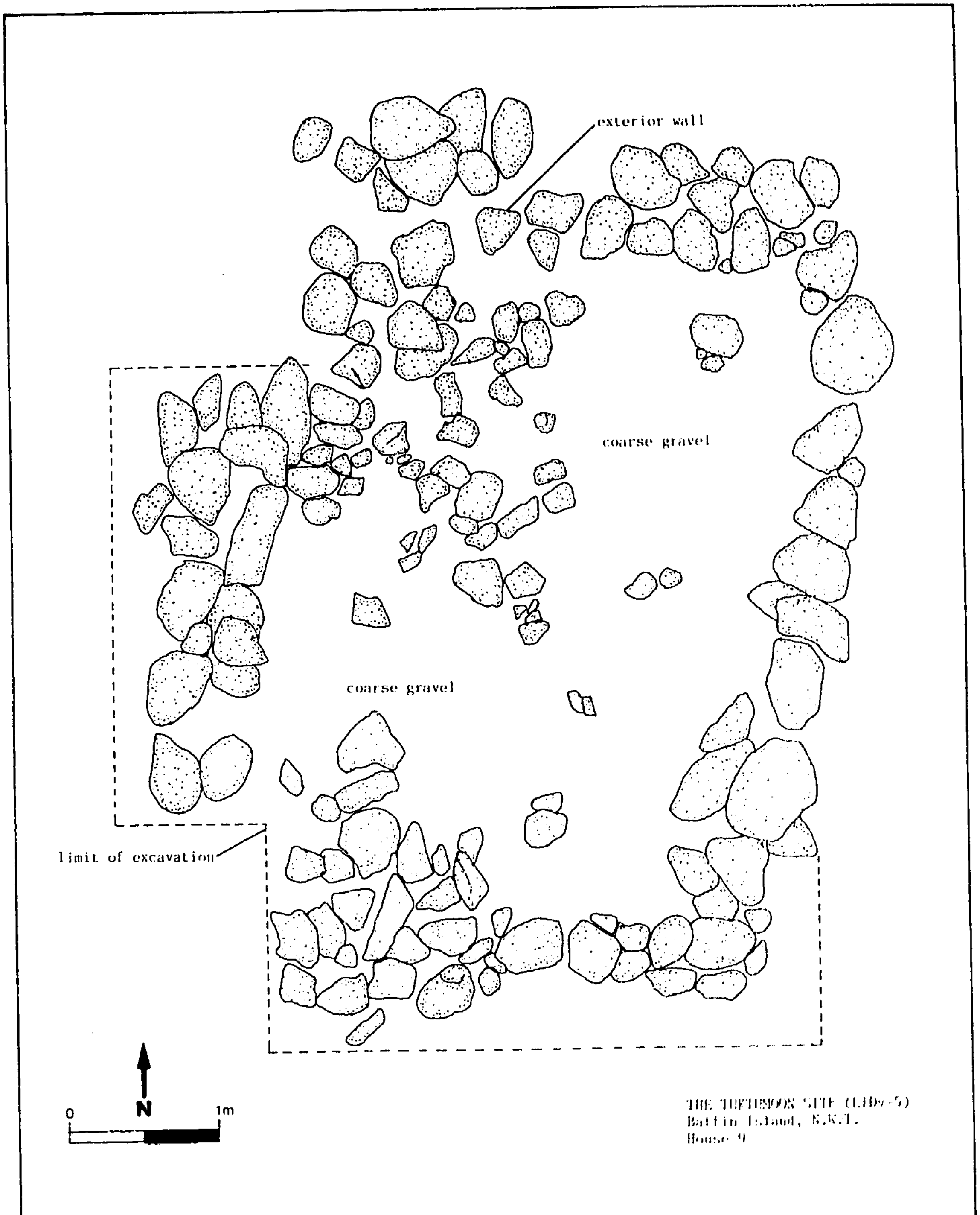

Figure 45. Plan view of House 9, site LlDv-5, Burwash Bay area, Nettilling Lake.

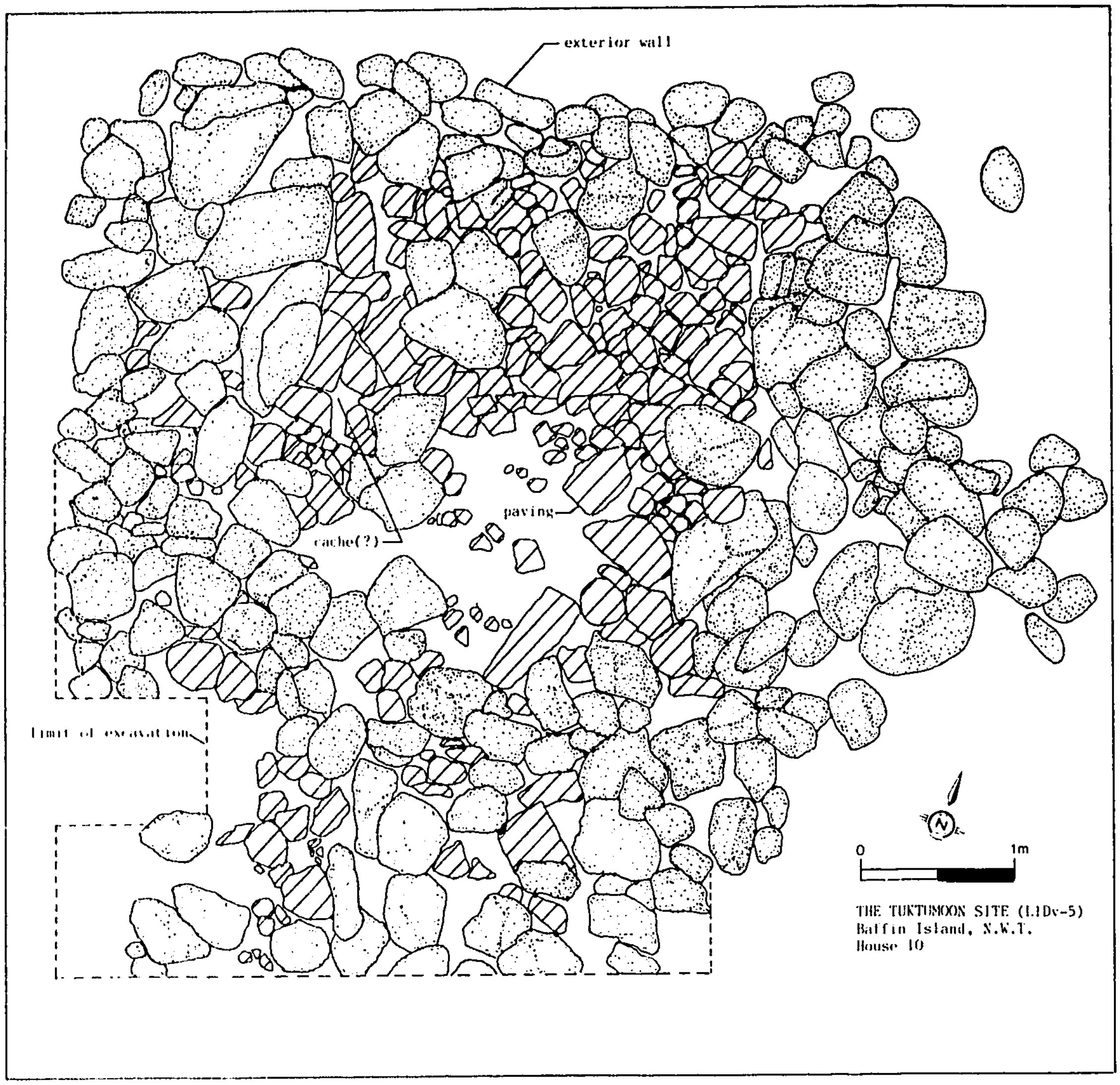

Figure 46. Plan view of House 10, site L1Dv-5, Burwash Bay area, Nettilling Lake.

Summary

The habitation features excavated at LlDv-5 share a number of common characteristics. They are of substantial construction, with heavily built exterior walls and complete or partial paving of the interior living/sleeping areas. Several also contain areas used for the preparation of food. The degree of lichen cover on the rocks used in the construction of the features is generally similar, and when combined with the small artifact collections, place the period of their use during the Thule era. Few diagnostic Thule artifacts are present; however, the total absence of contact material and the presence of other artifacts characteristic of the Thule period supports the temporal classification of the features. Other features of comparable design that were not excavated, have been assigned to the Thule period on the basis of the results of the excavations in the various components at LlDv-5.

The presence of Paleoeskimo materials in the houses, although primarily non-diagnostic, suggests the long-term importance of the Burwash Bay area to human groups on southern Baffin Island. This period is discussed in more detail below.

Caches

The Tuktumoon site contains a remarkable number of stone features, particularly at its eastern limit near the mouth of the Amadjuak River, which are identified as caches. In the largest cluster there are 49 such features (see Figure 38) which assume a variety of forms and sizes, but all are surface constructions. The majority show evidence of disturbance at some point in the distant past, but we were able to locate a several which appeared intact, suggesting they might still contain faunal remains or other materials.

Eleven caches were opened and excavated. These contained samples of faunal material (primarily caribou) in generally good condition and ranging in size from less than 15 to over 4000 bones. Two of the caches each contained a single artifact. Cache H contained a large brown slate endblade with double-drilled line holes and several chips along the lateral margins. It is broken medially with the remaining portion measuring 5.9 cm in length, 4.7

cm in width and 0.73 cm thick. Cache J contained a short fragment of bowhead whalebone with three drilled holes at one end.

A radiocarbon date of AD 1164-1410 was obtained on caribou bone from the largest cache assemblage (Cache A). This age estimate, combined with the similar degree of lichen cover over the features, suggests the remaining caches also date to the Thule period. None of the features displayed any evidence of use during the historic period, with the stones in both the disturbed and undisturbed caches completely covered with lichen.

Both Dorset and Pre-Dorset sites were located through surveys in the South Burwash moraine area. These include sites/components that contain non-diagnostic materials, but nevertheless of Paleoeskimo origin.

Paleoeskimo: Dorset.

The Rapids site (LlDv-4) is located on the west bank of the Amadjuak River at the point where the main channel branches into two narrow chutes (see Figure 34). The site is elevated 4.8 m above the river and it has two components. The first contains 2 tent rings situated directly opposite the rapids on a small platform of outcropping bedrock. A well-developed soil covers most of one feature, varying from 0.10 - 0.16 m in depth and underlain by a sandy gravel. On the north edge of the component are several small blow-outs, in and around which chert artifacts and detritus were exposed.

The tent rings measure 4.0 x 2.0 m (TR #1) and 2.50 x 3.10 m (TR #2) respectively. Tent ring 1 (Figure 47) was completely excavated and produced two dozen stylistically Late Dorset stone tools and approximately 7,000 chert flakes. The primary raw materials are a blue-grey chert and crystal quartz, but only trace amounts of quartz debitage were recovered. This suggests either restricted availability of this raw material or the manufacture of these tools at a different location. The inventory is typical of Late Dorset assemblages (ca. 1000 BC-1000 BP) and includes side-notched chert endblades, flared end scrapers, asymmetrical "knives" and the distal end of a quartzite burin-like tool. Noticeably absent, however, are

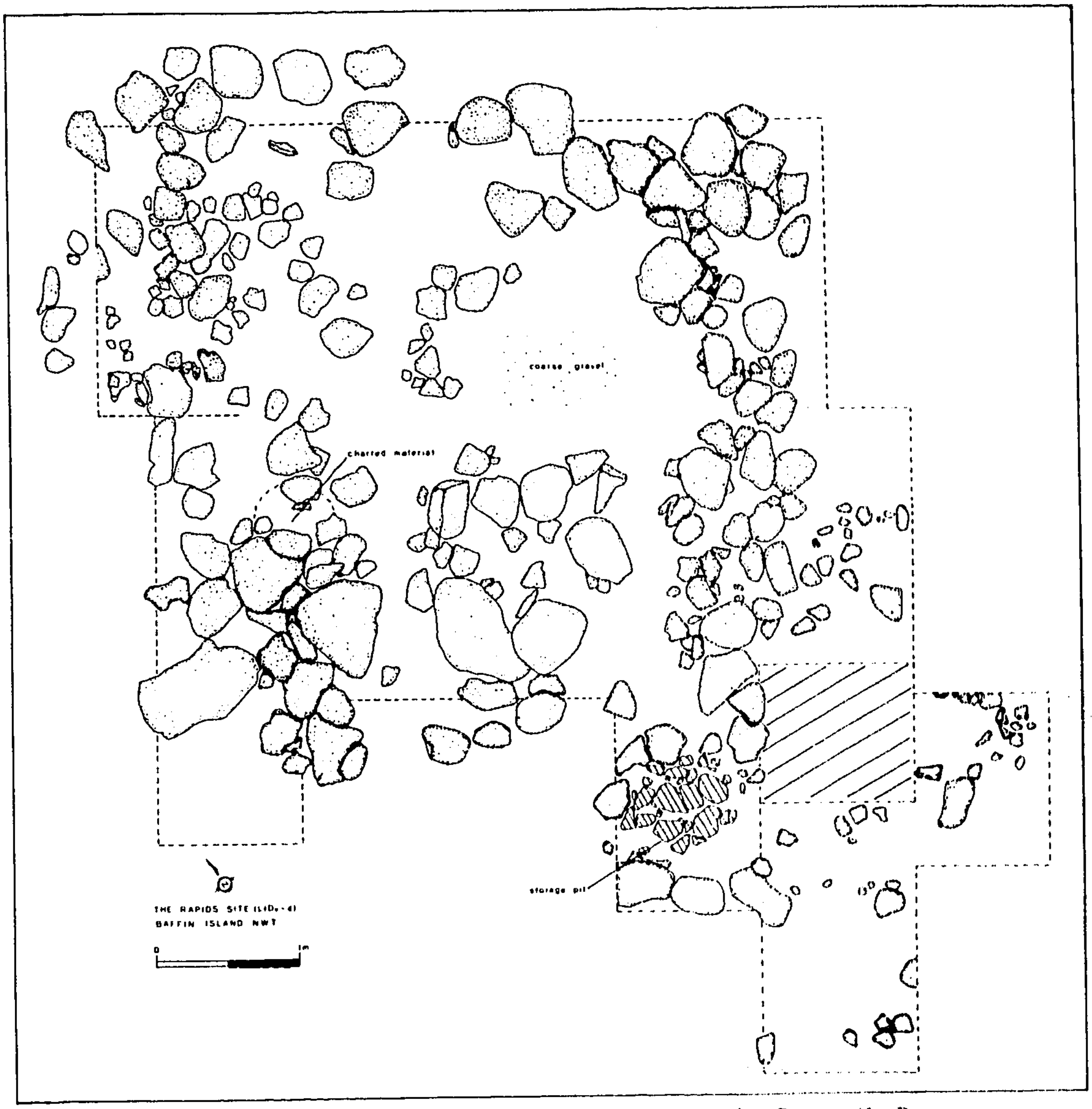

Figure 47. Plan view of Tent Ring 1, site LlDv-4, Burwash Bay area, Nettilling Lake.

stemmed and concave-base endblades with finely serrated cutting edges. Also recovered were a single spalled chert burin and fish spear (?) preform.

A small assemblage of chert was surface collected from tent ring 2, located 3 m south of tent ring 1. There is little soil development over this feature, the surface being dominated by lichens and mosses. No diagnostic tools were present in the surface scatter. A preliminary comparison of the diagnostic artifact forms from this component with other Dorset sites in the Baffin region suggest an occupation date of ca. 900 - 1000 A.D.

The second component of the Rapids site also contains two tent rings located 30 m to the south and near the edge of the Amadjuak River. These measure approximately 3.0 m^2 and are completely overgrown with a thick mat of vegetation. The apron stones are deeply set into the turf. Two small trowel tests produced no artifacts or faunal remains.

LlDv-5: House 12

House 12 is a tent ring structure which, prior to excavation, was almost completely buried by surface vegetation up to 17 cm thick. Only the top of several perimeter stones were visible.

After excavation, the feature remained poorly defined with approximate measurements of 4.8 x 2.3 m (Figure 48). A fine, sterile gravel was reached at a depth below datum of 0.41 m which graded into a coarser matrix at a depth of 0.45 m.

The artifact sample recovered included one Thule slate endblade, numerous quartzite flakes and one Late Dorset crystal quartz endblade with concave base and serrated lateral margins. The small faunal sample includes seal and caribou remains. Although the slate blade suggests a Thule occupation, this artifact was recovered from the eastern side of the feature which is very poorly defined, and given the extent of vegetation overgrowth it is considered to be of Dorset age.

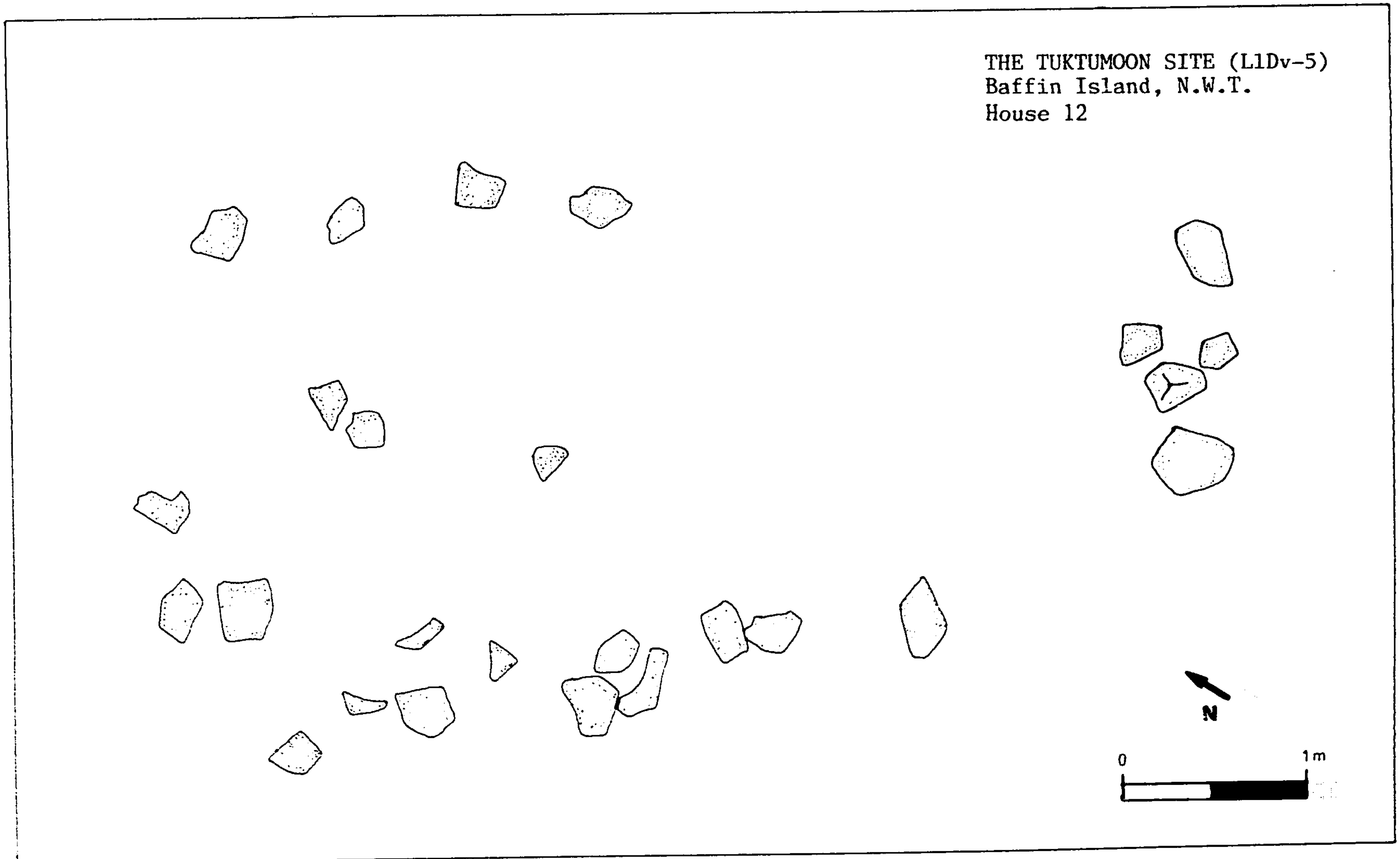

Figure 48. Plan view of House 12, site L1Dv-5, Burwash Bay area, Nettilling Lake.

Paleoeskimo:Pre-Dorset

The Sandy Point site (LlDv-10)(see Figure 35) is located on the west shore of Burwash Bay, on a narrow point of land approximately 4 km north of the mouth of the Amadjuak River. The site has two components (island and mainland) both of which are defined by surface scatters of chert artifacts that have been eroded out of their original context through wave action. The artifacts are stylistically of Pre-Dorset age (ca. 2000-600 BC), and a radiocarbon date of 974 BC, obtained on a peat sample, places the site in the middle to late Pre-Dorset period. A detailed discussion of the excavations made at LlDv-10 is presented in Stenton (1986b).

Paleoeskimo:LlDv-2

As previously noted, the Amadjuak-1 site contains two components. The prehistoric component contains one large tent ring, two collapsed caches and one cairn. Three small test pits were excavated in the tent ring, producing a few flakes of chert and crystal quartz, and one piece of soapstone. No diagnostic tools were recovered,but the feature is considered to date to the Paleoeskimo period.

Paleoeskimo:LlDv-5

Paleoeskimo materials recovered from excavations in features dated to the Thule period at LlDv-5 have already been described. Two additional habitation features were excavated at the Tuktumoon site that have been assigned to the Paleoeskimo period.

House 1

House 1 (Figure 49) is a large stone walled feature located on the south side of the South Burwash moraine. It measures approximately 5.0 m^2 and has 3 interior and 2 exterior "alcoves". These presumably functioned as food storage/preparation areas, although we lack specific evidence to support this suggestion. The exterior walls of the house stand four

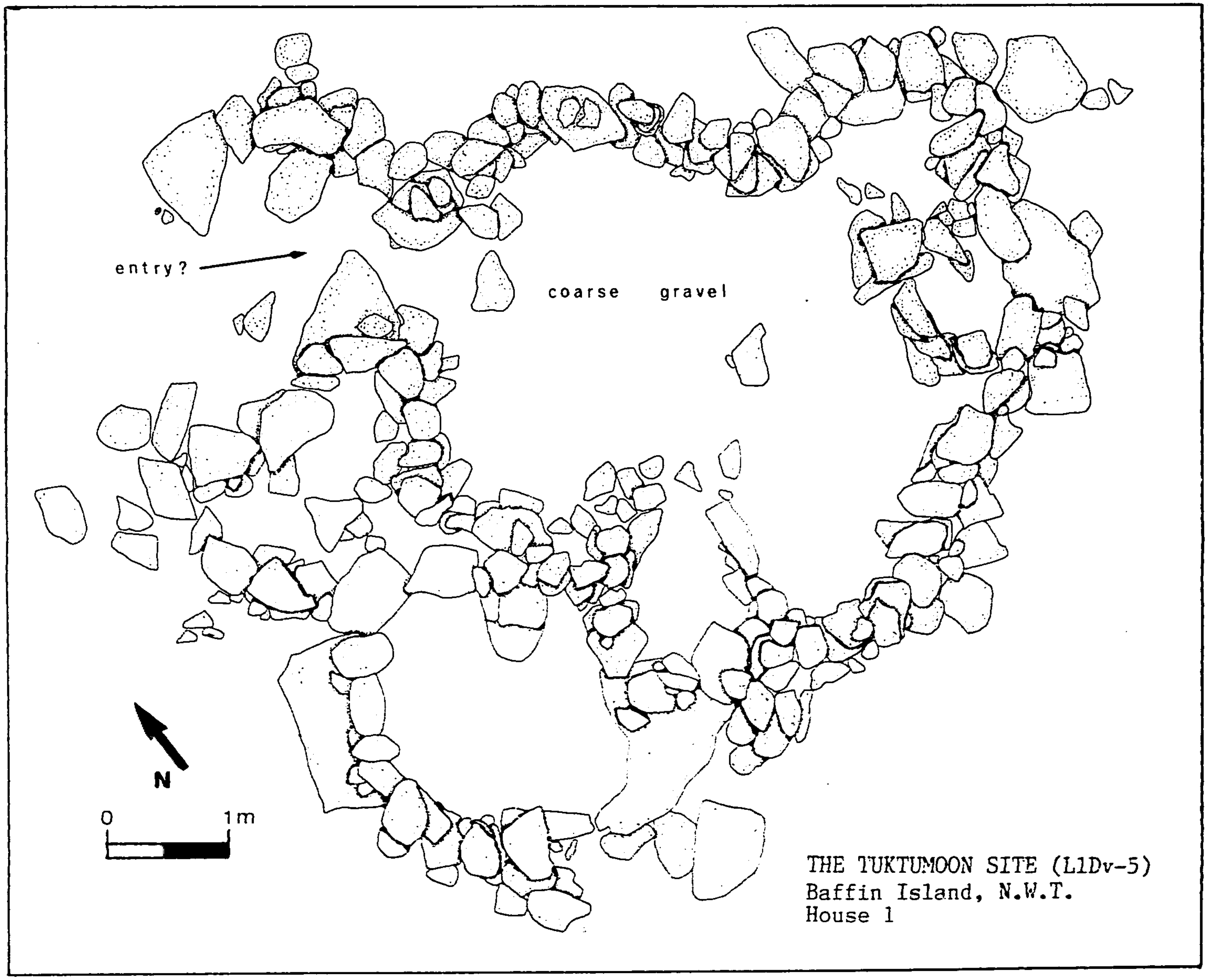

Figure 49. Plan view of House 1, site L1Dv-5, Burwash Bay area, Nettilling Lake.

courses to a measured height of 0.90 m, and incorporate several large erratic boulders into their structure. All stones support extensive lichen growth, particularly Rhizocarpon sp. and Alectoria minuscula. The entry to the house faces northwest and is 0.50 m wide.

The house interior was covered by a thin sod layer of grasses and mosses. Test pits in the central house area yielded 8 chert flakes and 1 quartzite flake, all found beneath the sod layer on the surface of the underlying gravels. The complete excavation of this feature, however, produced no additional artifacts and only a small sample of faunal material (primarily bird bone). The combined evidence from House 1 suggests it is of considerable age, and despite its large size, the recovery context of the chert flakes (i.e., at the interface of the sod and gravel) suggests it is of Paleoeskimo age.

House 11

This feature is located approximately 70 m southeast of House 2, near the edge of the moraine at the mouth of the Amadjuak River. It measures 4.0 x 2.0 m (Figure 50), is constructed of moderate sized boulders and the interior is covered with a moss and grass overburden approximately 10 cm thick. Beneath this is a coarse gravel base. On the north side of the feature is a 1.0 X 0.5 m cache-like annex which contained a small amount of very poorly preserved caribou bone. There is no clearly defined entry to the structure, nor is there any interior paving or well defined hearth area.

The complete excavation of House 11 yielded only 3 artifacts: 2 large utilized chert flakes found at the soil/gravel interface, and 1 cork net float resting on the interior surface in the northwest corner of the feature. A small faunal sample was also recovered. As in House 1, the recovery context of the chert flakes, and lack of interior paving suggest that the features dates to the Paleoeskimo period.

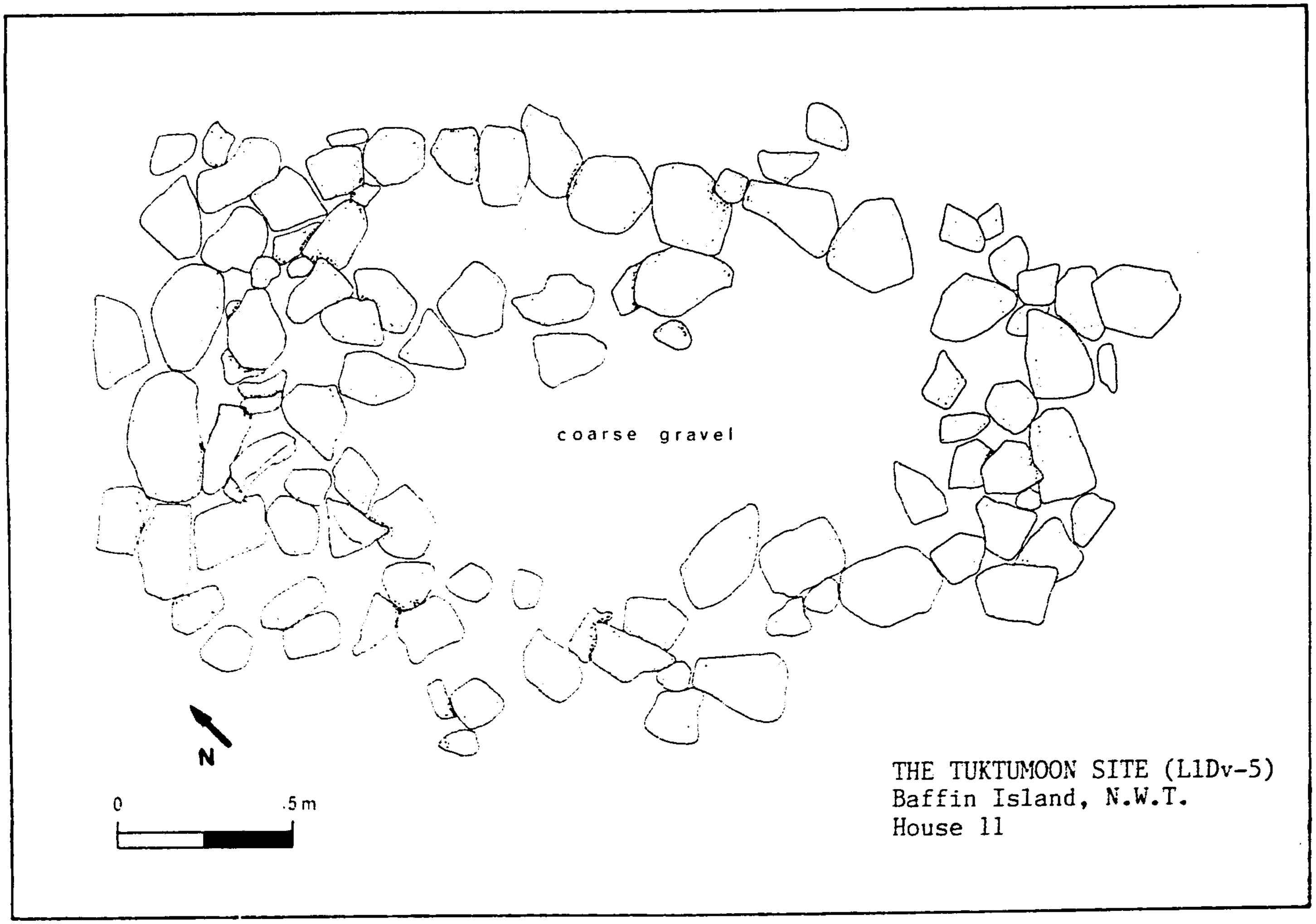

Figure 50. Plan view of House 11, site L1Dv-5, Burwash Bay area, Nettilling Lake.

Summary

In the areas surveyed, the available evidence suggests that Paleoeskimo occupations on Nettilling Lake may be concentrated in the southern Burwash Bay area, near the mouth of the Amadjuak River, and along the west side of the bay. In the latter area (i.e., Sandy Point and Mosquito Ridge sites) there is greater evidence for Pre-Dorset occupations, whereas at the mouth of the Amadjuak River, Dorset materials are more common. In particular, there seems to be an extensive (spatially) Dorset occupation at LlDv-5. In the small sample of diagnostic material that was found, primarily Dorset tools occur (i.e., concave base, triangular endblades), although it should be noted that one spalled chert burin, characteristic of Pre-Dorset assemblages, is included in the material excavated from LlDv-4.

Prehistoric

As noted earlier, many of the sites recorded along the South Burwash moraine offer no reliable means of establishing their age, beyond their elimination from the historic or modern periods. None of these sites/components display any evidence of construction or use during the period of Euro-American contact (i.e., approximately the last 200 years), and the difficulty, therefore, lies in isolating those features that relate to the Thule period, from those of either the Dorset or Pre-Dorset eras. The sites share a number of characteristics, including generally small size, virtually total absence of artifactual/faunal data, and have generally similar degrees of lichen or other vegetation cover. No culturally distinctive house forms (e.g., mid-passage, central hearth or long houses) are present.

At a general level certain features could theoretically have served similar basic functions regardless of their cultural affiliation. Cairns, for example, act to direct movement along particular courses (e.g., route markers) or to particular places (e.g., good camp locations), and caches function as receptacles regardless of what is put into them. Accordingly, classifications of such features as logistical may be valid despite the inability to infer specific behaviours associated with their use (e.g., short-term versus long-term food storage). A particular type of habitation structure, however, could reflect quite different behaviour from one or two families travelling between different hunting areas, to a group of men hunting away from a base camp for a few days. In the latter case, however, since field camps were places where task groups ate, slept, repaired/manufactured tools or weapons, a greater amount/type of material debris might be expected to remain than at travelling camps. In the discussion that follows functional classifications of sites containing habitation features are based largely on subjective evaluations and are, therefore, necessarily tentative. For the sake of brevity only short descriptions of these sites are given. The first group of sites is concentrated in the central area of the moraine. Site locations are referenced to one another and shown on Figure 34.

Site LlDw-8 is located at the south corner of the moraine pond and consists of 1 tent ring and 3 caches. The tent ring measures 3.0 x 4.2 m and is situated near the crest of the moraine. It has an abundant lichen cover on the interior gravel surface and apron stones which are deeply set into the ground surface. The caches are small, approximately 2.5 x 2.0 m in area, and all have collapsed. No surface material is associated with any of these features.

The LlDw-9 site consists of a single collapsed cairn found 45 m northwest of LlDw-8. The small cairn was originally 2 stones high (ca. 0.50 m) and of a typical south Baffin form.

LlDw-10 is sixty metres northwest of the LlDw-9, and contains a single tent ring constructed adjacent to a glacial erratic. The dimensions of the tent ring are ca. 4.2 x 3.4 m and the interior overburden consists of a fine sand covered by generally sparse grasses. Lichen cover on the feature is extensive .

LlDw-11 is located immediately south of the midpoint of the large pond, on the crest of the moraine. It consists of a single stone digit cairn (ca. 0.45 m high) with considerable lichen cover.

LlDw-12 contains one small (3.2 X 3.3 m) tent ring with an associated stone box hearth on its northern side. It is located at the southwest corner of the moraine pond, near the base of the slope here. The interior gravel surface of the tent ring is completely covered with lichen and mosses and the stones are very deeply set in the ground 0.15 m).

LlDw-13 is located fifty metres west of LlDw-12 and contains 3 caches and 2 small tent rings. Average tent ring dimensions are 2.5 x 3.0 m, and apron rocks are deeply set into the moraine surface. Both caches are small, approximately 1.5 m^2.

The LlDw-14 site is located approximately 75 m west of the LlDw-13 site and is comprised of 2 small tent rings placed on the northern edge of the moraine. The rings measure 1.9 x 1.2 m and 4.0 x 1.8 m respectively, and are separated by a distance of 3.8 m. The surface of both features is sterile.

LlDw-15 is located approximately 95 m west of LlDw-14 and consists of a single tent ring (3 m^2). The interior of the feature is well-vegetated, with a moderate-heavy lichen cover on the perimeter apron stones.

LlDw-16 consists of three cairns. The first is 13 m west of LlDw-15 and is 0.6 m high with extensive lichen cover. The second is 9.0 m further west and is 0.4 m in height. The third is located an additional 22 m west and is ca. 0.5 m high. No other features or artifacts were recorded in the immediate vicinity, and based on similar degrees of lichen growth, the features are believed to be of the same age.

LlDw-17 is located 70 m west of LlDw-16. It contains a single tent ring (3.2 m^2), the interior of which is completely overgrown with grass and moss.

LlDw-18 is a small windbreak/hunting stand constructed against the side of an glacial erratic. It measures 0.94 x 0.67 m and is devoid of any other cultural materials. Lichen cover is abundant.

LlDw-19 contains two oval tent rings 500 m west of the moraine pond, at the point where the moraine begins to widen. The dimensions of the tent rings are 4.5 x 4.0 m and 4.1 x 3.1 m. Interiors have a lichen-covered gravel surface and contained no artifacts or faunal remains.

LlDw-20 is found on the north crest of the ridge, approximately 120 m west of LlDw-19. It consists of 1 dismantled cache (1.6 x 2.7 m) of medium sized boulders. Lichen cover is light to moderate over the exposed interior of the feature.

LlDw-21 contains two tent rings (4.9 x 6.0 m / 3.4 x 4.2 m) and 2 caches (1.9 x 1.7 m/ 2.6 x 2.8 m) located 120 m west of LlDw-20. Stones used in all features are deeply set into the moraine surface.

LlDw-22 consists of one oval tent ring (3.7 x 2.8 m), situated 80 m north of the LlDw-21 site. Vegetation completely covers the interior, but there is comparatively light lichen cover on the apron stones.

Two sites of indeterminate age were recorded near the mouth of the Amadjuak River Site LlDv-6 is situated on the largest island in the mouth of the Amadjuak River. It consists of 1 large (empty) boulder cache at the northern tip of the island, 3 tent rings in a small saddle near the southwest shore and 1 tent ring at the highest point of the island's southwest corner. All of the tent rings are of light construction, but no associated surface materials of any type were observed.

The Fish Point site (LlDv-7) is located at the eastern tip of the South Burwash moraine at the water's edge. It consists of a short row of small cairns and 3 dismantled features interpreted to be tent rings. All features are situated on exposed boulders/bedrock and are devoid of other cultural material.

The following sites are all located on isolated bedrock exposures south of the South Burwash moraine.

The Trap site (LlDv-9) is located approximately 0.5 km southwest of the South Burwash moraine on a large bedrock exposure. It contains 3 stone fox traps of the "box" variety in which a stone slab drops to cover the entry once the bait has been taken. The maximum dimensions of the traps are approximately 1.0 m^2. Height ranges between 0.5 and 0.6 m. Interior dimensions were recorded for 2 of the features: internal passage length: 0.40 and 0.60 m; trap entry: 0.20 m^2.

The Monolith site (LlDv-11) consists of a large, tabular block of granite which forms the most prominent cultural landmark south of Burwash Bay. It is located approximately 1 km south of the moraine and contains three components. The main component is the standing stone, which rests on outcropping bedrock. It is 1.1 m high, 0.85 m wide at the base and is 0.28 m thick. Several abrasion marks are visible on its west face, presumably the result of initially positioning the stone. South of the main block are three fallen stones which are thought to represent the "arms" and "head" of the original Inukshuk. Support for the interpretation that these rectangular blocks were formerly positioned on the main block is found in the presence of plant growth beneath them.

Six metres southeast of the Inukshuk is the remains of a small hearth or lamp/stove platform. It consists of two rectangular blocks approximately 0.3 m in length and 0.1 m in width, and two smaller fragments. There are no surface materials of any type around this feature. Both of the larger stones are anchored to the bedrock by black crustose lichens (tentatively identified as Alectoria miniscula). The diameters of the lichens suggests the feature may have been constructed as much as two centuries ago.

A third component is located 30 m southeast of the Inukshuk, is thought to be a hearth/workshop area. Its areal extent is defined primarily by several small scatters of quartzite flakes and other detritus. This material is identical to that recovered from excavation of tent rings at the Tuktumoon Site (LlDv-5). Alectoria miniscula is present on the stones which define the feature, as well as on the quartzite detritus.

The LlDv-12 site is a large (1.18 m diameter; 1.0 m high) tower cache located 80 m southeast of the Monolith site. The walls of the cache are partially dismantled and the interior contains a very small amount of caribou bone (<10 elements) and luxurious plant growth.

LlDv-13 is located approximately 90 m southeast of the Monolith site is a single crevice cache (est. size 1.0 m^3) with medium sized boulders and flat slabs piled across the top. The boulder "roof" is almost completely dismantled and the cache contained no faunal material or artifacts. Its interior is heavily vegetated.

LlDv-14 consists of two crevice caches (est. size 0.9 m^3 each) and is located approximately 115 m southeast of the Monolith site. Both are quite deep and have collapsed inward. No artifacts or faunal materials were observed in these features.

LlDv-15 is located 180 m southeast of the Monolith site and consists of 1 boulder and 1 crevice cache. Both are dismantled and approximately 1.0 to 1.3 m^3 in size. Both features were empty.

LlDv-16 is situated 750 m southeast of the Monolith site and contains 10 features: 2 Inuksuit, 2 tent rings, 5 crevice caches and 1 boulder cache. The Inuksuit are large granitic blocks approximately 1.0 to 1.3 m in height. One Inukshuk is associated with smaller, fallen blocks which apparently once represented the "head" and "arms" of the feature. The second Inukshuk is of the single block type and is associated with (i.e., marks the location of) four of the caches at the site. Both Inuksuit have extensive lichen cover and appear to be of considerable age.

Each tent ring is comparatively small (1.3 x 1.4 m / 3.5 m^2), has widely spaced stones and low rock walls. Lichen cover is heavy on the aprons stones and interior of both features. One of the rings has an associated lamp platform. All of the caches have volumes on the order of 0.75 to 1.0 m^3 but only a few caribou elements were observed in one of the features.

Discussion

The survey results provide a basis for a general discussion of the patterns of settlement on Nettilling Lake. Since the Burwash Bay region was the most thoroughly investigated much of the following discussion focusses on this area.

The general distribution of sites is clearly influenced by local topography. Seventy-five percent of all sites are located on glacial landforms (i.e., moraines, eskers, beach ridges). Exceptions to this trend are most evident in Mirage Bay and along the southeast side of the lake, areas which are dominated by Shield topography. The high frequency of use of the glacial features is consistent with expectations concerning the potential of such areas for building supplies, drainage, travel and monitoring for game, as well as the use of these landforms by caribou while feeding in the lake area during the summer and migrating south in autumn. In addition to caribou, other food resources must also have influenced the location of settlements. The concentration of sites around the mouth of the Amadjuak River, for example, can be partially attributed to the good availability of fish. Similarly, at Tikeraq Bay and in the vicinity of the Mosquito Ridge site the availability of waterfowl, particularly snow geese, would have attracted settlement there.

It is also evident that the eskers and moraines have been preferred settlement locations on the lake by all cultural groups who exploited the Nettilling region. Many sites show evidence of use by Pre-Dorset, Dorset, Thule and Inuit groups. The temporal overlap is most evident between Thule and Inuit populations, with nearly all of the larger sites in Burwash Bay providing evidence of use by both groups. No definite Paleoeskimo structures have been located; however, artifact assemblages clearly indicate the presence of both Pre-Dorset and Dorset cultures. Isolated Paleoeskimo sites were also recorded at LlDv-4 (Rapids Site) , LlDv-10 (Sandy Point Site) and MaDv-11 (Mosquito Ridge Site).

Concerning the seasonality of land use in the interior, for the prehistoric period virtually all of the sites can be associated with summer and fall activities. Only four features (three at MaDv-3; one at MaDv-11) can be considered to have been occupied during the winter. Individual features recorded at MaDw-2 and MaDv-13 are of the Thule semi-subterranean style, but are essentially surface constructions and are not thought to have functioned as winter dwellings. While sites in areas yet to be surveyed may reveal greater use of the interior during the winter season the available evidence suggests that groups rarely wintered on Nettilling Lake or, if they did, they occupied snow houses which have left no archaeological remains. The lack of evidence for a substantial year-round prehistoric occupation of the area is consistent with ethnographic descriptions and historic reports of poor game availability (cf. Soper 1928; Neatby 1977). During the historic period families from various parts of southern Baffin Island did winter on Nettilling and Amadjuak Lakes in order to trap foxes, but these camps were usually provisioned in part with food supplied by the Hudson's Bay Company. In any event, such groups would have made use of snow houses and evidently seldom stayed more than one winter.

Consistent with the patterns described thus far, there is also evidence for overlap in the seasonal use of residential sites. Of the five main Thule sites identified in Burwash Bay that appear to have functioned primarily as residential camps, all contain habitation features associated with both summer (e.g., "light" tent rings) and fall occupations (e.g., "heavy" tent rings/qarmat), and two contain winter structures. In addition to the diversity of habitation structures, the general range of variation in sites indicates that many specific locations have served multiple functions through time. This is especially evident at LlDv-5, the largest site located, which contains a variety of habitation and storage features in spatial components (defined arbitrarily) from different time periods.

As a possible means of assessing the role of logistical mobility at a general level in the Burwash Bay area, 10 km foraging radii are shown for five summer/fall sites assumed to have been Thule residential camps, and two sites assumed to have functioned as field camps with associated storage and hunting facilities (Figure 51). Several points emerge from the illustration. The first is that the radii overlap considerably with the result that most sites, regardless of function, fall within the foraging zone of each residential camp. Such a pattern is consistent with expectations regarding the general role of logistical mobility (i.e., relatively close to base camps) in the interior. However, it should not be assumed that these spatial relationships allow a particular special purpose site to be linked with any specific residential base and, therefore, the identification of components of individual camp "systems". For example, the Rack Site (MaDw-2) located on the West Burwash Moraine, which is considered to have been a field camp, falls within the foraging radius of four of the five base camps and barely penetrates the logistical radius of the fifth (LlDv-1). As a result, it could have been

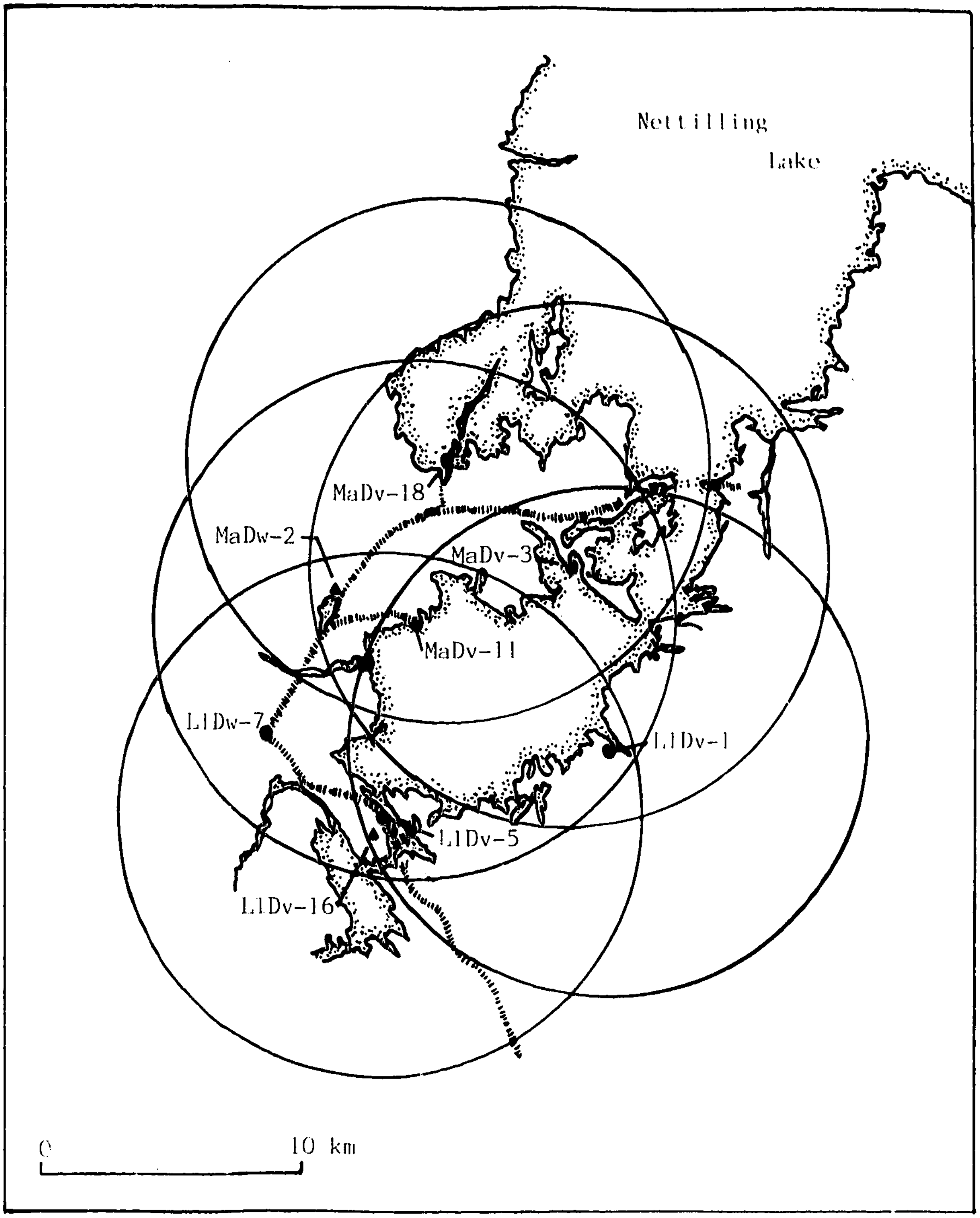

Figure 51. Foraging radii associated with residential sites located in Tikeraq and Burwash Bay areas, Nettilling Lake.

generated by a task group operating from any one of these camps, or possibly other camps not located through survey. Using a slightly different form of reasoning, the close proximity of site LlDv-16, and a small cluster of nearby sites (LlDv-11 to 15), to LlDv-5 near the mouth of the Amadjuak River, can be viewed as a negative association. During a period when LlDv-5 may have been used as a residential camp, there would be no reason to establish a field camp and storage facilities if animals were killed only a few hundred metres away. These facilities would have presumably been generated when the residential camp was located elsewhere, and at a distance beyond which it was feasible to transport immediately all of the animals killed.

Based on a study of short-term site use frequency, Binford (1978:488 ff.) found that among the Nunamiut, preexisting seasonal residential sites were seldom, if ever, reused. By contrast, special function camps (e.g., hunting camps, fishing camps, caches, kill sites) had a very high rate of redundancy in their use. The archaeological implications of this are that if specific residential camps are unlikely to be used sequentially in a more or less redundant fashion, they should exhibit considerable variation in the occupational debris left behind, while special purpose locations will exhibit redundancy in their assemblages. Grønnow (1986:78), however, states that among "part-time" interior hunters in West Greenland, redundancy in the use of residential sites, also over the short-term, was common:

> "A single family's use of an inland camp during several hunting seasons did not result in several dwellings; the same tent house, tent ring or other structures were generally used over and over again..." (Grønnow 1986:78).

Under these conditions, assemblage redundancy in residential sites might occur, and several residential sites in Burwash Bay suggest that they were used in a similar manner on some temporal scale. At Mosquito Ridge, for example, there are only two types of features, tent rings and semi-subterranean houses. The seven semi-subterranean houses (actually qarmat) are approximately the same size, built on the same edge of the ridge and presumably represent autumn occupations of the site, possibly time spent while waiting until freeze-up in order to return to the coast by komatiq. It is unlikely that seven families would occupy this location at one time, but the grouping of six of the houses into three pairs might indicate that smaller groups of families did. The tent ring structures at this site are also consistent with repeated use. Of the seventeen tent rings recorded at this site, a few are thought to relate to a Pre-Dorset occupation, with the remaining fourteen dating to the early historic period. The structural similarity of the features and the lack of other types of features, suggests a degree of redundancy in use.

A similar situation appears at MaDv-18 in Tikeraq Bay, and at the LlDv-5 site. Habitation features thought to be of Thule age appear to fall into two basic types: "lightly" and "heavily" constructed tent rings. Although the number of features present in this site might suggest occupation by a relatively large groups, it may also be the result of repeated occupations over a long period of time.

Artifacts

The artifact assemblages recovered through the excavation of Thule habitation features and caches are very small and limited to a few functional categories (Table 12). These characteristics can be attributed to the fact that most tools and weapons were highly "curated" (Binford 1979), and brought to interior camps from the coast or retrieved from storage in equipment caches at special purpose sites (e.g., Isoa). The recovery of two artifacts from stone caches at LlDv-5 indicates that items were occasionally left in other locations.

In spite of their small quantities, the artifacts do provide useful information relevant to settlement and subsistence strategies on Nettilling Lake. Evidence for travel to and from the lake by komatiq, presumably during spring or early winter, is provided by whalebone sledshoe and ivory trace buckle fragments from MaDw-2 and LlDv-5. As would be expected,

Table 12. Summary of artifacts from Thule period sites in Burwash Bay area, Nettilling Lake, Baffin Island.

Artifact	MaDv-3	MaDv-11	MaDw-2	LlDv-5									
				H2	H4	H6	H7	H8	H9	H10	H12	CH	CJ
soapstone	-	1	-	1	3	8	-	-	-	-	-	-	-
slate blade	-	-	-	-	-	3	-	-	3	3	1	1	-
slate frag.	1	6	-	2	2	1	3	-	6	3	-	-	-
whetstone	-	-	-	1	1	-	-	-	1	-	-	-	-
drilled slate	1	-	-	-	-	-	-	-	-	-	-	-	-
baleen strip	-	-	-	-	-	-	-	-	1	-	-	-	-
worked w' bone	1	-	-	-	1	-	-	-	-	-	-	-	1
harpoon head	-	-	-	1	-	-	-	-	-	-	-	-	-
kakivak barb	-	-	-	3	-	1	-	-	-	-	-	-	-
trace buckle	-	-	1	1	-	-	-	-	-	-	-	-	-
bone awl	-	1	-	-	-	-	-	-	-	-	-	-	-
bowdrill mouthpiece	-	-	-	1	-	-	-	-	1	-	-	-	-
worked bone	-	3	-	3	-	-	-	1	-	-	-	-	-
bone scraper	1	-	-	-	-	-	-	-	-	-	-	-	-
bone endblade	-	-	-	1	-	-	-	-	-	-	-	-	-
worked ivory	-	-	-	-	-	-	-	1	-	-	-	-	-
sledshoe frag.	-	-	-	-	-	-	-	-	1	-	-	-	-
Total	4	11	1	14	7	13	3	2	13	6	1	1	1

artifacts related to subsistence activities are those associated with caribou and fish procurement. Kakivak side-barb fragments in houses at LlDv-5 suggest the use of weirs, although none were observed in the Amadjuak River. As previously discussed, existing weirs may have been completely destroyed by river ice during spring break-up. Ground slate endblades found in several houses at LlDv-5 are presumed to have been fitted to bone or antler lance heads, since seal hunting is thought to have been a minor subsistence activity while residing in the lake area. Nevertheless, a self-bladed Thule Type II (Mathiassen 1927) harpoon head was recovered from House 2 at LlDv-5. Although by no means numerous, small slate fragments occur in most features suggesting that endblades (or ulu or other knife blades) may have been manufactured or modified on site. This suggestion is supported by the presence of several whetstones. Other manufacturing/processing tools are rare (e.g., bow drill mouthpiece, bone awl, scraper).

The general characteristics of the assemblages provide useful information concerning procurement techniques and, insight regarding possible functional classifications of specific sites.. For example, in the LlDv-5 assemblages the recovered artifacts are associated with food preparation and other "domestic" activities (e.g., soapstone lamps/vessels) and with the procurement of a range of subsistence resources (e.g., fish, seal, caribou, waterfowl), many of which are most efficiently harvested by small groups acting in a cooperative fashion. Interestingly, items associated with more "individualistic" strategies (e.g., those related to stalking individual or small groups of caribou with bow and arrow) were not found at LlDv-5 nor in any of the other prehistoric sites on Nettilling Lake. LlDv-5 is located on the crest of a moraine near the mouth of the Amadjuak River, at a crossing point apparently used on a fairly regular basis by caribou. The surrounding terrain (i.e., below the moraine) provides many locations suitable for ambushing individual animals or small herds while on land. The artifacts, however, suggest that most caribou were killed while crossing the Amadjuak River. At its mouth the river is approximately 0.5 km wide, and once in the water it takes animals several minutes to cross, providing ample time for hunters to lance them from kayaks. A similar strategy may have been employed at LlDv-1, located on the south side of a narrow inlet northeast of the Amadjuak River. We have observed caribou crossing this inlet, and hunters may have taken advantage of similar behaviour in the past. This procurement strategy obviously could not have been adopted at other sites not situated at or near rivers (e.g., along the West Burwash moraine), and bow hunting may have been practiced. The few artifacts recovered from these sites, however, provide no specific evidence concerning hunting strategies. At LlDv-5 the limited amount of information provided by the artifacts suggests occupation by larger numbers of people (i.e., multi-family groups) and implies greater residential than logistical use of the location. However, when combined with the the number and variability of features present, it is probable that the site was occasionally used as a hunting camp by groups residing elsewhere. In either case, similar hunting tactics may have been employed, although the presence of caches at a small group of sites behind LlDv-5 (i.e., LlDv-11 to 15), approximately 1 km away from the river, suggests that ambush hunting was also practiced.

CHAPTER TEN

FAUNAL ANALYSIS

Introduction

The principal hypothesis examined in this study is that Late Prehistoric caribou hunting systematics in the Nettilling Lake district was characterized by a subsistence-settlement pattern featuring both low residential and low logistical mobility. That is, during periods of low availability of this resource groups positioned themselves at the few specific locations where harvesting was possible, but only after significant movements away from the "normal" settlement pattern.

As discussed in chapter one, Binford (1978, 1980) proposed a model of hunter-gatherer settlement and subsistence organization incorporating two basic adaptive strategies. Foraging systems tend to be associated with environments in which resources are generally distributed in an undifferentiated fashion, and are procured on a frequent (often daily) basis through what is called an "encounter" strategy. Because adequate supplies of resources are available locally and can be harvested as required, foraging groups normally confine their procurement activities to a limited area (i.e., "foraging radius") surrounding a camp. In addition, there is usually little or no requirement for food storage to meet future needs. Foraging strategies generate two basic types of archaeological sites: residential bases and locations. Residential sites serve as the central base of activities, whereas locations are those places where food procurement and other tasks are carried out. The economic criterion for residential mobility in a foraging system is the depletion of one or more essential resources within the foraging radius. As a result, base camps may be shifted frequently through an annual cycle, resulting in high residential mobility.

Collecting systems, by contrast, normally occur in environments where there may be both spatial and temporal variability in the distribution of key resources. Because residential moves alone cannot adequately compensate for these circumstances, specialized "task groups'" leave residential camps for extended periods to procure food and other resources. As a result, collecting strategies generate three types of special purpose sites (i.e., field camps, stations and caches) in addition to the base camps and locations also recognized for foragers.

Residential mobility among collectors is lower than for foragers, but collecting systems are characterized by high "tactical" or logistical mobility. The economic criteria for residential and logistical mobility in a collecting system are seasonal changes in the resource structure and the spatial consequences of these changes (i.e., primarily as they affect the scale of logistical mobility) for the organization of resource procurement.

To evaluate the study hypothesis within the collector/forager organizational context, it is necessary to assess the potential role of individual sites within the settlement-subsistence system. Although all sites need to be appraised in terms of their possible functions, residential bases are of special relevance because they form the core or "hub" of subsistence activities in both systems, and their locations define the zones of both foraging and logistical activities. Accordingly, the role of both residential and logistical mobility cannot be evaluated without reference to a residential base.

As already discussed, determining the function of specific sites or components in the study area is hampered by the general lack of associated artifacts and faunal materials. While many sites are readily classified as logistical in function (e.g., caches, monitoring stands, Inuksuit) others cannot be easily categorized. This is true particularly for habitation structures which assume a variety of forms and occur within sites in numbers from as few as one to more than twenty. To some extent, functional classifications are aided by consideration of topographic location, and the number and type of features present. However, in the absence of supportive evidence, in many cases such classifications may be incorrect.

Faced with a similar problem, Savelle assumed that Thule sites consisting of only one or two dwelling structures represented field camps, while those consisting of larger numbers of such features represented residential camps (Savelle 1986:97-98). Such a distinction may be appropriate, but it assumes contemporaneity of features in any given type of site. Moreover, it is difficult in the present context to distinguish travel camps generated by movements of families or individuals around the lake area from transit and field camps generated by hunting parties. Certain sites thought to have functioned as field camps (e.g., LlDv-16, MaDw-2) have characteristics consistent with the criteria used by Savelle (i.e., two habitation features each); however, their classification was also based on other lines of evidence (e.g., presence of temporary storage features).

As previously discussed, most habitation features occur on the moraine and esker networks, which clearly were used repeatedly as thoroughfares for both travel and hunting around the southern end of the lake. As a result, over the long term it is probable that certain locations were utilized differentially, resulting in a complex history of use. A hunting camp consisting of a single tent ring established midway between the Amadjuak River and Tikeraq Bay, for example, could subsequently have been used by families travelling between residential camps, or to/from the general lake area. This form of use could increase the number of habitation features present and thus affect the site's classification. Even if the size of the site was not increased, given that both site types are typically occupied for brief periods of time and may leave little if any debris, it may be impossible to distinguish the different functions served by the site, let alone its primary one. In view of these difficulties, sites considered to have been used primarily for residential purposes have been classified as such according to several criteria including the number and structural complexity of habitation structures (i.e., with multiple coursed walls, sleeping platforms, interior paving, cooking alcoves, etc., cf. Figure 16), location of the site relative to primary and secondary (e.g., water, fuel, building supplies) resources, and the number and type of associated features (e.g., caches, hearths, etc.). Camps consisting of fewer and less complex forms of dwelling structures (e.g., light tent rings, overnight shelters) and which are judged to be less preferentially located with regard to secondary resources are considered to have served primarily logistical functions. It should be emphasized that in many cases the resulting classifications are tentative, due in part to the lack of supportive evidence (e.g., artifacts, faunal remains) and in the larger sites, an obvious heterogeneity in the types of features present.

This condition is presumably the result of successional use of specific locations through time. Binford (1983:366 ff.) has discussed the palimpsest assemblages produced by Nunamiut hunters as a consequence of variable usage of specific places through a single hunting season. Among the effects of variable site utilization reported by Binford (op. cit.) was a tendency for residential locations to display greater complexity in their archaeological remains, as a result of the use of such locations for both residential and logistical (i.e., when the residential camp is located elsewhere) purposes . The frequency of site utilization in the present context is unknown (i.e., whether it varied within a single season of occupation, or on an interannual basis), but many of the camps classified as residential display the type of complexity suggested by Binford.

Although site attributes (e.g., location and feature types) and the limited artifactual data can be combined with ethnographic analogues to derive possible functions for camps in the Nettilling Lake region, they offer no means of empirically assessing the classifications. Where faunal remains occur, however, their analysis may provide a method of evaluating the function(s) of a particular site. In his study of Nunamiut procurement systems, Binford (1978) demonstrated that while variability is introduced by specific forms of processing and other formation processes, at a general level, different types of logistical sites produce internally consistent faunal assemblages (e.g., kill sites, hunting camps). Faunal patterning in residential camps was found to be more complex and conditioned by the season of occupation as well as the extent to which food was introduced from or removed to frozen or dried reserves, among a host of other variables (e.g., attrition by dogs). Nevertheless, from a general perspective, Binford suggests that residential sites can provide basic information about the form of an adaptive strategy:

> "The accumulated debris at such a base or hub of operations reflects the execution and relative success of all the separate strategies executed during the occupation. It is, in many ways, an accumulated sample of the adaptive system, composed of numerous strategies and different activities with very different goals, clothing production versus food procurement..." (Binford 1978:487).

Among the key factors identified by Binford (1983) as conditioning site content homogeneity/heterogeneity is the scale of mobility. Binford (1983:370-371) proposed that as residential mobility decreases in a logistically organized hunter-gatherer system, repetitive use of other locations will increase as the economic potential of the surrounding habitat becomes stabilized or "fixed". The overall effect of this is to increase site content homogeneity:

> "This should have the cumulative effect of yielding a regional archaeological record characterized by greater intersite diversity among ancillary or or non-residentially used sites but less intrasite diversity arising in the context of multiple occupations." (Binford 1983:371).

In the present study two system "states" have been modelled for one of which it is hypothesized that residential mobility is at a minimum and in locational terms geographically repetitive. Under such conditions, greater redundancy in assemblage content may be anticipated in residential sites, notwithstanding the important effects of various site formation processes (Schiffer 1976,1987). Were it possible to distinguish clearly the various processes influencing the composition of the faunal assemblages a better understanding of the role of successional site use would emerge. However, lacking such information examination of the general nature of the faunal evidence is considered an appropriate means of developing a provisional understanding of the form of inland adaptive strategies.

Using this reasoning, the objectives of the faunal analysis are to: (i) determine if sites considered on other lines of evidence to have functioned as residential camps were in fact used in that manner, (ii) assess the degree of culling of low-utility anatomical parts and, therefore, (iii) evaluate the role of logistical mobility in the subsistence strategy. An additional objective is to explore the possibility of selective procurement of animals on the basis of age or sex as a response to conditions of low caribou abundance. The specific techniques used are discussed below.

Faunal assemblages appropriate for these types of analyses were recovered from three sites only. From LlDv-5, situated near the mouth of the Amadjuak River, faunal material was recovered from nine tent ring features and nine caches. Most of the assemblages are very small and analyses were conducted only on assemblages from four of the caches and two of the houses. The largest cache assemblage has been radiocarbon dated to the Thule period, and both house samples are also of Thule age. In view of its size and proximity to the river (where caribou cross and secondary resources are available), this site was considered to have functioned primarily as a residential camp, despite the large number of caches present which might be interpreted to reflect storage from field hunting (i.e., logistical camps). The nature of these features is discussed below, but it should be noted that LlDv-5 is located on the surface of the moraine well above (7.7 m) and several hundred metres away from the Amadjuak River where caribou cross. After crossing the river animal movements tend to parallel the moraine for several kilometres, but camps would not be established on the hunting site itself.

From LlDw-7, faunal material was excavated from a large cache constructed against an erratic boulder. This site is located at the junction of the South and West Burwash moraines and the cache was interpreted as a storage facility for caribou killed by hunting parties operating out of a base camp located elsewhere in the region. The faunal assemblage has also been radiocarbon dated to the Thule period.

The third assemblage comes from a Thule semi-subterranean winter house at the Mosquito Ridge site (MaDv-11). On the basis of excavation results, this assemblage was interpreted to be refuse dumped into the entry of the feature and was not considered to represent debris associated with a winter occupation of the site. This site is, however, considered to have functioned primarily as a summer and/or autumn residential camp.

While the total sample analyzed is small, it includes sites located in different topographic settings and thus was expected to provide insight regarding patterns of settlement and subsistence in the Burwash Bay district.

Cache Structures

It is appropriate to note at this point that the faunal assemblages recovered from features identified as "caches" do not represent the remains of food stored for later consumption. For many hunter-gatherer societies a basic assumption concerning features identified as caches is that they reflect a specific form of subsistence behaviour (i.e., food or equipment storage), and that where found, they provide information concerning the nature of the subsistence base and its effects on the settlement and subsistence system. Caches constructed by prehistoric Arctic hunter-gatherers are not routinely excavated since they are often found through visual inspection to be empty, or appear to contain only a few bone fragments considered inadequate for analysis. In some cases, excavations may confirm their function (e.g., Binford 1978), but the general lack of data on which to base interpretations may lead to inaccurate conclusions regarding the nature of the resource base and the role of a particular site or component in a settlement system.

Several lines of evidence support the argument that the caches excavated at Nettilling Lake sites were not used to store food. The first is the degree of bone fragmentation. Out of the total number of caches recorded on Nettilling Lake only a single one, located on Nikku Island, contained unbroken caribou long bones. This assemblage presumably represents a meat cache that was never retrieved. In every other cache investigated, and that contained faunal material, all long bones present were broken. This indicates clearly that the animal parts had been processed for both meat and marrow, and had little food value beyond that possibly obtained through additional processing for bone grease. However, no direct evidence for grease manufacture (cf. Binford 1978:157-167) was found in any of the sites.

A second form of evidence is the composition of the cache fauna. All samples are dominated by caribou bone, but several include elements from other species such as goose, fox, dog, and seal. The low frequency of these remains, and the fact that they are also broken or otherwise damaged, makes it unlikely that they were deposited with attached meat.

Carnivore damage to the bones further suggests that they had been completely processed for food since it is assumed that dogs (or wolves) would not be allowed general access to the animal remains, but only to those parts discarded (i.e., by wolves when site is abandoned) or intentionally fed to them (i.e., dogs).

A final consideration is the structural attributes of many of the caches. Most are of the freestanding boulder type, but only a few contained an interior chamber large enough to hold segments of animal carcasses (cf. Binford 1978: Figure 5.49, 5.50). Clearly some of these features may have collapsed inward, but as a rule, the boulders covered accumulations of bone fragments in a few cases set into shallow excavations, up to 20 cm deep. In still other cases, the caches were constructed against glacial erratics and in narrow, deep crevices. In the latter type it was very difficult for excavators to reach the bones at the bottom of the crevice, and it appears, therefore, that they were never intended to be retrieved.

In combination, these attributes suggest that the majority of the features identified as caches at Nettilling Lake sites did not function as food storage receptacles, but as refuse deposits. While it is not suggested that all such features in the area were originally constructed or subsequently used for this purpose, there is little empirical evidence demonstrating a sequence of functionally discrete use. As previously discussed, only two caches (at LlDv-5) contained material other than faunal remains, but it remains unclear whether the two artifacts had been discarded or stored (although it is conceivable that both could have been reused).

Other investigators have reported caches that apparently were designed and used for food storage (e.g., Binford 1978:240-245; Grønnow et al. 1983:49-50; Savelle 1988:60-62, 1989: pers. comm.). Binford (1978:241 ff.) described the caches at Tulugak Lake as containing meat dried or otherwise processed, but does not refer to any fragmented long bones in the sample. Grønnow et al. (1983) discuss similar features at the Aasivissuit site in West Greenland, from which long bones with desiccated meat still attached were recovered. In the central Canadian Arctic, Savelle (1988) has reported on faunal assemblages from caches at the Malerualik site on King William Island. Long bone shaft fragments and articular ends, were well represented in both assemblages, each of which was nevertheless interpreted to be the remains of stored food (Savelle 1988:61). The evidence from Nettilling Lake suggests that these assemblages may actually consist of bone refuse, and thus reflect discard rather than storage behaviour (cf. Schiffer 1987).

The size and design of several empty caches in the study area are consistent with use for food storage, but these are relatively few in number and all of the excavated caches consistently produced faunal samples of the same general type (i.e., highly fragmented). This is viewed as compelling evidence for the final, if not original, use of most features as discard facilities. The reasons for this behaviour, and its implications for understanding subsistence and settlement in the Nettilling region are discussed in a later section.

Assuming that the cache faunal data does not represent food storage introduces the issue of cumulative assemblages. That is, bone refuse may have been deposited into a single feature on more than one occasion and thus alter the original structure of the assemblage. As in the case of attempting to identify sequential use, there is no reliable means of determining whether or not this occurred for any particular feature. No internal stratigraphy was observed in the deposits, and even in the very small collections many long bone shaft fragments can be refitted to their articular ends, suggesting that the elements could represent discrete assemblages, possibly deposited during single events. Based on these admittedly subjective criteria, but recognizing that existing structures may have been reused, for present purposes each cache assemblage is treated as a discrete unit.

Methods

Faunal materials were obtained through excavation of houses and caches, or by surface collection. Efforts were made to collect all bone fragments, but the matrix surrounding subsurface faunal remains was not screened. As a result, smaller bones or fragments as well as very small bone chips (particularly in the large cache assemblages) were not collected. The faunal remains were analyzed at the University of Alberta using comparative materials in the Department of Anthropology, and at the Provincial Museum of Alberta.

The units of analysis are individual site features. The number of identified specimens (NISP) and minimum number of individuals (MNI) are calculated for each assemblage (Klein and Cruz-Uribe 1984). The derivation of MNI's follows the procedure outlined by Binford (1978:69-72). In this method the quantity of a particular element recovered archaeologically is divided by the number of times it occurs in an individual animal. The resulting MNI's are then converted to a standardized scale out of 100. Thus, an assemblage containing 57 mandibles would result in an MNI of 28.5. If this were the highest MNI value for the sample, MNI values obtained for other elements in the assemblage would be divided by this figure and expressed as %MNI. The age and sex of the animal, and side of the element are not considered. In his experiences with the Nunamiut, Binford (1978:70) found that hunters did not discriminate between the left and right side of a caribou while butchering it. Binford defends the use of this technique by arguing that once an animal is killed, it is dismembered into segments and it is these units that are subsequently transported and processed, not whole animals. As such, the use of additional criteria to derive a "maximum MNI" may distort the character of the assemblage, particularly by inflating estimates of meat yield. Binford acknowledges the potential importance of information on the ages and sexes represented in an assemblage, but maintains that it presents an inaccurate picture of the frequencies of animal parts present.

Binford's technique has been used in several recent faunal analyses (e.g., Speth 1983; Todd 1987) and is employed in this study since the structure of the assemblages are examined using other analytical techniques developed by Binford (1978, 1981). It should be noted, however, that analysts may calculate MNI's in slightly different ways depending on the specific research questions (e.g., Speth 1983; Will 1985). As Will (1985:9[illegible]) has noted, Binford's method is inappropriate where the problem of interest centers on a great disparity between the actual number of animals killed and the number of bones present, as well as determination of the age and sex of the animals. Accordingly, in this study estimates of the number of animals in a particular age class represented in the faunal assemblages are based on calculations of MNI which consider the anatomical position (i.e., side) of elements, and where noted may differ from those used for other purposes.

<u>Taphonomic Considerations</u>

Consideration of the respective roles played by human and natural agents in structuring archaeological faunal assemblages has become an increasingly important part of contemporary archaeology (see Gifford 1981; Behrensmeyer and Hill 1980). This is true particularly in cases where the role of hominid behaviour in the formation of a particular assemblage is questionable (Binford 1981), but such information also contributes to an understanding of the processes affecting deposits of clearly human origin.

The general condition of the excavated faunal remains was quite good, despite the shallow soil and vegetative overburdens in most features and the [illegible] of permafrost conditions typical of coastal Thule sites. Permafrost on the moraines is reached at a considerable depth (i.e., > 1 m) below the surface. Bones recovered from surface scatters typically displayed various forms of weathering (e.g., bleaching, cracking, exfoliation) as well as modification by carnivores.

All of the faunal samples show evidence of modification by carnivores. Gifford (1981) refers to two basic forms of taphonomic processes which affect element frequencies in archaeological bone assemblages. Selective transport of elements away from or into a deposit may result from the action of nonbiological (e.g., water) or biological (e.g., scavengers) agents. There is clear evidence of erosion by wave action at MaDv-11, with the entry passages of several semi-subterranean houses having been washed into Burwash Bay. This form of transport is non-selective, however, and is not considered to have affected the recovered assemblages selectively.

The second process is attrition, a term referring to a suite of agents, that combined with the structural characteristics of bone, result in the differential destruction of certain elements or parts thereof. Carnivore activity represents one of the more prominent forms of bone attrition and in recent archaeological analyses considerable emphasis has been placed on understanding the role of carnivore activity on the composition of bone assemblages (e.g.. Binford and Bertram 1977; Binford 1981; Lyman 1982, 1985).

There is clear evidence of bone modification by carnivores in most of the recovered assemblages, but it varies considerably in degree between sites/components presumably as a result of the length of time the bones were accessible to scavengers. With few exceptions, carnivore damage is slight in most subsurface assemblages. Surface assemblages suffered the greatest attrition with virtually all bones displaying surficial scarring (e.g., punctures, pitting) and breakage patterns (e.g., impact notches, channeling, gnawing) similar to the forms discussed by Binford (1981:44-86). The assemblage at LlDw-7, for example, has been accessible to carnivores for several decades, a fact which has contributed greatly to the degree of attrition. Bones remaining in habitation structures subsequent to their abandonment would also be available to carnivores, but elements recovered from the houses generally do not show the same degree of damage as do the surface collections. The cache assemblages are particularly interesting in that most show some evidence of carnivore damage, but this must have occurred prior to the bones being deposited in the features.

Cache fauna was recovered from features that were solidly constructed and showed little or no evidence of disturbance. It is considered impossible, therefore, for the elements to have suffered any significant attrition by carnivores subsequent to their placement in the caches.

Determining whether dogs or wolves were primarily responsible for this form of bone damage is problematic. Although we rarely observed wolves in the study area while conducting the fieldwork, their presence has been documented by wildlife biologists (Ferguson 1986: pers. comm.). From ethnographic information we know that dogs were used either to pull komatiit or as pack animals while travelling to the interior (Boas 1964), and for this reason may have been the more important agent of attrition in most cases. Wolves, however, may have played a greater role in structuring surface assemblages after summer/fall sites were abandoned. It should also be noted that at least some of the surficial scarring and puncturing can be attributed to consumption by humans.

To assess the degree of attrition by carnivores, Binford (1978; 1981; Binford and Bertram 1977) developed several techniques using assemblages known to have been scavenged by dogs and others by wolves. These involve comparison of the ratios of long bone fragments to cylinders or articular ends. However, as noted by Lyman (1985:226) they do not necessarily allow the differentiation of cultural from non-cultural destructive agents, nor the relative role of transport versus in situ destruction. In this study, the potential role of carnivore scavenging is assessed using Lyman's (1985:Table 2) Bulk Density values. These values are plotted against the %MNI and the relationship evaluated using Spearman's Rank Correlation Coefficient (Siegel 1956).

The logic underlying this approach is that the frequency ("survivorship") of an element in an assemblage is determined in part by its ability to withstand destructive forces as a result of its density (Lyman 1985:226). Bones, or parts of bone, with low bulk densities are less likely to survive destruction than those with high bulk density. Whether or not carnivore scavenging occurred can be determined by simple inspection of the bones in a sample. Correlations obtained between element frequencies and their density, however, provide an empirical basis for evaluating the importance of this form of attrition in controlling the composition of a given archaeological assemblage. The results may assist, for example, in determining whether the faunal assemblage resulted from bones being transported or by other taphonomic factors (Lyman 1985: op. cit.). Morrison (1988:81), for example, reported that only about five percent of the faunal assemblage from the Kugaluk site displayed evidence of carnivore damage, yet a significant correlation was found between Bulk Density and %MAU values. As a result, scavenger destruction was identified as the primary factor responsible for the composition of the assemblage (Morrison 1988:87). Establishing the role of attrition is particularly important in analyses which employ Binford's (1978, 1981) economic utility indices to explore the possible function(s) of a particular site and variation in subsistence activities between sites. Since the latter indices stress the role of differential transport of elements based on a scale of economic utility, consideration must be given to the role of attrition.

Economic Utility

When an animal is killed decisions must be made concerning what parts will be returned to the habitation site and what, if any, will be abandoned at the kill or butchering site, assuming that all parts of an animal are not considered to be of equal value. These decisions may be based on any number of criteria, including idiosyncratic preferences; however, archaeologists have recognized for many years that in general, the parts of the carcass having the greatest food value (originally considered in terms of meat) will be returned to the habitation site, and those of low value abandoned at the kill location (e.g., White 1953). Transport decisions based strictly on the perceived value of the food are mediated by the distance between the kill and residential sites, mode of transport, amount of time available for butchering and the number of animals killed (e.g., Perkins and Daly 1968; Binford 1978, 1981; Lyman 1985; Metcalfe and Jones 1988). Where selective transport/abandonment of body parts occurred, this behaviour should be reflected in the relative frequencies of elements recovered from a site and provide a means of distinguishing, for example, kill sites from residential sites.

To provide an empirical basis for the analysis of variations in the utilization of animal carcasses, Binford (1978) quantified the amount of meat, marrow and grease for one caribou and two domestic sheep, and derived a set of utility indices based on these values. The Meat, Marrow and Grease indices were combined into a General Utility Index (GUI), which was further modified (MGUI) to account for the fact that certain low utility elements ("riders") may be butchered out and transported with higher utility elements due to their anatomical proximity (e.g., scapula with proximal humerus (Binford 1978:74). Binford's utility model, or permutations of it, have been applied in a number of archaeological studies (e.g., Speth 1983; Will 1985; Todd 1987; Legge and Rowley-Conwy 1988). While a number of recent studies have suggested improvements to the original indices (Lyman 1985; Metcalfe and Jones 1988), the technique provides a generally useful "...set of expectations about how different hunting and subsistence strategies should be reflected in the frequency of faunal elements in archaeological assemblages" (Metcalfe and Jones 1988:486).

In application, the %MNI for anatomical elements in an archaeological assemblage is plotted against the utility value for that element. Decisions made by the hunting group are then evaluated from the form of the relationship. Where negative correlations are obtained between element frequencies and their indexed utility, the relationship may indicate, for example, the presence of a kill site at which highly valued elements are selectively removed for consumption elsewhere. By contrast, higher frequencies of valuable elements and low frequencies of lower utility elements are typically interpreted to reflect a habitation (i.e., consumption) site. Three hypothetical strategies have also been suggested regarding transport decisions. "Bulk" strategies select for parts of high and moderate value, with few low value parts represented. A "gourmet" strategy is produced by the selection of parts of the highest value only, and in an "unbiased" strategy elements occur generally in proportion to their economic utility. Mixed strategies will also occur.

Using these criteria, a site that functioned as a residential camp should yield a faunal assemblage that correlates in a positive fashion with a scale of general utility (i.e, MGUI). Conversely, field processing or kill sites would be indicated where an inverse relationship with overall utility is found. It is hypothesized that the placement of residential sites close to procurement locations reduces transport constraints, and that this will also be reflected in the composition of the faunal assemblages. Binford (1978:459) has stated: "The greater the distance over which meat is to be transported, per unit of time, the more radical will be the culling of low-utility anatomical parts along the transport route." The degree of element culling is evaluated using line graphs which plot the frequency of elements present as a percentage of the total MNI using the technique suggested by Binford (1978:69-72). It is assumed that the greater the degree of culling of low utility elements the greater the distance the elements comprising the assemblage has been transported and, therefore, the greater the role of logistical mobility.

It is important to note that since the faunal assemblages being analyzed here are assumed to have resulted from processing for food (as well as skins and other raw materials for manufacturing purposes), the Modified General Utility Index (MGUI) is considered to be the most appropriate index for evaluating general assemblage composition. Values for other indices are tabled and occasionally referenced for discussion purposes. Binford (1978) has modelled a large number of permutations of the indices, based to a large extent on a highly specific knowledge of the original composition of assemblages and, in most cases, the human behaviours that subsequently modified them. The faunal samples analyzed in this study, however, represent the terminal end (i.e., they have been deliberately discarded) of continuum of use, which may have involved a number of variables for which we cannot control at this point. Moreover, many of the models derived from the Nunamiut system were based on consideration of future food requirements, since caribou was the staple food of their annual diet. For coastal Inuit, whose primary food base consisted of sea mammals, many of these variables may not have been as important. Parenthetically, it is clear that these indices do not monitor the value or use of skins. However, it is assumed that (i) obtaining skins was a principal motivation for settlement on the lake, and (ii) decisions made relative to the general value of other animal parts will be similar to other hunting contexts. It should also be noted that none of the various utility indices account for the possible role of social relationships (e.g., sharing) in faunal assemblage patterning.

Following the suggestion of Lyman (1985), curves are not visually fitted to the scatter diagrams; instead relationships between the various utility indices and element frequencies in the archaeological samples are examined using Spearman's Ranked Correlation Coefficient (Siegel 1956:202-213).

Age and Sex Structure

As Klein (1980; Klein and Cruze-Uribe 1984) has pointed out, important information concerning the manner in which people utilized particular species can be obtained when its age and sex composition in an assemblage can be reconstructed. Although information on animal age can be used to infer season of occupation as well as scheduling of the hunt, in the present study predation patterns, specifically evidence for selective predation is of greatest interest. In general terms, predation can be viewed as either unbiased or opportunistic in which the ages and/or sexes of animals harvested are simply those encountered or available. Faunal assemblages produced by this form of hunting will normally display little if any preference for animals of a particular sex or age. By contrast, where selective predation was in operation the resulting faunal assemblages, other things being equal, should display a clear bias for animals in a certain age class or of a particular sex.

A predation pattern that is selective implies that the prevailing resource conditions permit hunters to exercise choice during the harvest, taking into account the specific hunting technique employed (i.e., pit-fall traps are non-selective, Inuksuit drive systems, stalking and hunting at river crossings can be highly selective). According to Piryuaq (1986:14), young Caribou Inuit hunters were instructed by elders to only kill caribou of a certain age or sex at a particular time of year (based on its perceived dietary or other value at that season), and that it was only under conditions of resource scarcity that this rule or law could be deliberately broken. Soper (1932) reported that one of the consequences of the decline in the south Baffin herd was that hunters would kill any and all caribou encountered both for meat and in order to acquire skins for clothing. Based on these modern precedents which imply that procurement strategies were typically discriminating, the age and sex composition of the faunal assemblages from Nettilling Lake was analyzed in order to identify and evaluate procurement patterns. If predation (or "culling") proved to be highly selective according to either or both variables this might signify good availability of caribou and constitute a disproof of the resource stress hypothesis. Conversely, if predation was essentially unbiased in terms of animal age and sex, this could be interpreted as an indication of a reduction in resource availability consistent with the stress model, and thus reduced opportunity to harvest animals according to preference.

Age Structure

Establishing the age structure in the assemblages is complicated by the low frequency of teeth suitable for thin-section analysis and the high frequency of unfused epiphyses on the articular ends of long bones. Most of the teeth listed in the faunal summaries consist of small fragments that cannot be used to construct an age (or season of death) profile with any degree of confidence. A small number of intact teeth (n=10) were thin-sectioned, however, these produced very poor (i.e., unreadable) results. An attempt was made to estimate the age and season of death for a sample of reasonably intact molariform teeth on eruption and wear criteria using information published by Miller (1974). This also yielded equivocal results, partly due to the small number of teeth recovered, and in other cases the inability to determine which teeth might have come from a single individual. A small number of mandible fragments, however, were aged on the basis of tooth eruption.

Estimates based on the timing of epiphyseal fusion also present problems. First, there is little published information concerning the fusion sequence of post-cranial caribou bones. In this study the sequence suggested by Spiess (1979:Table 3.15) is used. Second, and of particular importance, is the fact that epiphyses on the articular ends of elements fuse to their diaphyses at different times, in some cases years apart. The timing of fusion for the proximal and distal ends of the humerus, for example, may differ by as much as two years (Spiess 1979:Table 3.15). As a result very different age estimates will be produced depending on which element or part is used. This problem is compounded by the degree of breakage and attrition in the assemblages from Nettilling Lake. A fused distal tibia, for example, indicates an animal greater than approximately 1.5 years of age, but the proximal epiphysis for this element does not fuse until between 3-5 years of age. Where both articular ends are present in an assemblage containing many tibiae with different fusion attributes, but cannot be confidently paired, a misleading picture of the age structure may result. Although some long bones in the assemblages could be partially reconstructed, it was considered impractical to attempt this for the purpose of constructing an age profile, since a number of the larger bone samples contained hundreds, and in one case thousands of long bone shaft fragments.

In view of these constraints, assemblages are subdivided into broad age classes using epiphyseal fusion data. In many cases only a mature/immature distinction is reported while in others approximate age classes are suggested.

Sex Structure

Comparatively few archaeological analyses dealing with caribou remains have attempted to determine the sex structure of prehistoric assemblages. This can be attributed to the fact that elements in caribou bone assemblages are often highly fragmented, and to a lack of suitable comparative collections of known age and sex from which control measurements can be derived. An additional factor is the fact that sexual dimorphism in caribou is not as pronounced as in other species (e.g., bison, Todd 1987) making it more difficult to sex elements or parts thereof accurately.

Despite these potential limitations, several studies that have used metric data to reconstruct the structure of caribou faunal assemblages have yielded interesting results. Among the more detailed studies is that of Spiess (1979) who used measurements taken from nineteen caribou skeletons of known age and/or sex to evaluate procurement strategies responsible for Rangifer-dominated assemblages from Upper Paleolithic France. Grønnow et al. (1983) also successfully used osteometric data from two elements to estimate the proportion of male and female caribou in archaeological assemblages from West Greenland dating to 1650-1750 AD (Grønnow et al. 1983:Figure 79). Legge and Rowley-Conwy (1988) have employed similar techniques on the remains of elk, roe deer and other species from the important Mesolithic site at Star Carr.

In the present study measurements were recorded for the following bones: humerus, radio-ulna, metacarpal, femur, tibia and metatarsal. Measurements used follow the suggestions of von den Driesch (1976) and variations defined by Spiess (1979). Since there are no complete long bones in any assemblage recovered from Nettilling Lake sites all measurements are for articular ends only. Unfortunately, the analysis is limited by a lack of comparative data for most of the skeletal elements recovered through excavations and only metapodial data are presented in this study. Control data from 62 distal metatarsals from southern Baffin Island caribou were obtained (Ferguson 1987: pers. comm.) and measurements published by Spiess for metacarpals (1979:Table 3.13) have been used to evaluating sex structure for these elements. These two bones dominate two of the the three main faunal assemblages analyzed and thus provide a means of estimating the proportion of cows and bulls.

A scatter diagram of the control measurements for the distal metatarsals is shown in Figure 52. There is a definite zone of overlap in the measurements for large females and small (possibly immature) males; however, unless all measurements taken on the archaeological specimens cluster within this range it is still possible to estimate the relative

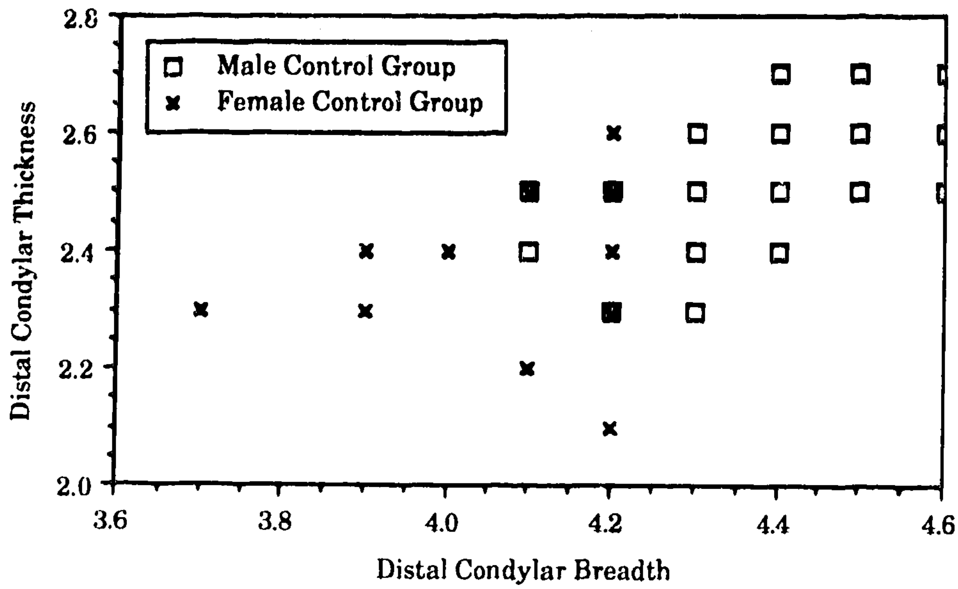

Figure 52. Scatterplot of control measurements for caribou metapodials.

proportions of each sex for a given assemblage. Measurements taken on other archaeological specimens (e.g., distal humerus) suggest that they also can be used to sex a caribou bone assemblage, but a comparative data set is lacking and the archaeological samples are too small to be used independently.

Two measurements were taken on the distal epiphysis of metatarsals and metacarpals: greatest bicondylar breadth and greatest anterior-posterior thickness. These are presented in a series of bivariate plots in which the archaeological samples are superimposed on the male and female control measurements. Measurements were obtained for all specimens judged to be sufficiently intact to provide accurate results. Specimens on which the distal epiphysis had been subjected to extensive chewing by carnivores or damaged by other attritional agents are not included. On a small percentage of the measured elements the epiphysis was not fused to the diaphysis. Spiess (1979:88) has argued that unfused epiphyses can be used in osteometric analyses if the measurements are not total length, which is affected by growth and fusion. In the sample analyzed here, 95% of the metacarpals (n=60) and 88% of the metatarsals (n=58) are from skeletally mature individuals.

Because metacarpals were common in some assemblages, but no control measurements were available for this element, a method was devised to sex metacarpals using control data from metatarsals. To accomplish this the size relationship between the distal ends of these elements was explored using measurements published by Spiess (1979). In Figure 53, five distal metatarsal and metacarpal measurements from comparative skeletons of known sex are plotted (Spiess 1979:Table 3.13). Although the sample is admittedly small, a definite relationship appears between the sets of measurements. In each case the distal metacarpal is smaller than the metatarsal, and the single female caribou in the sample is clearly distinguished from the males. Spiess' sample is a diverse one and the consistent nature of the relationship suggests that it can be used in the absence of available control data to evaluate tentatively assemblages in which metacarpals are common.

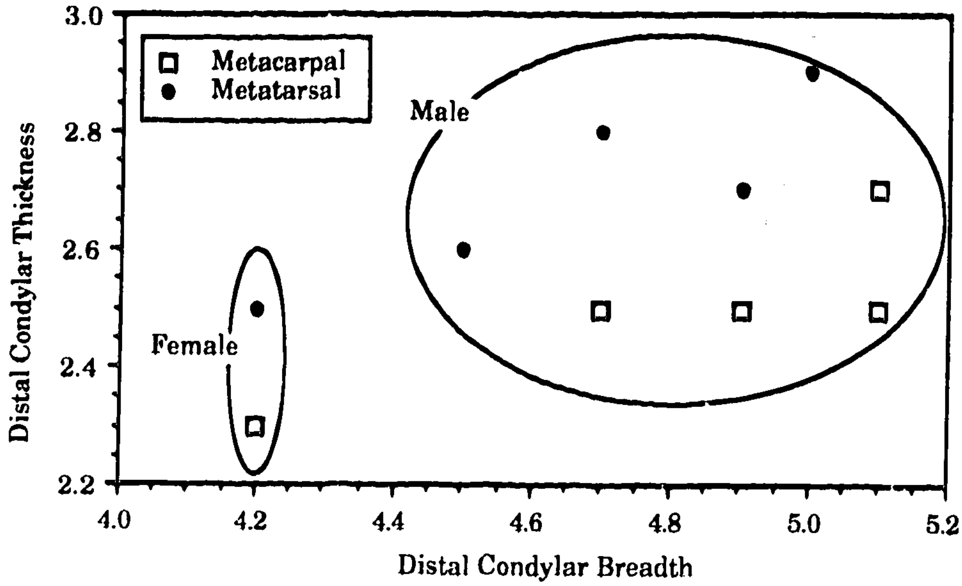

Figure 53. Scatter diagram showing metric relationship between caribou distal metapodials. After Spiess (1979:Table 3.13).

Using these criteria, female metacarpals should be distributed on the lower left side of the plot below the range of measurements for the metatarsals, while the males should be distributed in a similar fashion on the lower right side of the graph. As with the metatarsals some overlap is to be expected, but again the values would have to cluster within a very narrow range to negate the utility of the approach. This technique can also serve as a general check on estimates of the sex structure derived from metatarsals only. Unless extreme cultural or preservational bias was in operation prior to the discard of these elements, similar sex ratios should be produced by both plots where comparable samples of each element are present. If the plots yield conflicting ratios, differential processing or discard treatment may be indicated.

Results

Site LlDv-5

A summary of the faunal remains by feature from site LlDv-5 is presented in Table 13. Tables 14 and 15 list the relative frequencies of caribou remains by feature type. Minimum numbers of individuals are listed in Tables 16 and 17. Goose and miscellaneous faunal remains are listed in Tables 18-21. With few exceptions, caribou bone dominates the assemblages. Exceptions include Caches 2 and 8, and Houses 1, 2 and 4 where goose remains equal or exceed those of caribou and attests to the importance of this resource to the diet. Several assemblages contain minor amounts of dog and seal bones. With the exception of House 4, no fish bones were recovered despite the site's close proximity to a good char fishing location.

Table 13. Faunal Summary LlDv-5, Burwash Bay, Nettilling Lake.

Feature	Caribou	Goose	Dog	Seal	Char	Fox	?Mamm	?Bird	Total
Cache 1	1284	0	14	0	0	0	0	2	1300
Cache 2	13	33	0	2	0	0	0	0	48
Cache 4	135	2	0	0	0	0	0	0	137
Cache 5	66	27	4	0	0	0	0	0	97
Cache 6	500	9	0	0	0	1	0	0	510
Cache 7	199	0	0	1	0	0	2	0	202
Cache 8	18	17	0	1	0	0	0	0	36
Cache 9	4	0	0	0	0	0	0	0	4
Cache 10	393	1	0	1	0	0	0	11	406
House 1	13	36	0	0	0	0	0	0	49
House 2	198	416	8	15	9	0	3	3	652
House 3	4	2	0	0	0	0	0	0	6
House 4	72	70	0	4	57	0	4	1	208
House 6	1	5	0	0	0	0	0	0	6
House 8	54	0	0	0	0	0	0	0	54
House 9	74	33	1	6	0	0	1	0	115
House 10	55	4	1	2	0	0	0	3	65
House 12	5	0	2	0	0	0	0	0	7
Total	3088	655	30	32	66	1	10	20	3902

Table 14. Summary of Caribou Faunal Remains: Site LlDv-5 - Caches.

Element	Cache 1		Cache 4		Cache 6		Cache 7	
	f	%	f	%	f	%	f	%
Antler	0	0.0	0	0.0	0	0.0	0	0.0
Cranial	7	0.5	0	0.0	0	0.0	0	0.0
Mandible	4	0.3	0	0.0	1	0.2	0	0.0
Tooth	4	0.3	1	0.7	0	0.0	0	0.0
Atlas	1	0.1	0	0.0	0	0.0	0	0.0
Axis	0	0.0	0	0.0	0	0.0	0	0.0
C. Vrt.	1	0.1	0	0.0	1	0.2	0	0.0
T. Vrt.	26	2.1	3	2.2	2	0.4	2	1.0
L. Vrt.	6	0.5	0	0.0	0	0.0	0	0.0
Vrt. Frg.	17	1.4	0	0.0	1	0.2	1	0.5
Rib	42	3.3	7	5.2	11	2.4	2	1.0
Rib Frg.	198	15.7	22	16.3	18	4.0	22	11.1
Sternum	8	0.6	0	0.0	0	0.0	0	0.0
Scapula	5	0.4	0	0.0	3	0.7	2	2.0
P. Humerus	4	0.3	1	0.7	2	0.4	0	0.0
D. Humerus	10	0.8	6	4.4	9	2.0	0	0.0
P. R/Ulna	4	0.3	0	0.0	3	0.7	6	3.0
D. R/Ulna	4	0.3	0	0.0	0	0.0	2	1.0
Carpal	8	0.6	1	0.7	2	0.4	12	6.0
P. M'Carpal	4	0.3	3	2.2	1	0.2	3	1.5
D. M'Carpal	16	1.3	0	0.0	8	1.8	4	2.0
Phalange	0	0.0	0	0.0	0	0.0	0	0.0
Pelvis	1	0.1	5	3.7	1	0.2	0	0.0
P. Femur	11	0.9	1	0.7	1	0.2	2	1.0
D. Femur	10	0.8	1	0.7	3	0.7	2	1.0
Patella	1	0.1	2	1.5	1	0.2	0	0.0
P. Tibia	1	0.1	0	0.0	1	0.2	4	2.0
D. Tibia	3	0.2	0	0.0	4	0.9	4	2.0
Calcaneus	0	0.0	0	0.0	0	0.0	4	2.0
Astragalus	0	0.0	0	0.0	0	0.0	4	2.0
Tarsal	0	0.0	0	0.0	0	0.0	3	1.5
P. M'Tarsal	3	0.2	0	0.0	1	0.2	6	3.0
D. M'Tarsal	1	0.1	3	2.2	2	0.4	6	3.0
Longbone Frg.	851	68.1	79	58.5	379	83.4	108	54.3
Total	1254	100.0	135	100.0	455	99.9	199	99.9

Table 15. Summary of Caribou Faunal Remains: Site LlDv-5 - Houses.

Element	House 2 f	House 2 %	House 8 f	House 8 %
Antler	7	3.6	0	0.0
Cranial	2	1.0	0	0.0
Mandible	2	1.0	0	0.0
Tooth	8	4.2	1	1.9
Atlas	0	0.0	0	0.0
Axis	0	0.0	0	0.0
C. Vrt.	0	0.0	3	5.5
T. Vrt.	0	0.0	3	5.5
L. Vrt.	0	0.0	1	1.9
Vrt. Frg.	12	6.3	2	3.7
Rib	5	2.6	2	3.7
Rib Frg.	0	0.0	0	0.0
Sternum	6	3.1	0	0.0
Costal	5	2.6	0	0.0
Scapula	2	1.0	1	1.9
P. Humerus	1	0.5	1	1.9
D. Humerus	1	0.5	1	1.9
P. R/Ulna	0	0.0	1	1.9
D. R/Ulna	2	1.0	1	1.9
Carpal	1	0.5	0	0.0
P. M'Carpal	1	0.5	1	1.9
D. M'Carpal	0	0.0	0	0.0
Phalange	6	3.1	2	3.7
Pelvis	0	0.0	1	1.9
P. Femur	0	0.0	1	1.9
D. Femur	1	0.5	2	3.7
Patella	5	2.6	1	1.9
P. Tibia	0	0.0	0	0.0
D. Tibia	1	0.5	1	1.9
Calcaneus	1	0.5	1	1.9
Astragalus	3	1.6	2	3.7
Tarsal	7	3.6	0	0.0
P. M'Tarsal	0	0.0	1	1.9
D. M'Tarsal	0	0.0	0	0.0
Longbone Frg.	112	58.3	24	44.0
Total	192	99.6	54	100.0

Table 16. Minimum Number of Caribou: Site LlDv-5 - Caches.

Element	Cache 1 MNI	Cache 1 %	Cache 4 MNI	Cache 4 %	Cache 6 MNI	Cache 6 %	Cache 7 MNI	Cache 7 %
Antler	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranial	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mandible	2.0	25.0	0.0	0.0	0.5	11.1	0.0	0.0
Atlas	1.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0
Axis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Vrt.	0.2	2.5	0.0	0.0	0.2	4.4	0.0	0.0
T. Vrt.	2.0	25.0	0.2	6.7	0.2	4.4	0.2	6.7
L. Vrt.	1.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0
Rib	1.6	20.0	0.3	10.0	0.4	8.9	0.1	3.3
Sternum	1.1	13.8	0.0	0.0	0.0	0.0	0.0	0.0
Scapula	2.5	31.2	0.0	0.0	1.5	33.3	1.0	33.3
P. Humerus	2.0	25.0	0.5	16.7	1.0	22.2	0.0	0.0
D. Humerus	5.0	62.5	3.0	100.0	4.5	100.0	0.0	0.0
P. R/Ulna	2.0	25.0	0.0	0.0	1.5	33.3	3.0	100.0
D. R/Ulna	2.0	25.0	0.0	0.0	0.0	0.0	1.0	33.3
Carpal	0.8	10.0	0.1	3.3	0.2	4.4	1.2	40.0
P. M'Carpal	2.0	25.0	1.5	50.0	0.5	11.1	1.5	50.0
D. M'Carpal	8.0	100.0	0.0	0.0	4.0	88.9	2.0	66.7
Phalange	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pelvis	0.5	6.2	2.5	83.3	0.5	11.1	0.0	0.0
P. Femur	5.5	68.8	0.5	16.7	0.5	11.1	1.0	33.3
D. Femur	5.0	62.5	0.5	16.7	1.5	33.3	1.0	33.3
Patella	0.5	6.2	1.0	33.3	0.5	11.1	0.0	0.0
P. Tibia	0.5	6.2	0.0	0.0	0.5	11.1	2.0	66.7
D. Tibia	1.5	18.8	0.0	0.0	2.0	44.4	2.0	66.7
Calcaneus	0.0	0.0	0.0	0.0	0.0	0.0	2.0	66.7
Astragalus	0.0	0.0	0.0	0.0	0.0	0.0	2.0	66.7
Tarsal	0.0	0.0	0.0	0.0	0.0	0.0	0.6	20.0
P. M'Tarsal	1.5	18.8	0.0	0.0	0.5	11.1	3.0	100.0
D. M'Tarsal	0.5	6.2	1.5	50.0	1.0	22.2	3.0	100.0

Table 17. Minimum Number of Caribou: Site LlDv-5 - Houses.

Element	House 2		House 8	
	MNI	%	MNI	%
Antler	0.0	0.0	0.0	0.0
Cranial	0.0	0.0	0.0	0.0
Mandible	1.0	66.7	0.0	0.0
Atlas	0.0	0.0	0.0	0.0
Axis	0.0	0.0	0.0	0.0
C. Vrt.	0.0	0.0	0.6	60.0
T. Vrt.	0.0	0.0	0.2	20.0
L. Vrt.	0.0	0.0	0.2	20.0
Rib	0.2	13.3	0.1	10.0
Sternum	0.9	60.0	0.0	0.0
Scapula	1.0	66.7	0.5	50.0
P. Humerus	0.5	33.3	0.5	50.0
D. Humerus	0.5	33.3	0.5	50.0
P. R/Ulna	0.0	0.0	0.5	50.0
D. R/Ulna	1.0	66.7	0.5	50.0
Carpal	0.2	13.3	0.0	0.0
P. M'Carpal	0.5	33.3	0.5	50.0
D. M'Carpal	0.0	0.0	0.0	0.0
Phalange	0.3	20.0	0.1	10.0
Pelvis	0.0	0.0	0.5	50.0
P. Femur	0.0	0.0	0.5	50.0
D. Femur	0.5	33.3	1.0	10.0
P. Tibia	0.0	0.0	0.0	0.0
D. Tibia	0.5	33.3	0.5	50.0
Calcaneus	0.5	33.3	0.5	50.0
Astragalus	1.5	100.0	1.0	100.0
Tarsal	1.4	93.3	0.0	0.0
P. M'Tarsal	0.0	0.0	0.5	50.0
D. M'Tarsal	0.0	0.0	0.0	0.0

Table 18. Summary of Goose Faunal Remains: Site LlDv-5 - Caches.

Element	Cache 2		Cache 4		Cache 5		Cache 6		Cache 9		Cache 10	
	f	%	f	%	f	%	f	%	f	%	f	%
Cranial	1	3.0	0	0.0	0	0.0	0	0.0	1	5.9	0	0.0
Maxilla	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Mandible	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Trachea	0	0.0	0	0.0	3	11.1	0	0.0	0	0.0	0	0.0
Vertebra	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Rib	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Sternum	0	0.0	0	0.0	3	11.1	0	0.0	0	0.0	0	0.0
Scapula	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Coracoid	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Humerus	6	18.2	1	50.0	9	33.3	2	22.2	2	11.7	1	100.0
Radius	0	0.0	0	0.0	0	0.0	0	0.0	2	11.7	0	0.0
Ulna	0	0.0	0	0.0	3	11.1	0	0.0	1	5.9	0	0.0
C'mcarpus	1	3.0	0	0.0	0	0.0	0	0.0	1	5.9	0	0.0
Femur	0	0.0	0	0.0	1	3.7	0	0.0	0	0.0	0	0.0
T'tarsus	1	3.0	0	0.0	4	14.8	0	0.0	0	0.0	0	0.0
T'Mtarsus	2	6.1	0	0.0	0	0.0	0	0.0	1	5.9	0	0.0
Phalange	1	3.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Furculum	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Fragments	21	63.6	1	50.0	4	14.8	7	77.8	9	52.9	0	0.0
Total	33	99.9	2	100.0	27	99.9	9	100.0	17	99.9	1	100.0

Table 19. Summary of Goose Faunal Remains: Site LlDv-5 - Houses.

Element	House 1		House 2		House 3		House 4		House 6		House 9	
	f	%	f	%	f	%	f	%	f	%	f	%
Cranial	0	0.0	3	0.7	0	0.0	0	0.0	0	0.0	0	0.0
Maxilla	0	0.0	6	1.4	0	0.0	1	1.5	0	0.0	0	0.0
Mandible	1	2.8	33	7.9	0	0.0	1	1.5	0	0.0	0	0.0
Trachea	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Vertebra	0	0.0	8	1.9	0	0.0	0	0.0	0	0.0	0	0.0
Rib	0	0.0	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0
Sternum	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0
Scapula	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Coracoid	0	0.0	7	1.7	0	0.0	0	0.0	0	0.0	0	0.0
Humerus	12	33.3	42	10.1	0	0.0	11	16.7	1	20.0	5	15.2
Radius	0	0.0	47	11.3	0	0.0	5	7.6	0	0.0	0	0.0
Ulna	7	19.4	47	11.3	0	0.0	3	4.5	0	0.0	7	21.2
C'mcarpus	1	2.8	14	3.4	0	0.0	2	3.0	0	0.0	0	0.0
Femur	0	0.0	18	4.3	1	50.0	4	6.1	0	0.0	1	3.0
Pelvis	0	0.0	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0
T'tarsus	2	5.6	10	2.4	0	0.0	8	12.1	0	0.0	1	3.0
T'Mtarsus	0	0.0	16	3.8	0	0.0	1	1.5	0	0.0	0	0.0
Phalange	0	0.0	2	0.5	0	0.0	1	1.5	0	0.0	0	0.0
Furculum	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0
Fragments	13	36.1	157	37.7	1	50.0	29	43.9	4	80.0	19	57.6
Total	36	100.0	416	99.9	2	100.0	66	99.9	5	100.0	33	100.0

Table 20. Summary of Miscellaneous Faunal Remains: LlDv-5 - Caches.

Cache	Species	Element	No.
1	Dog	Cervical Vrt.	2
		Rib	11
2	Ringed seal	Phalange	2
5	Dog	Radius	1
		Ulna	1
		Tibia	1
		Metatarsal	1
6	Fox	Mandible	1
7	Ringed seal	Rib	1
8	Ringed seal	Rib	1
10	Ringed seal	Phalange	1

Table 21. Summary of Miscellaneous Faunal Remains: LlDv-5 - Houses.

House	Species	Element	No.
2	Dog	Mandible	1
		Tooth	4
		Cervical Vrt.	1
		Thorassic Vrt.	1
		Lumbar Vrt.	1
	Arctic Char	Vertebra	1
		Unident.	8
4	Arctic Char	Mandible	6
		Vertebra	8
		Unident.	43
9	Dog	Atlas	1
10	Dog	Radius	1
12	Dog	Atlas	1
		Scapula	1

The absence of fish bones is typical of many Arctic faunal assemblages where the resource is known to have been utilized (Taylor 1979), and is usually explained in terms of poor preservation qualities of the bone.

Cache 1

Cache 1 produced a total of 1284 caribou bones and a small sample of dog and bird remains. Although there is evidence of carnivore chewing on a number of the caribou elements there is no significant correlation with Bulk Density values (Table 22) suggesting that bone destruction was not an important factor in the variation of element frequencies. The frequency of elements expressed as %MNI (n=8) are shown in Figure 54a. The most common elements in the assemblage are the humerus, metacarpal and femur, which have high meat and marrow values. Certain low utility elements are absent (e.g., cranial, axis vertebrae, phalanges); but there does not appear to have been any radical culling of other low utility elements consistent with parts having been transported over a long distance. In fact, several elements of low general utility are overrepresented, particularly the forelimb, against which Binford (1978:40) reported a general bias. This observation is supported by the form of the relationship between the Cache 1 element frequencies and the Modified General Utility Index (MGUI) illustrated in Figure 54b. Elements of both low and moderate utility dominate the assemblage, suggesting a selection made in favour of quantity of food over quality. This is supported by the Spearman's rho values listed in Table 22, where the strongest correlations ($p < .01$) were obtained for the Marrow and Meat indices, which may partially explain the high frequency of distal metacarpals. The relatively low frequency of metatarsals and distal tibiae, however, which have the highest marrow values may reflect consumption of these parts at another location. Consideration of the limb elements alone produced no significant correlations, suggesting that these were not preferentially transported to the site (i.e., presumably as a function of distance). Element frequencies are also correlated

Table 22. Summary of Spearman's Rank Correlation Coefficients: %MNI and Utility Indices[a] - Site LlDv-5.

Feature	Bulk Density[b]	P	MGUI	P	Marrow	P	Meat	P	Grease	P
Cache 1	.17	>.05	.384	<.05	.539	<.01	.482	<.01	.232	>.05
Cache 4	-.039	>.05	.343	<.05	.268	>.05	.290	>.05	.198	>.05
Cache 6	.292	>.05	.357	<.05	.705	<.01	.253	>.05	.433	<.05
Cache 7	.667	<.01	.052	>.05	.660	<.01	-.287	>.05	.665	<.01
House 2	.321	>.05	.194	>.05	.024	>.05	.034	>.05	.241	>.05
House 8	.146	>.05	.422	<.05	.327	<.05	.317	<.05	.273	>.05

All tests one-tailed, all r_s values corrected for ties.
[a]After Binford 1978
[b]After Lyman 1985

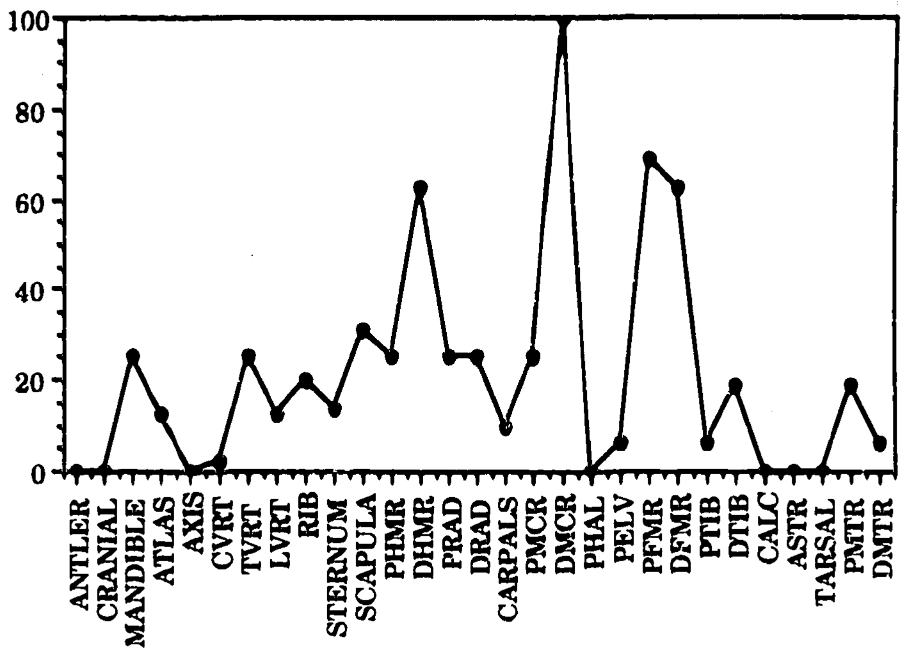

Figure 54a. %MNI frequency of caribou elements: LlDv-5 Cache 1

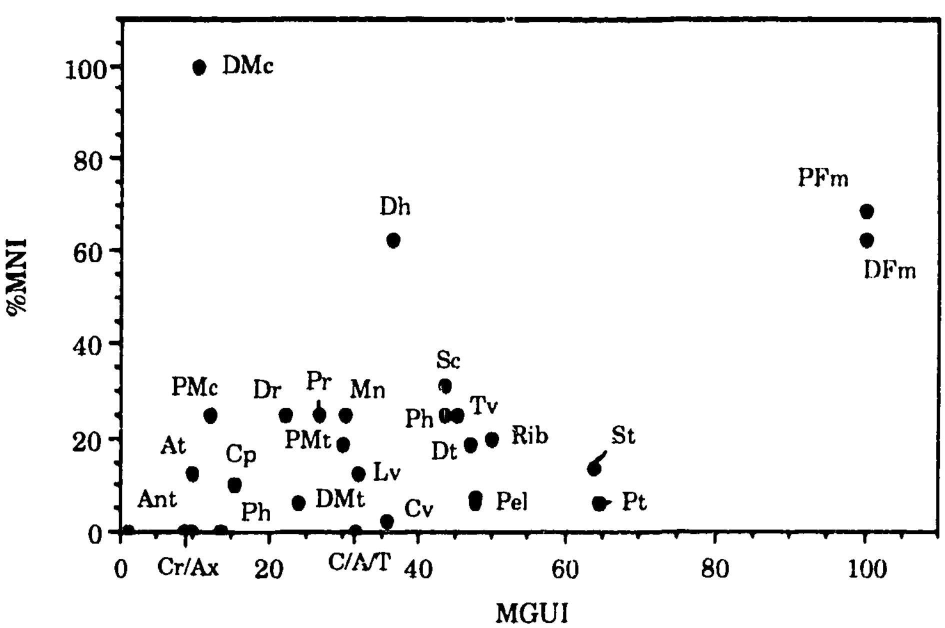

Figure 54b. LlDv-5 Cache 1 %MNI/MGUI

(at p <.05) with the MGUI, and the fact that all correlations are positive suggests that the Cache 1 assemblage was generated during a period when the site was used as a residential camp.

Scatterplots of metatarsal and metacarpal measurements are shown in Figure 55. The small sample of metatarsals suggests a bias in favour of female animals; on the other hand a comparison with the plot of metacarpal measurements clearly indicates the presence of males in the assemblage. Three of the metacarpal measurements overlap with female metatarsal values and are therefore considered to be males. Nevertheless, a procurement bias in favour of female caribou is still evident in an approximate ratio of 2:1.

Analysis of the fusion of long bones suggests the assemblage is dominated by animals younger than three years of age. Young animals are indicated by the presence of unfused distal humerii (i.e., < 14 months) and a few mandibles from calves (with only the deciduous dentition erupted) are also present. With the exception of one distal articular end, all of the femora (MNI=6) are unfused. The proximal femoral epiphyses fuse between 2.5 and 3 years of age, the distal epiphysis between 3 and 5 years.

Cache 4

Cache 4 contained a small assemblage of 135 caribou elements. The element frequencies (MNI=3) are shown in Figure 56a. Cranial and axial skeleton parts are underrepresented in the assemblage, which is dominated by upper fore and hindlimb parts including the pelvis. Little evidence of carnivore damage was observed on the bones, and the slight negative correlation with Bulk Density indicates that the assemblage includes some of the more fragile elements.

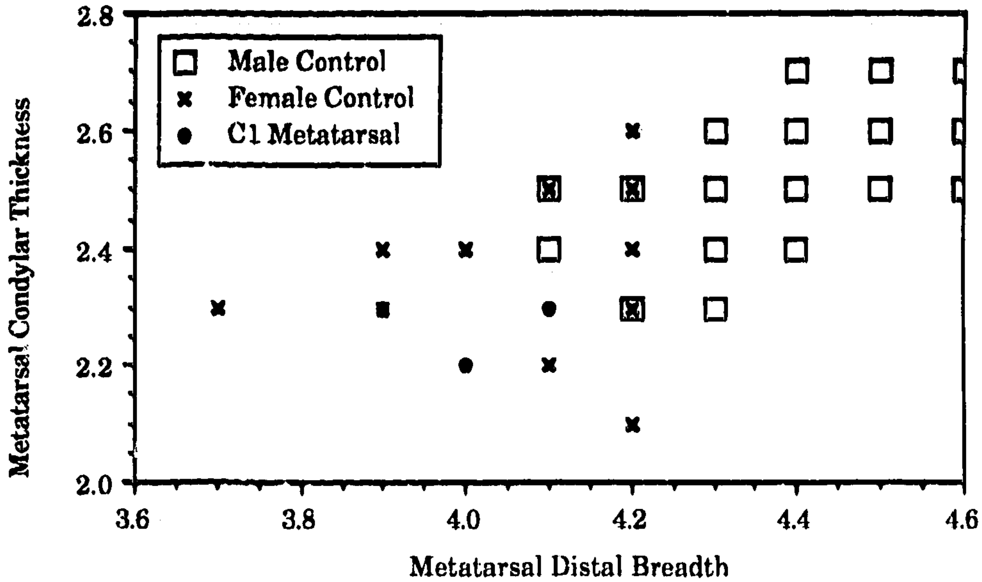

Figure 55a. Scatterplot of distal metatarsal measurements, LlDv-5: Cache 1 (n=4)

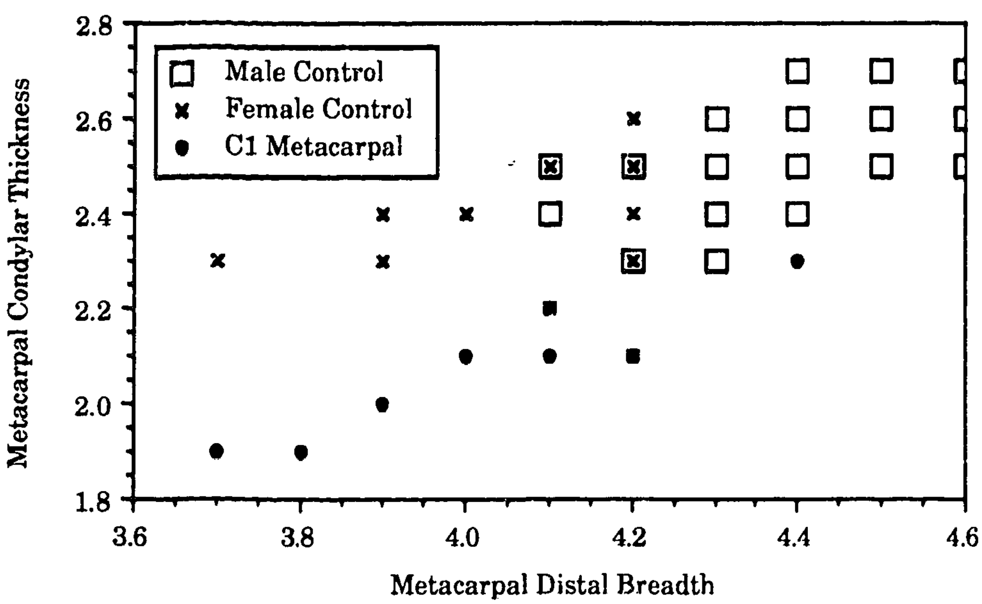

Figure 55b. Scatterplot of distal metacarpal measurements, LlDv-5: Cache 1 (n=12)

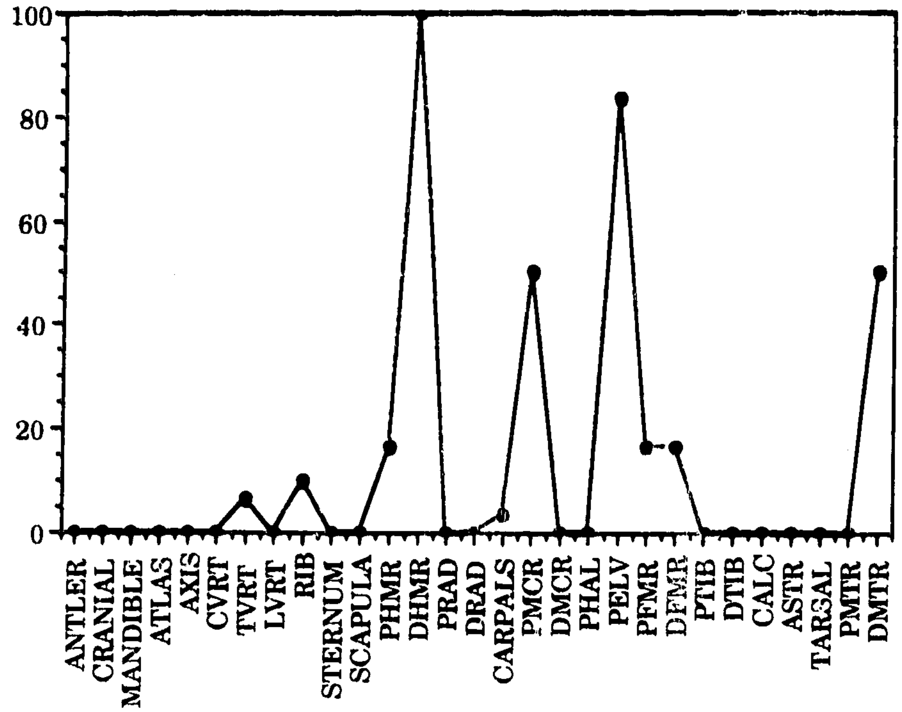

Figure 56a. %MNI frequency of caribou elements: LlDv-5 Cache 4

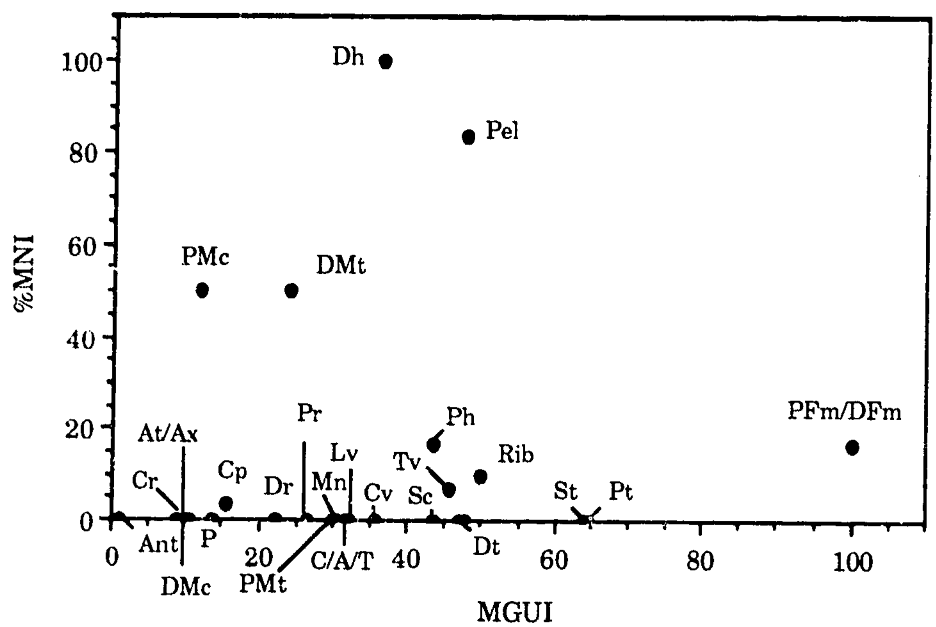

Figure 56b. LlDv-5 Cache 4 %MNI/MGUI

When compared with the various utility indices, a positive correlation was obtained only with the MGUI ($p < .05$)(Figure 56b) suggesting that general utility is the best predictor of the element frequencies in this feature. However, the form of Figure 56a suggested that primarily limb elements were being brought to the site, and thus the possibility of long-distance transport. When considered separately, the limb elements yielded poor results with probability values exceeding .05. The observed distribution of elements has probably been affected by the small size of the sample.

Cache 4 contained three distal metatarsals, only one of which could be measured. When plotted against the control data this specimen clearly falls within the size range for females (Figure 57). No metacarpals are present in the assemblage. A single fused distal femur indicates an animal between three and five years of age, but most elements are unfused and point to the harvesting of generally younger animals. All distal metatarsals (n=3) are unfused suggesting ages of less than 2.5 years, and three of six distal humerii are unfused, indicating ages of less than 14 months.

Cache 6

Cache 6 contained a total of 455 caribou elements of which a large percentage are long bone shaft fragments. Carnivore damage to the bones is evident, but as in the other cases described thus far, it does not appear to have affected the composition of the assemblage. The frequency of elements present is shown in Figure 58 (MNI=4.5). As in Cache 4, cranial and axial skeletal parts are underrepresented; however, there is a general tendency for the frequencies of other elements to increase with their overall value. Certain underrepresented elements, including phalanges, may have been abandoned at the kill/butchering site. In other cases, (e.g., ribs) elements may have been brought to the site, processed and removed, either to another camp, or possibly even back to the coast.

The correlation results indicate that the best predictor of element frequencies in this assemblage is the marrow index. Comparison of the element frequencies for limbs only with

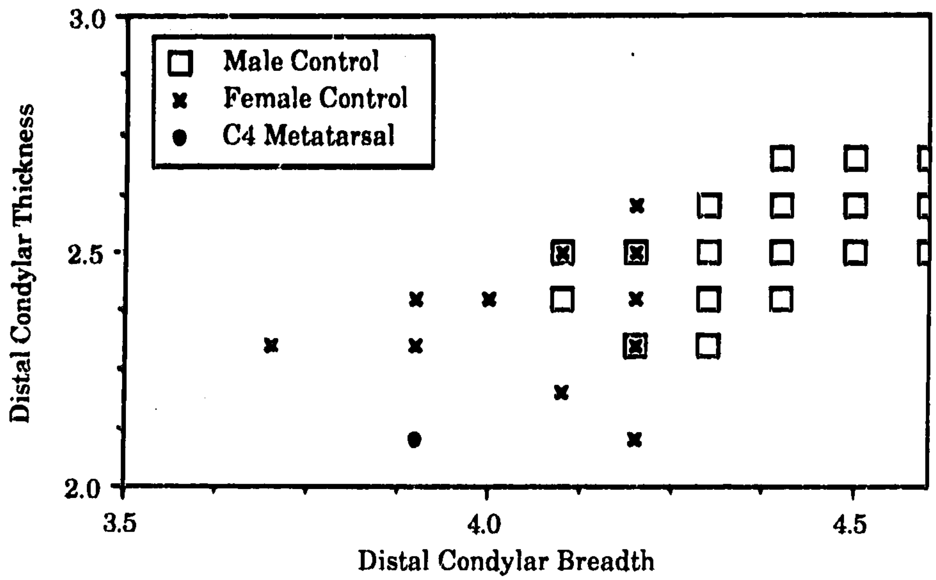

Figure 57. Scatterplot of distal metatarsal measurements, LlDv-5: Cache 4 (n=1)

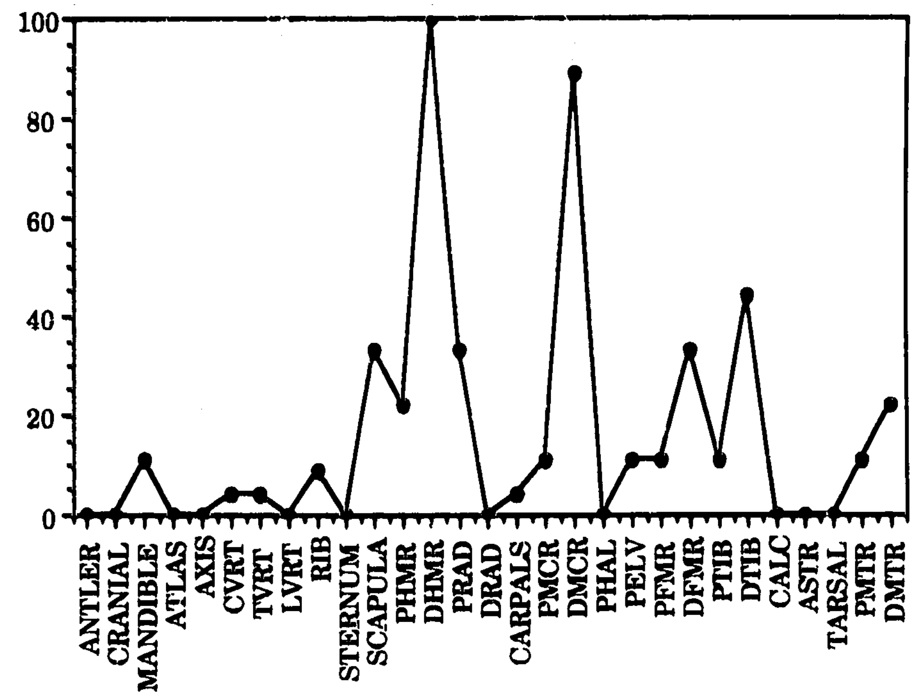

Figure 58a. %MNI frequency of caribou elements: LlDv-5 Cache 6.

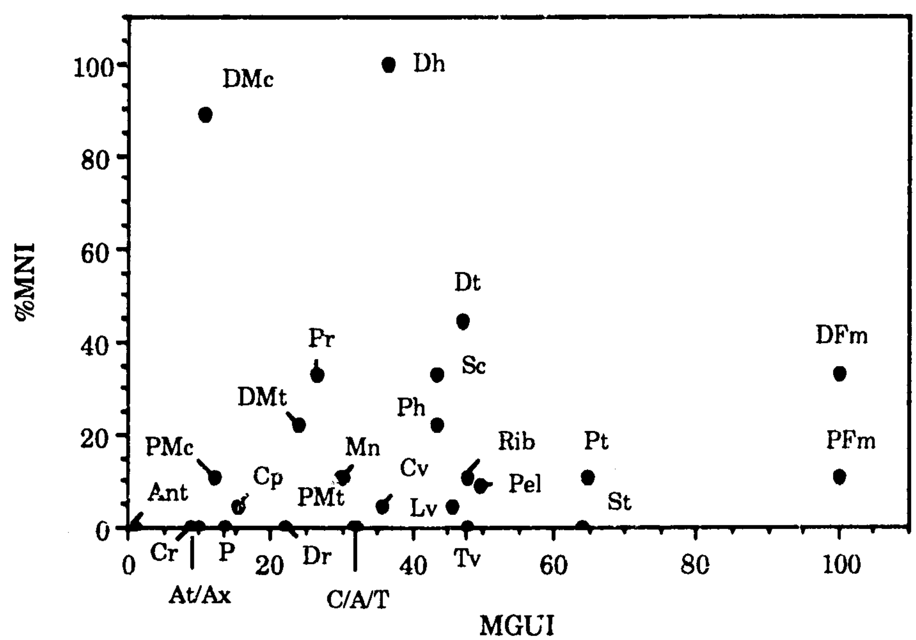

Figure 58b. LlDv-5 Cache 6 %MNI/MGUI.

the utility indices, as a possible measure of limb bones being introduced in favour of other parts did not produce significant results. Given that the element frequencies also correlate positively with the general utility model, the Cache 6 assemblage is interpreted to be associated with an episode of residential use of the site.

Cache 6 yielded a single distal metatarsal the dimensions of which fall within the center of the zone of overlap between the male and female control group (Figure 59a). As such, it cannot be accurately sexed. The metacarpal data, however, point to a clear bias in favour of the hunting of females in a ratio of approximately 2:1 (Figure 59b).

The majority of the elements in this small sample are skeletally mature. Younger animals (i.e., < ca. 14 months) are indicated by a single unfused distal tibia and humerus, but overall, an older age profile is suggested. All metatarsals and metacarpals are fused (> ca. 29 months), as are two of three distal femora and a single proximal tibia (each fusing between 3 and 5 years).

<u>Cache 7</u>

Cache 7 contained a small assemblage of 199 caribou elements. The relative frequencies are shown in Figure 60a. Cranial and axial skeletal parts are underrepresented, as are phalanges, with the assemblage dominated by fore and hind limb elements. A comparison of element frequencies with Bulk Density produced a positive correlation (Table 22), suggesting that scavenger destruction may have influenced the composition of the assemblage. A visual inspection of the bones showed few signs of extensive damage, but the elements in this assemblage are weathered to a greater extent than other samples. If carnivore activity was the primary controlling factor, it would have to have occurred prior to the bones being deposited in the feature which would presumably have related to some form of camp maintenance or clean-up. On the other hand, the strength of the correlation between the marrow (and grease) index (Figure 60b) and essentially random relationship with general utility, suggests the possibility that limb elements were selectively introduced to the site,

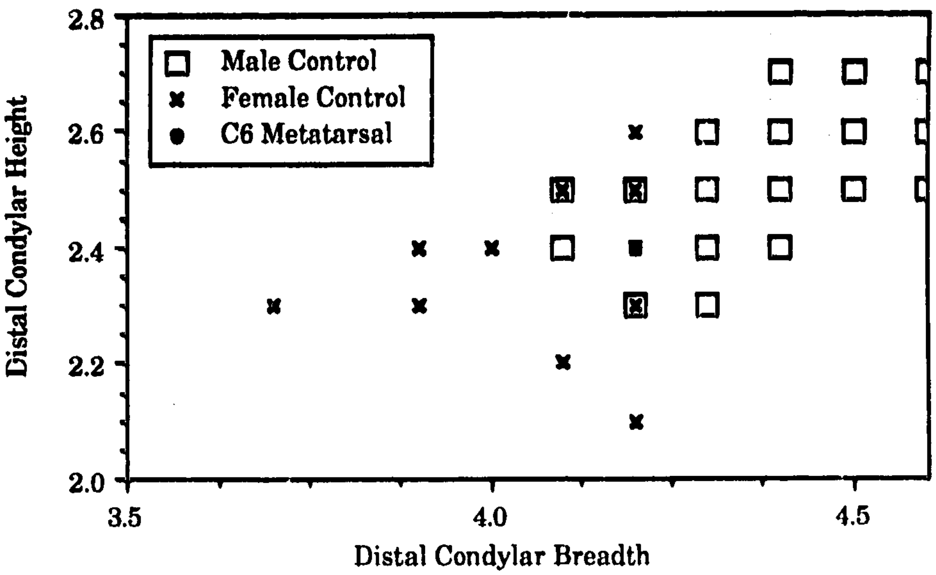

Figure 59a. Scatterplot of distal metatarsal measurements, LlDv-5 Cache 6: (n=1)

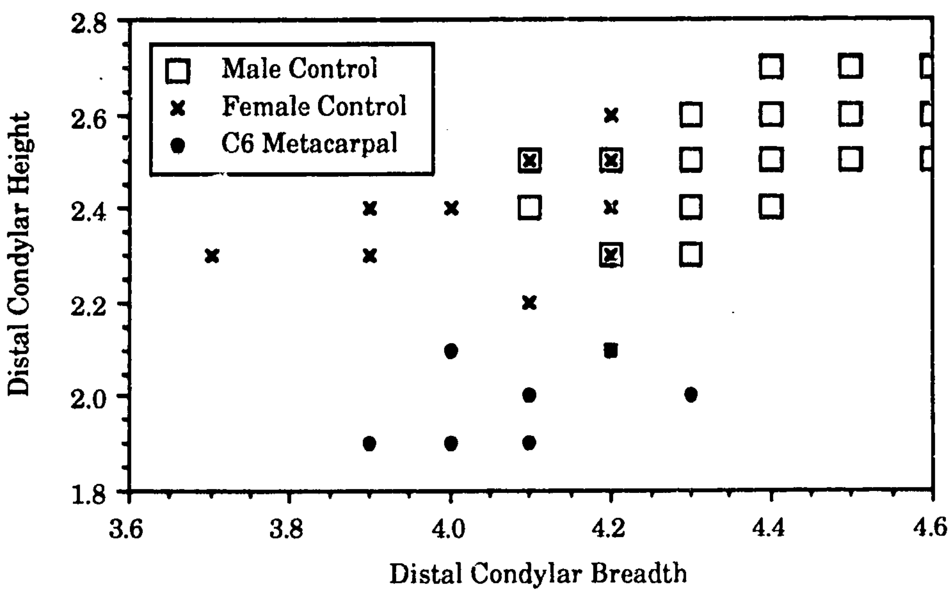

Figure 59b. Scatterplot of distal metacarpal measurements, LlDv-5: Cache 6 (n=9)

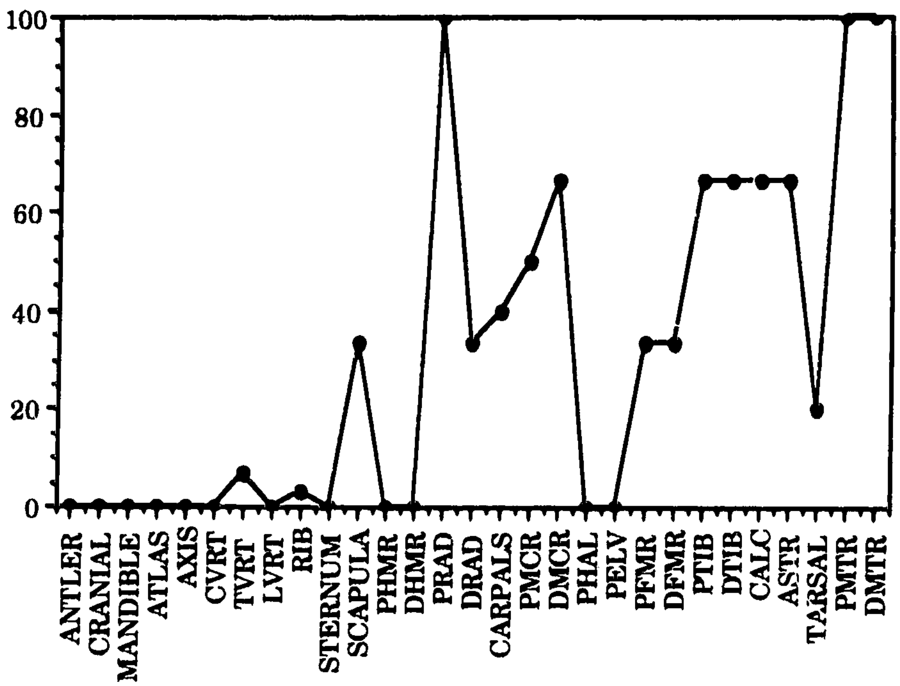

Figure 60a. %MNI frequency of caribou elements: LlDv-5 Cache 7

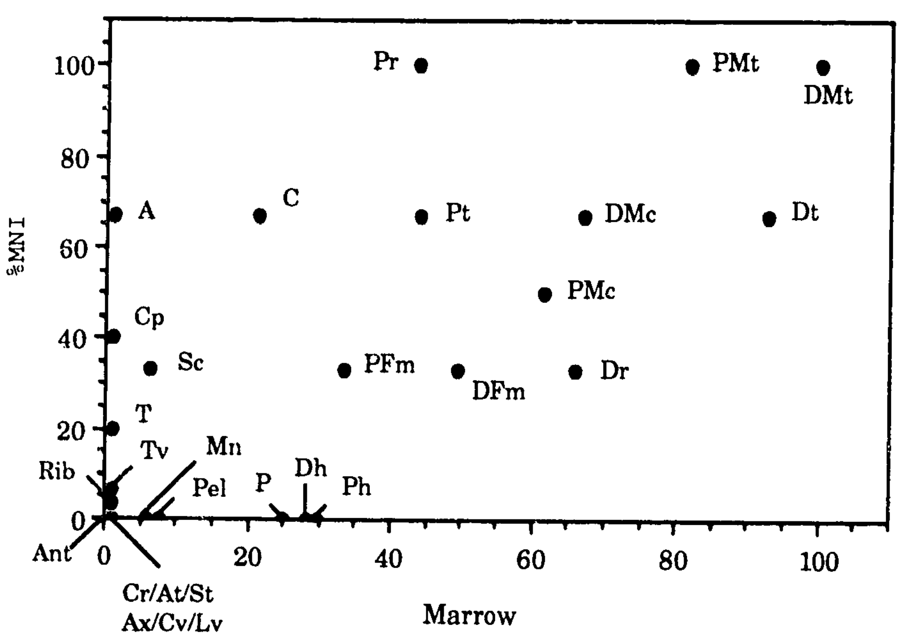

Figure 60b. LlDv-5 Cache 7 Marrow Index.

perhaps during a period of use as a hunting camp. Comparison of the limb bones only with the utility models also yielded a significant correlation with the marrow index (r_s=.669 p <.05), lending support to this hypothesis. Morrison (1988), however, has noted that the marrow index is positively correlated with Bulk Density (cf. Lyman 1985:Table 3). As a result, and given the better correlation between the %MNI and Bulk Density (i.e., p <.01), the relationship between the %MNI and Marrow index may have been distorted through carnivore activity.

Measurement of the Cache 7 metatarsals (Figure 61a) suggests that only females are represented in the assemblage. In the small sample of metacarpals (Figure 61b) two specimens fall within the upper range of female metatarsal measurements. These could represent either large females or small (i.e., immature) males. There appears nevertheless to be a bias in favour of female caribou.

All of the elements in the Cache 7 sample are fused except for a single distal metacarpal (indicating an animal < ca. 2.5 years old). Included are distal tibiae and proximal radio-ulnae, which only indicate ages of about fourteen months or older. However, proximal portions of these same elements were also recovered, which fuse between three and five years of age. This suggests that mainly adults are represented in the sample.

House 2

As with the caches, the faunal assemblages from the houses are quite small both in terms of the numbers of elements and MNI present. Examination of these assemblages nevertheless yielded interesting results. Element frequencies for House 2 are shown in Figure 62a. Although mandibles are more common than was the case for the caches, the House 2 assemblage is similar in terms of the representation of head and the axial skeleton, particularly the vertebral column. The form of the relationship with the MGUI (Figure 62b), based on visual examination only, would appear to indicate an assemblage dominated by low utility elements (or an "L"-shaped curve; cf. Lyman 1985). It might logically be concluded

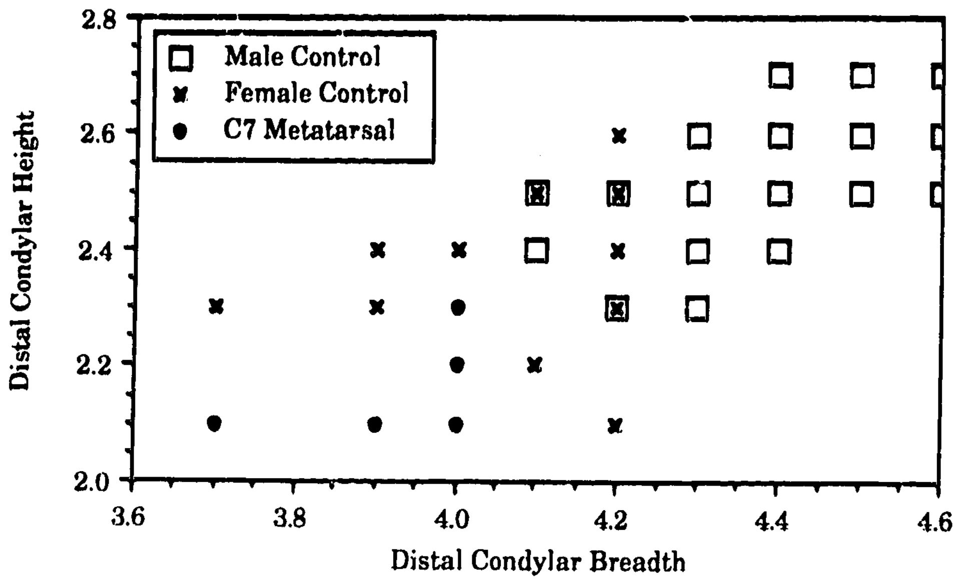

Figure 61a. Scatterplot of distal metatarsal measurements, LlDv-5: Cache 7 (n=5)

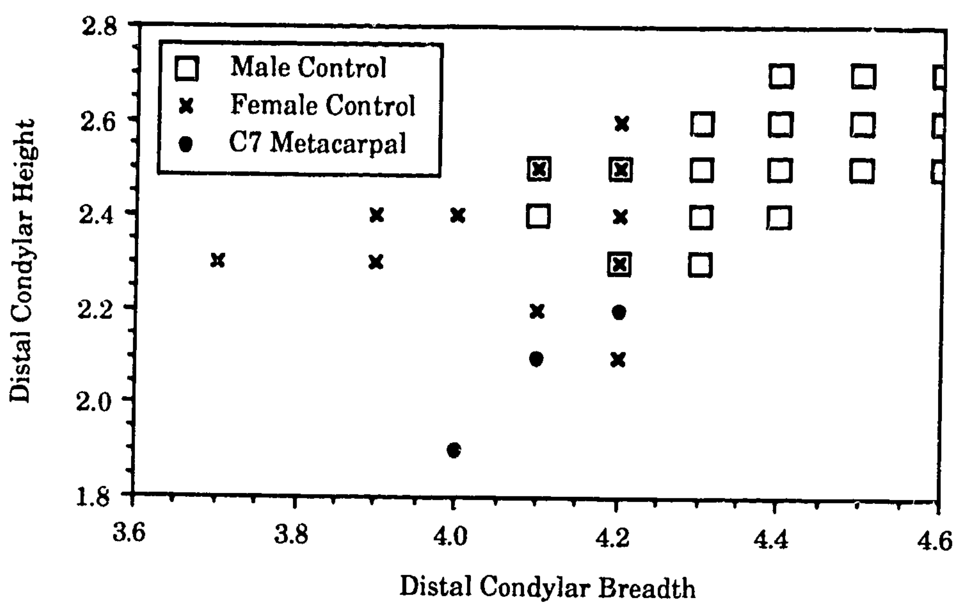

Figure 61b. Scatterplot of distal metacarpal measurements, LlDv-5: Cache 7 (n=3).

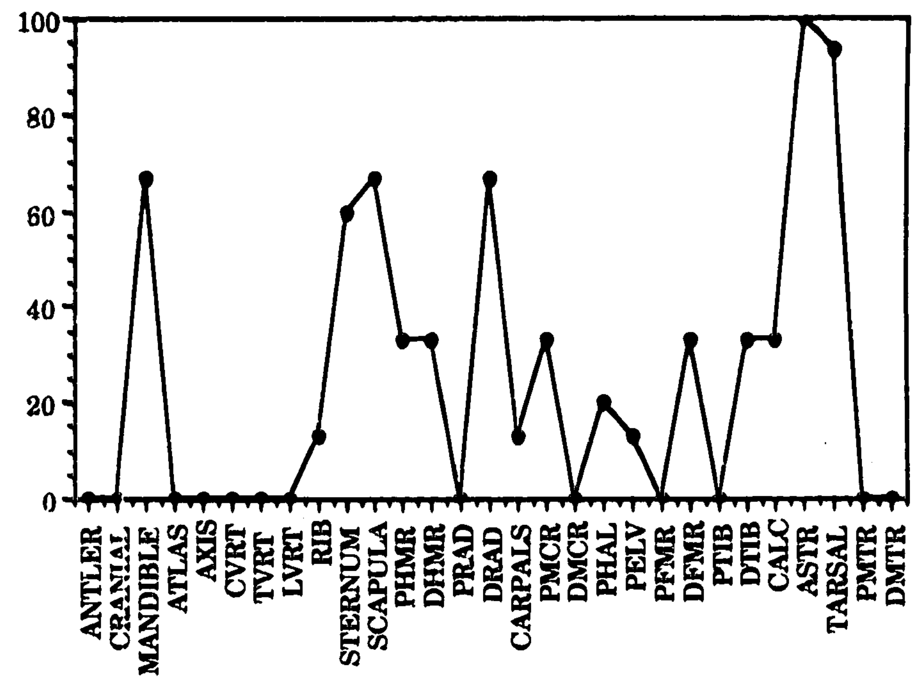

Figure 62a. %MNI frequency of caribou elements: LlDv-5 House 2.

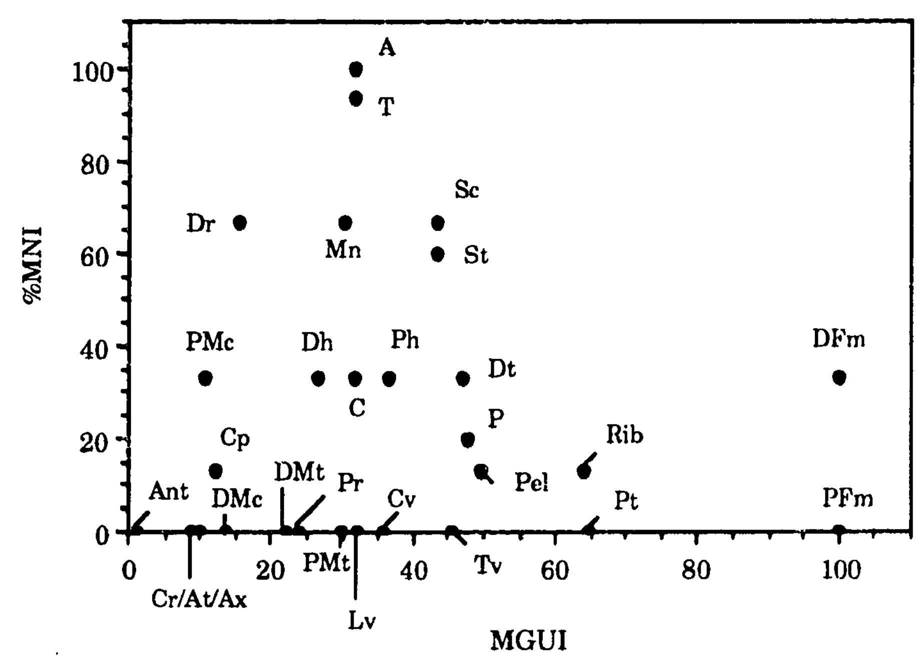

Figure 62b. LlDv-5 House 2 %MNI/MGUI.

from this that occupation of the feature was related to a period when the site was used as a residential hunting camp. Yet, as Table 22 shows, the relationship between the assemblage and the various utility indices is essentially a random one.

The few bones that could be aged on fusion criteria do not provide much useful information. A fused distal radius and femur indicate animals in the 3 to 5 year old class. Slightly younger animals are indicated by an unfused metacarpal (ca. < 29 months) and distal radius (< ca. 3 years).

House 8

The House 8 assemblage is also very small (MNI=1), but is included in the study because most elements were identifiable (i.e., not fragments). Unfortunately, there is very little that can be generalized from this sample. Unlike the other assemblages discussed, axial skeletal parts (i.e., cervical and lumbar vertebrae) are present, but consistent with the other samples, no cranial elements were found (Figure 63a). The remainder of the assemblage is dominated by proximal and distal ends of long bones, although the proximal tibia and distal metapodials are missing. Since there may be only a single animal present the overrepresentation of certain axial and appendicular elements of low general utility is not considered to be unusual (Figure 63b). There is no evidence that carnivores have played a role in the composition of the house sample, and while positive correlations were obtained for the meat and marrow indices, the MGUI appears to be the best predictor of the elements found.

No distal metapodials are present in the House 8 fauna, and the epiphyses of all leg bones are fused to their shafts. The minimum age for the individual animal represented is estimated between 3 and 5 years.

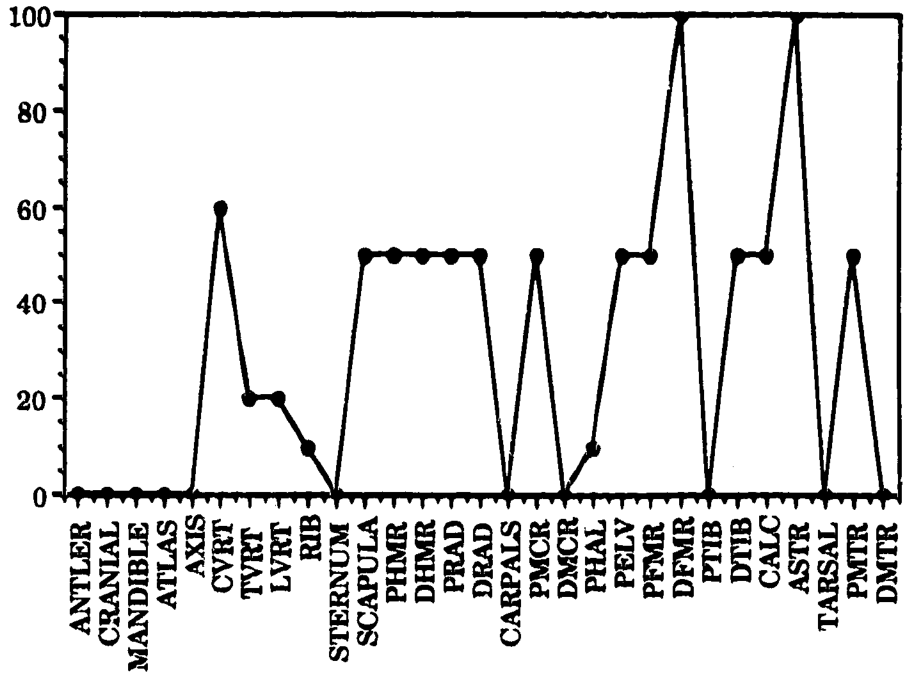

Figure 63a. %MNI frequency of caribou elements: LlDv-5 House 8.

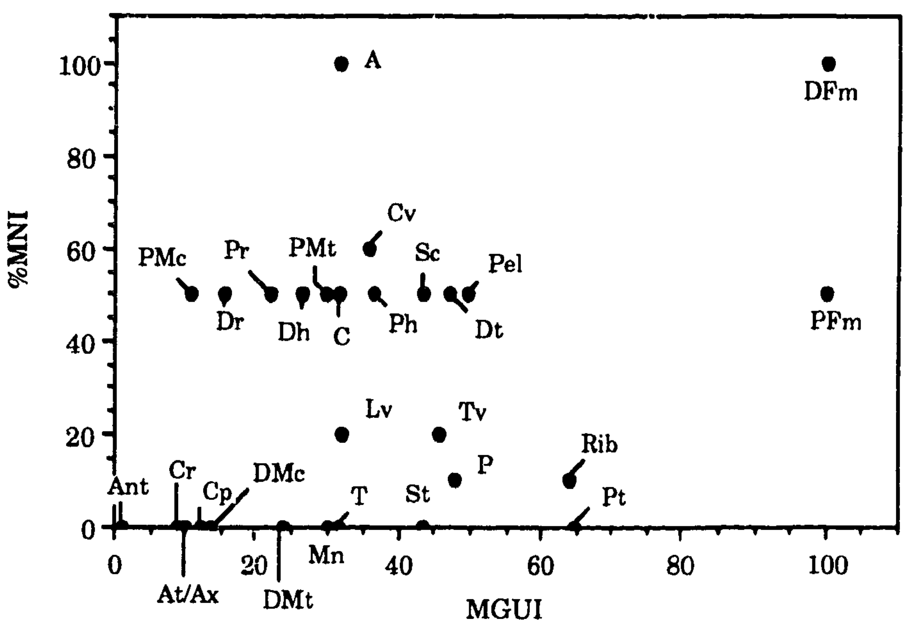

Figure 63b. LlDv-5 House 8 %MNI/MGUI.

Discussion

Of the total number of habitation and cache features at LlDv-5, only a few have been investigated. Of these, most have yielded comparatively small samples of faunal material. As a result the interpretations concerning site function, based on the faunal data, are of a preliminary nature.

On the basis of the available information, the classification of LlDv-5 as a residential site appears justified. Three of the four cache samples correlated in the expected fashion for a residential site when viewed against an index of the general utility of caribou anatomical parts. The composition of the fourth cache sample, which may have been affected by carnivore activity, does not correlate with general utility value but rather with the marrow and grease indices. Of the two house samples, one does not demonstrate any relationship with the indices while the second was found to be most closely associated with the MGUI. In both sample types (house and cache) bone shaft fragments are common, and in at least the larger assemblages, their frequency is consistent with a scale of activity typical of a residential location. When combined with other lines of evidence (such as site location, style and similarity of house construction (i.e., heavy walls, paved floors, cooking alcoves), artifacts (including "domestic" soapstone vessel fragments), the faunal data suggests that a primary, though not necessarily exclusive, form of use of LlDv-5 was as a residential camp.

In terms of the degree of culling of low utility parts of the animal to accommodate the factors of distance or mode of transport, it would appear from the cache assemblages that some parts of low value were being abandoned. Cranial parts occur in consistently low frequencies if not altogether absent. Also recovered in low frequencies are the cervical vertebrae, distal radii, carpals, tarsals and phalanges, which are low and moderately ranked parts. There are a number of variables not controlled for in the present study that may account for the low frequency of some of these elements. Among some caribou-dependent groups the head is one of the preferred dietary parts of the anatomy (e.g., Gubser 1965; Binford 1978) and was often returned to camp for consumption. In marked contrast, in other areas the head may be left behind (e.g., Anoee 1982:49), and only the mandible and tongue brought back to the base camp (e.g., Grønnow et al. (1983:36). This might explain the recovery of mandibles and fragments thereof, and the very low frequency of other cranial parts. Phalanges, ranked 23rd, may have been abandoned regardless of distance because of their low food value (e.g., Grønnow et al. 1983:Figure 85). These elements could be processed for marrow during times of subsistence stress (Binford 1978:31-31), and were occasionally eaten at other times (Anoee 1982). Contributing to the low frequencies of other elements would be dog feeding and the possible removal of ribs, for example, after the attached meat had been dried.

A comparison of the house and cache assemblages, however, suggests an additional factor that requires consideration. Although the element frequencies are in no sense "reversed", they are complementary and there is a tendency for those elements missing or in low frequencies in the caches to occur in the house assemblages. In Figure 64, the element frequencies for House 2 are compared with caches 1, 4 and 6. The House 8 sample is compared in Figure 65. The spatial segregation of body part frequency is most evident in the comparison between the caches and House 2. The caches are dominated by forelimb, metapodials, pelvis and femora fragments. By contrast, these elements occur in low frequency or are completely absent in the House 2 assemblage, which contains high frequencies of tarsals, distal radii, scapulae and sternum. In addition, phalanges, which are missing from all cache assemblages do occur (albeit in low quantity) in the house sample. Although the contrasts are not as well defined, similarities are present in the House 8 assemblage which also lacks distal metatarsals and metacarpals and contained higher frequencies of the proximal portions of these elements. As in House 2, calcaneum and astragali are common in House 8 although other tarsals are not represented. Pelves and forelimbs, which dominate the caches, are present, but in slightly lower amounts in the house.

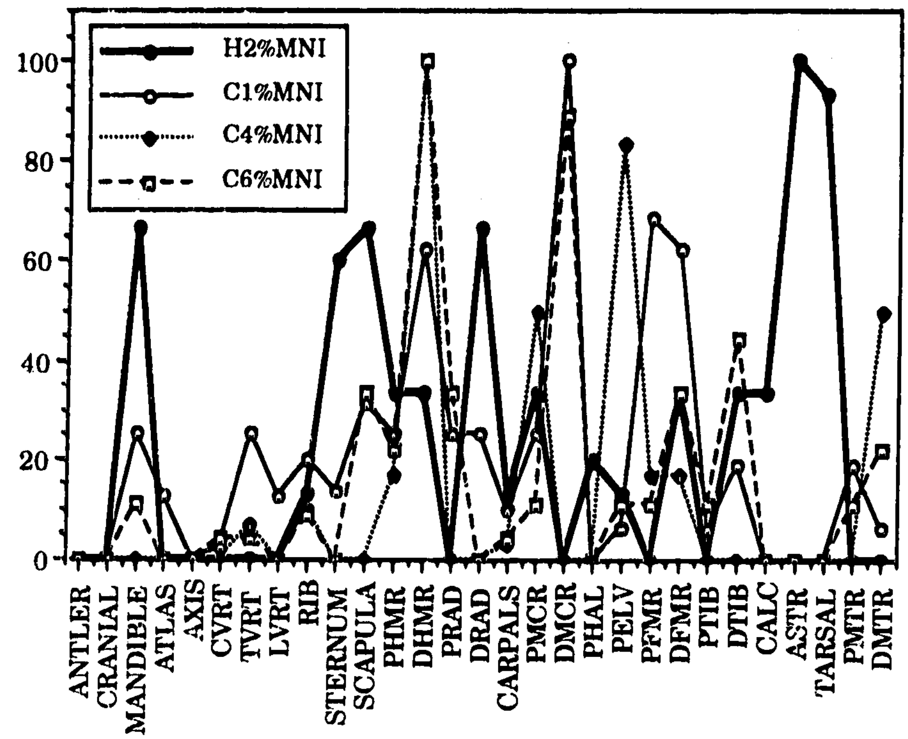

Figure 64. Comparison of element frequencies, LlDv-5: House 2/Caches.

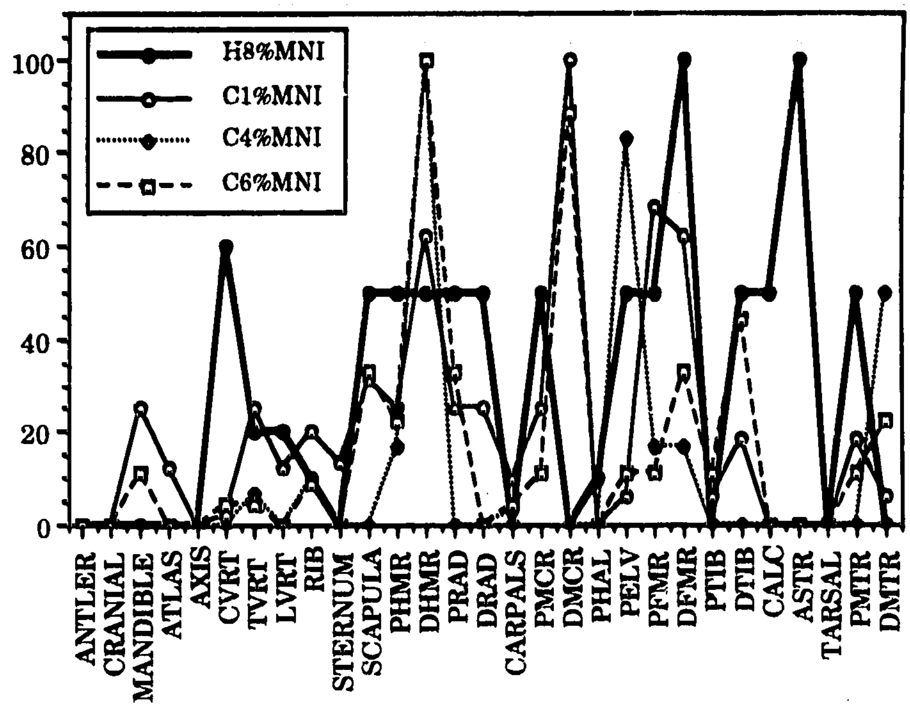

Figure 65. Comparison of element frequencies, LlDv-5: House 8/Caches.

Taking into account that these samples are small, and that the house assemblages cannot be linked with any specific cache, the apparent trend suggests that interpreting the role of logistical mobility relevant to LlDv-5 based only on faunal data from the caches (or the houses) would prove inaccurate. Both dietary preference and variation in the manner or degree to which disposal of bones was practiced may also have also played a role. It is suggested on this basis that in general, logistical mobility was not a paramount factor in the subsistence-settlement patterns of these sites. Additional observations support this conclusion. The first is the small number of animals represented in the assemblages, and the large number of cache-type features whose characteristics suggest they were not for food storage. In the collector model, caches are associated with locations where many animals are killed ("high-bulk") and used to store food temporarily until such time as it could be brought to consumers. By contrast, in foraging strategies locations are characterized by the harvesting of fewer animals ("low-bulk"), closer to the residential camp (i.e., within the foraging radius) which typically does not require temporary field storage in special facilities. The small number of animals represented in the faunal assemblages and the large number, form and content of the caches, suggests that the Amadjuak River was not a high-bulk location. This does not imply that the area surrounding LlDv-5 was not a productive one, but simply that large numbers were not killed at any one time. Small groups of caribou may have been available on a more or less regular basis throughout the summer and fall to meet the subsistence and clothing requirements of small family groups.

Several interesting points emerge regarding selective procurement of animals on the basis of age and sex. The osteometric data clearly indicate a bias in favour of the hunting of female caribou over males. This pattern is repeated in all assemblages where measurable bones were recovered. In terms of age, younger animals, including calves, are more common. Whereas calves might be preferred in summer and fall for their fine-haired skin used in children's clothing, female caribou are generally preferred during winter since they have greater fat reserves than the males.

During summer and fall, caribou bulls accumulate larger amounts of fat and meat, and a preference for killing bulls at this season is fairly constant cross-culturally. Grønnow et al. (1983:75) found that when compared with the recent census data from West Greenland, in which female caribou outnumber males by a ratio of approximately 2:1, bulls were being selectively hunted in the Aasivissuit area during the late Thule occupation of the site (i.e., the archaeological ratio was approximately 1:1). Estimates of the sex ratio of the South Baffin population are unknown and Ferguson (1989:pers. comm.) has suggested that the census figures from the tagging project may be misleading, since they are influenced by a number of variables affecting both animal movements and tagging procedures. Nevertheless, we know from biological data that caribou segregate according to sex and/or age classes through much of their annual cycle. On southern Baffin Island, male caribou are apparently found during the summer and fall to the east and/or south of the study area, either individually or in very small groups. Cows with calves, and yearlings of both sexes frequent the west and southwest sides of Nettilling Lake during the summer in the course of moving between the calving grounds near Dewar Lakes and their winter range further south (e.g., Kraft 1984a, 1984b). Preliminary archaeological reconnaissance has been completed around the southeastern region of Amadjuak Lake (Stenton 1987c), but at this time general comparisons between the two inland areas are not possible. Nevertheless, for purposes of limited comparison, and to explore the possibility that male caribou might be better represented in sites south and east of Nettilling Lake, measurements were taken on metapodials from a small refuse cache at a site presumed to be of Thule age on the Nuvungmiut River (LdDs-4). The results were plotted against the control data (Figure 66) and they provide provisional support for the spatial segregation of animals according to sex during the prehistoric period. All of the five metatarsals measured fall clearly within the male control group, as do six of the seven metacarpals.

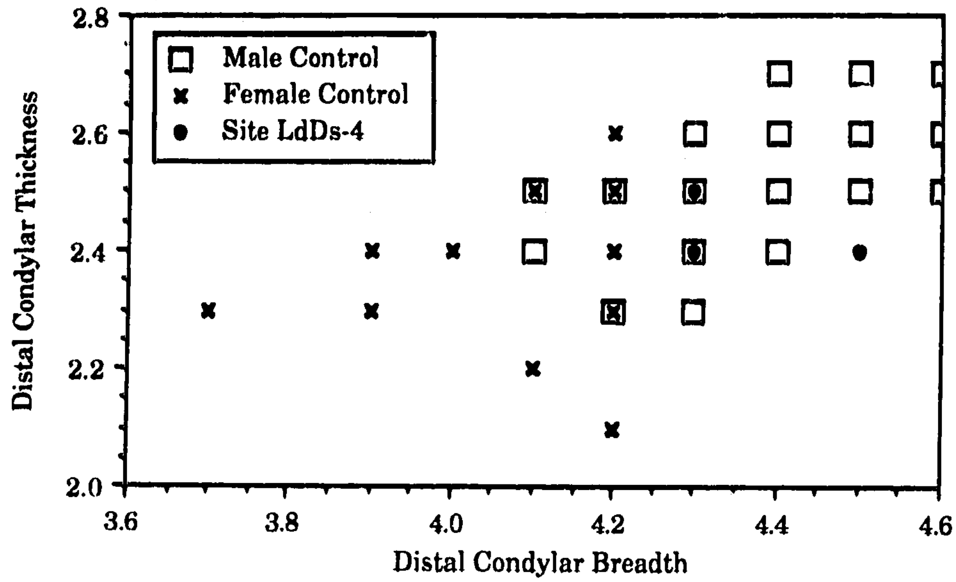

Figure 66a. Scatterplot of distal metatarsal measurements, LdDs-4: Cache 1 (n=5).

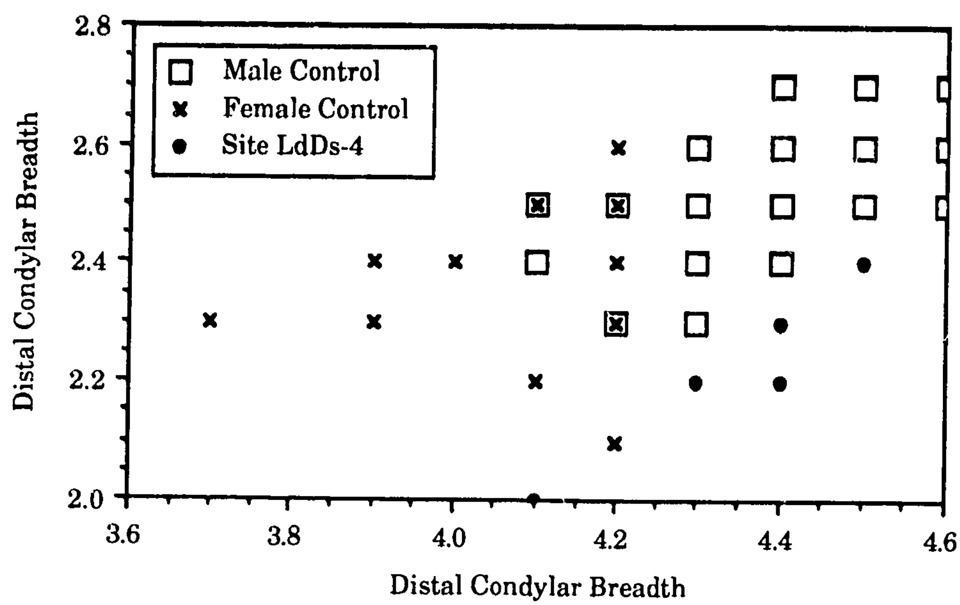

Figure 66b. Scatterplot of distal metacarpal measurements, LdDs-4: Cache 1 (n=7).

Concerning the distribution of female caribou and calves west of Nettilling, census data from the Koukdjuak River Tagging Project collected over a nine year period showed the proportion of adult males in the population to be consistently low at 13%. Yearling males were also underrepresented (Kraft 1984a:Table 1). This raises the question of whether cows and calves were actually being selectively hunted, or merely being harvested in greater numbers as a function of their availability and possible ease of capture (e.g., for calves). The combined evidence presents a strong case for the latter argument, although over periods of six to eight weeks in the field, bull caribou were observed fairly regularly in the vicinity of LlDv-5. These were generally sightings of individual animals, but small groups of bulls or individuals accompanying adult cows and and younger animals were also observed. Cow-juvenile or cow-juvenile-bull bands therefore, appear to represent the most locally aggregated and predictable source of animals, and it is concluded on this basis that the procurement pattern is not selective but instead reflects resource availability. This suggests another possible reason not only for the size of the LlDv-5 site, but also its location away from the river crossing point where human residence would not cause the animals to avoid the location.

Site: LlDw-7

As previously discussed, the cache at LlDw-7 was not judged to be contemporary with the historic tent rings, and this was subsequently confirmed by a radiocarbon age estimate. The structure was assumed to have been used for food storage purposes but it was immediately apparent that the assemblage was, apart from its size, remarkably similar to those excavated at the LlDv-5 site. Caribou remains found in the feature are listed in Table 23. Also present were minor amounts of dog and snow goose bones, listed in Table 24.

In terms of caribou utilization some culling of low utility elements is apparent, with low frequencies of cranial elements and atlas vertebrae, as well as carpals, tarsals and phalanges (Figure 67) (MNI=16). Nevertheless, other elements are overrepresented, particularly those

Table 23. Summary of Caribou Faunal Remains: Site LlDw-7 Cache.

Element	f	%	MNI	%
Antler	1	0.0	0.0	0.0
Cranial	7	0.2	0.0	0.0
Mandible	9	0.2	4.5	28.1
Tooth	28	0.6	0.0	0.0
Atlas	0	0.0	0.0	0.0
Axis	6	0.1	6.0	37.5
C. Vrt.	16	0.4	3.2	20.0
T. Vrt.	52	1.2	4.0	25.0
L. Vrt.	1	0.0	1.0	1.2
Vrt. Frg.	119	2.6	0.0	0.0
Rib	112	2.5	4.3	26.9
Rib Frg.	68	1.5	0.0	0.0
Sternum	20	0.4	3.3	20.6
Costal	104	2.3	0.0	0.0
Scapula	3	0.1	1.5	9.4
P. Humerus	6	0.1	3.0	18.8
D. Humerus	16	0.4	8.0	50.0
P. R/Ulna	9	0.2	4.5	28.1
D. R/Ulna	2	0.0	1.0	6.2
Carpal	10	0.2	1.0	6.2
P. M'Carpal	5	0.1	2.5	15.6
D. M'Carpal	21	0.5	10.5	65.6
Phalange	4	0.1	0.2	1.2
Pelvis	13	0.3	6.5	40.6
P. Femur	24	0.5	12.0	75.0
D. Femur	14	0.3	7.0	43.8
P. Tibia	1	0.0	0.5	3.1
D. Tibia	10	0.2	5.0	31.2
Calcaneus	3	0.1	1.5	9.4
Astragalus	2	0.0	1.0	6.2
Tarsal	6	0.1	1.2	7.5
P. M'Tarsal	5	0.1	2.5	15.6
D. M'Tarsal	32	0.7	16.0	100.0
Longbone Frg.	3750	83.1	0.0	0.0
Total	4510	100.0		

Table 24. Summary of Miscellaneous Faunal Remains: LlDw-7 Cache.

Species	Element	No.
Dog	Humerus	3
	Radius	2
	Ulna	2
	Pelvis	2
	Femur	1
	Tibia	1
Goose	Humerus	2
	Tibiotarsus	1
	Coracoid	2
	Longbone Frg.	8

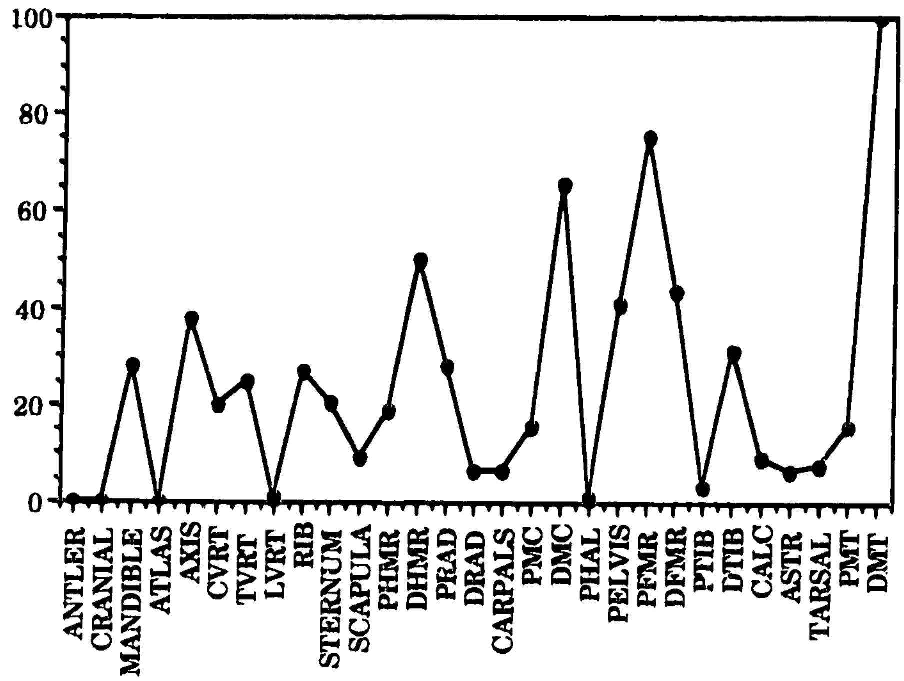

Figure 67a. %MNI frequency of caribou elements: LlDw-7.

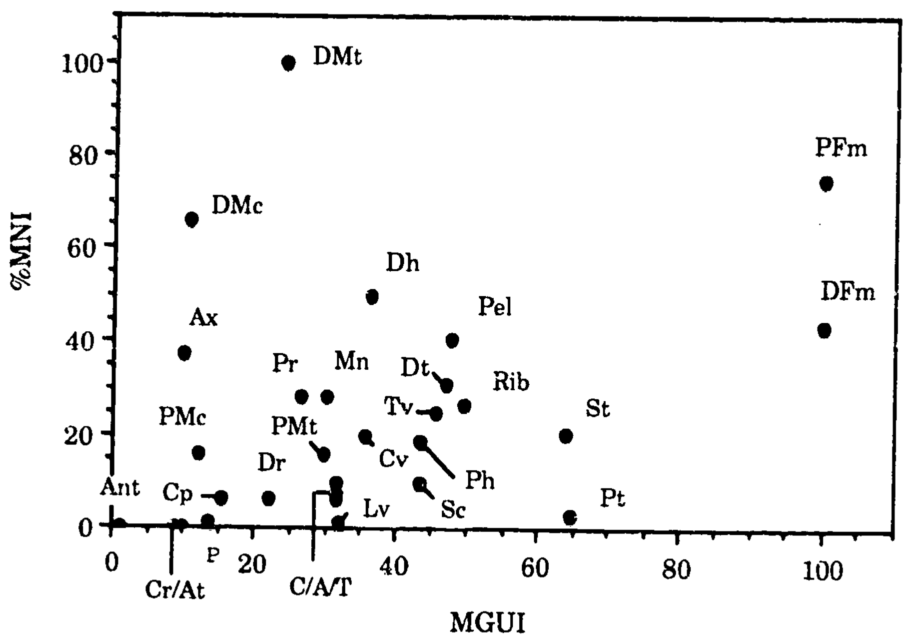

Figure 67b. LlDw-7 Cache %MNI/MGUI.

with high marrow values, and overall, the best predictors of the assemblage composition appear to be meat and marrow (Table 25). There is no evidence of carnivore activity having a significant impact on the form of the assemblage, and although the element frequencies correlate closely with the marrow index, a comparison of limb elements revealed no association with any of the indices. This suggests that limb bones were not being selectively brought to this location over other anatomical parts for marrow, or for that matter, meat or grease. The number of bone fragments, however, provide clear evidence that processing of meat and marrow for consumption occurred at this site. The latter activity typically takes place on such a scale in residential camps and leaves a somewhat redundant pattern in the placement of impact scars immediately below the articular ends of long bones (e.g., Binford 1981:157-163). Many of the long bones in the LlDw-7 (and MaDv-11) assemblage show evidence of patterned breakage consistent with processing in a residential camp.

A scatterplot of the metatarsal measurements is shown in Figure 68a. The majority of the sample falls clearly within the female control group, and nineteen of the twenty-two specimens are considered to be female. The metacarpal measurements (Figure 68b) show a similar distribution, with a minimum of thirteen and maximum of fifteen out of sixteen specimens grouped within the female range.

Animals generally younger than three years old dominate this assemblage, and both yearlings and calves are present. Eighty-six percent of the proximal and one hundred percent of the distal femora are unfused. These epiphyses fuse anywhere between 2.5 and 3 years and 3 to 5 years respectively. Sixty-four percent of the distal humerii and ninety percent of the distal tibiae are unfused, indicating animals of less than about 14 months of age. Calves are represented in the assemblage both on the basis of the small size of certain bones (e.g., proximal femora), and on dental criteria. Three nearly complete mandibles were found on which the first molar has not erupted. Based on the eruption sequence established

Table 25. Summary of Spearman's Rank Correlation Coefficients: %MNI and Utility Indices[a] - Sites: LlDw-7, MaDv-11.

Feature	Bulk Density[b]	P	MGUI	P	Marrow	P	Meat	P	Grease	P
LlDw-7										
Cache 1	.125	>.05	.399	<.05	.509	<.01	.418	<.05	.212	>.05
MaDv-11										
House 9	-.038	>.05	.781	<.01	.115	>.05	.689	<.01	.083	>.05

All tests one-tailed, all r_s values corrected for ties.

[a]After Binford 1978
[b]After Lyman 1985

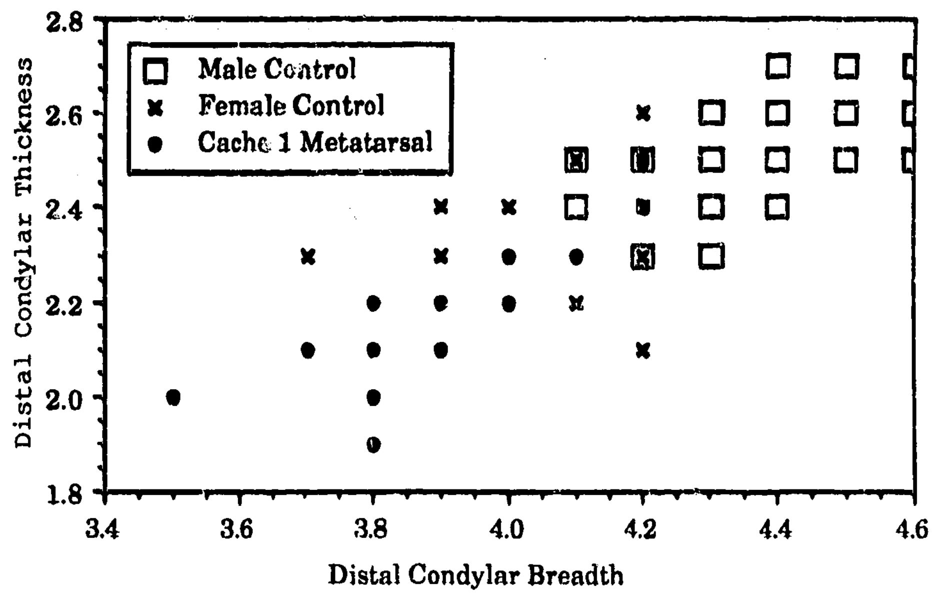

Figure 68a. Scatterplot of distal metatarsal measurements, LlDw-7 Cache (n=22).

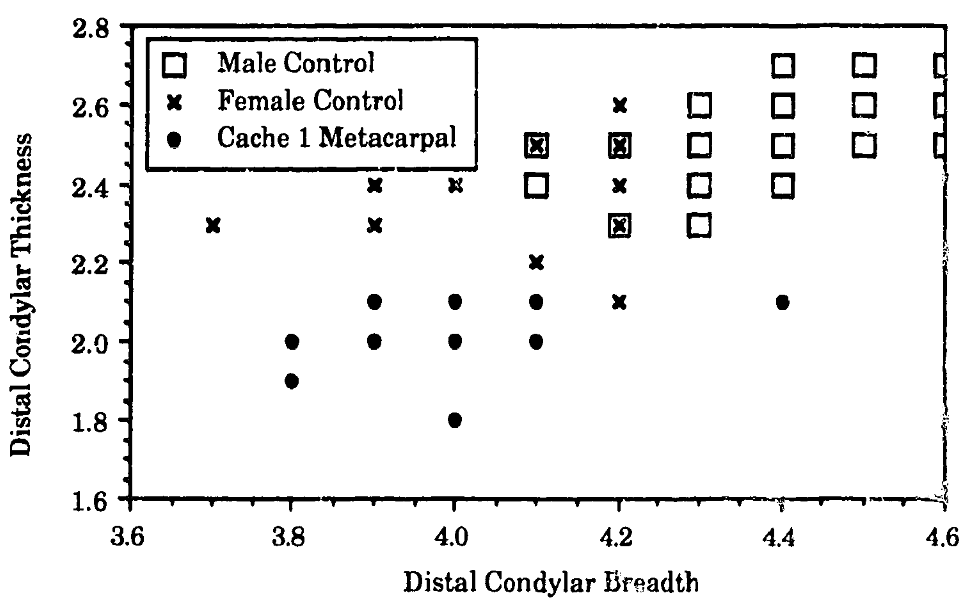

Figure 68b. Scatterplot of distal metacarpal measurements, LlDw-7: Cache (n=16).

by Miller (1974:14), these animals were between one and two months old at the time of death and were killed sometime between mid-July and mid-August.

Discussion

The Junction B cache assemblage, based on the combined evidence of its size and composition is interpreted to reflect residential use of the location. It is surprising that habitation features of possible Thule age were not identified in the vicinity of this feature, or the area in general. It is possible that they exist and were overlooked during the survey, or perhaps the historic age classifications for some of the habitation features at the site are incorrect. On a more speculative note, the stones used in the tent rings may have been used in the construction of the cache when the site was abandoned (cf. Savelle 1986). While there does not appear to be a shortage of boulders at the site, this behaviour certainly would not be inconsistent with the attention given to the disposal of caribou refuse seen at LlDv-5.

In terms of element culling, the assemblage shares a number of characteristics with the caches from LlDv-5, with the exception of the higher frequencies of vertebrae and distal metatarsals. This is illustrated in a comparison of the largest cache from LlDv-5 (Cache 1), the LlDw-7 assemblage and MaDv-11 (discussed below) in Figure 69. The tarsals, carpals, phalanges and crania occur in low frequencies in both assemblages, however, certain other low-ranked elements are common in the LlDw-7 sample, including axis vertebrae and metacarpals. It is suggested, therefore, that the kill site associated with the Junction B cache assemblage was not located a great distance from the site.

The LlDw-7 cache yielded the largest number of distal metapodials (n=38) and the metric analysis yielded results quite similar to LlDv-5. A minimum of 85% of the sample falls within the female range of the control data set, providing clear support for an emphasis on the hunting of female caribou. The available demographic information is also similar to LlDv-5, with primarily younger animals represented. The limited seasonal information provided by calf mandibles suggests an occupation of the site during July or August.

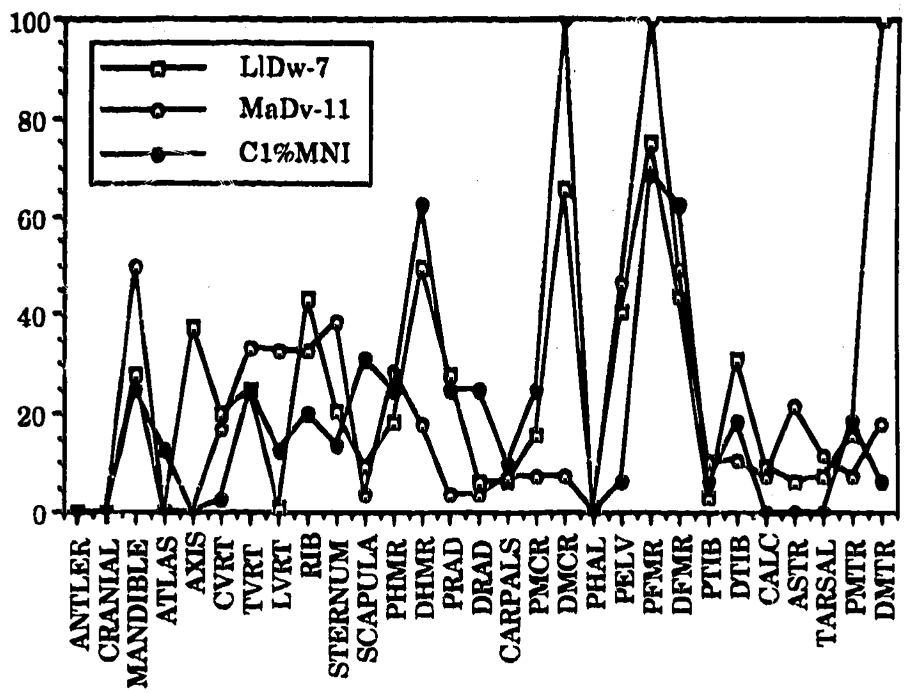

Figure 69. Comparison of relative frequencies of caribou elements: LlDv-5, LlDw-7, MaDv-11.

MaDv-11

The third faunal assemblage studied comes from House 9 at the Mosquito Ridge site located on an eastward extension of the West Burwash Moraine. This assemblage was recovered from the upper levels of the house entry beneath rocks originally used in the construction of the walls. The last use of the feature is interpreted to have been as a disposal area. The remains are dominated by caribou elements (Table 26), but also include small numbers of snow goose and dog bones (Tables 27 and 28).

Element frequencies for House 9 are shown in Figure 70. The high frequency of ribs, sternum, pelves and femora suggests that parts were introduced to the site primarily on the basis of their meat value. Tarsals and carpals are underrepresented, as are certain bones with high marrow values (e.g., metatarsals and metacarpals). This is also evident in the rho values listed in Table 25, which shows that the MGUI is the best predictor of element frequencies. Lumbar vertebrae and mandible fragments are slightly overrepresented, but in general, body parts of moderate to high value dominate the assemblage.

Since few metapodials were recovered little can be said regarding the sex structure of the assemblage. Of the four distal metatarsal two are considered to be males, and two fall into the zone of overlap and could be of either sex (Figure 71a). The metacarpals suggest the presence of both males and females (Figure 71b).

The long bones for which fusion information is available suggest that one-third of the animals killed were under 3 years of age, with a minimum age class for the remainder of 3 to 5 years. Both calves and yearlings were identified using tooth eruption and wear criteria. Mandible fragments with the M_1 erupting (but not in occlusion) indicate calves three to five months (September - November kill), while others with moderately worn deciduous molars suggest an age of twelve to fifteen months (July - September kill).

Although not discussed in detail, the test pits in House 2 at MaDv-11 also yielded a small assemblage of caribou bone, dominated by long bone shaft fragments but including several pieces of antler and cranial bone. The remainder of the sample, however, points to a

Table 26. Summary of Caribou Faunal Remains: Site MaDv-11 - House 9.

Element	f	%	MNI	%
Antler	4	0.4	0.0	0.0
Cranial	2	0.2	0.0	0.0
Mandible	14	1.4	7.0	50.0
Tooth	12	1.2	0.0	0.0
Atlas	0	0.0	0.0	0.0
Axis	0	0.0	0.0	0.0
C. Vrt.	17	1.8	2.4	17.1
T. Vrt.	61	6.3	4.7	33.6
L. Vrt.	23	2.4	4.6	32.9
Vrt. Frg.	81	8.4	0.0	0.0
Rib	120	12.4	7.2	32.9
Rib Frg.	67	6.9	0.0	0.0
Sternum	38	3.9	5.4	38.6
Costal	153	15.8	0.0	0.0
Scapula	1	0.1	0.5	3.6
P. Humerus	8	0.8	4.0	28.6
D. Humerus	5	0.5	2.5	17.9
P. R/Ulna	1	0.1	0.5	3.6
D. R/Ulna	1	0.1	0.5	3.6
Carpal	10	1.0	1.0	7.1
P. M'Carpal	2	0.2	1.0	7.1
D. M'Carpal	2	0.2	1.0	7.1
Phalange	2	0.2	0.1	0.7
Pelvis	13	1.3	6.5	46.4
P. Femur	28	2.9	14.0	100.0
D. Femur	14	1.4	7.0	50.0
P. Tibia	3	0.3	1.5	10.7
D. Tibia	3	0.3	1.5	10.7
Calcaneus	2	0.2	1.0	7.1
Astragalus	6	0.6	3.0	21.4
Tarsal	8	0.8	1.6	11.4
P. M'Tarsal	2	0.2	1.0	7.1
D. M'Tarsal	5	0.5	2.5	17.9
Longbone Frg.	248	25.6	0.0	0.0
Total	967	100.0		

Table 27. Summary of Goose Faunal Remains: Site MaDv-11 - Houses.

Element	House 2 f	House 2 %	House 9 f	House 9 %
Cranial	18	3.1	0	0.0
Maxilla	0	0.0	0	0.0
Mandible	5	0.9	0	0.0
Trachea	0	0.0	0	0.0
Vertebra	9	1.6	0	0.0
Rib	0	0.0	0	0.0
Sternum	68	11.9	0	0.0
Scapula	22	3.9	0	0.0
Coracoid	45	7.9	4	12.1
Humerus	108	18.9	4	12.1
Radius	43	7.5	4	12.1
Ulna	36	6.3	2	6.1
C'mcarpus	13	2.3	1	3.0
Femur	19	3.3	1	3.0
Pelvis	5	0.9	0	0.0
T'tarsus	32	5.6	1	3.0
T'Mtarsus	24	4.2	0	0.0
Phalange	0	0.0	0	0.0
Furculum	1	0.2	0	0.0
Fragments	123	21.5	16	48.5
Total	571	100.0	33	99.9

Table 28. Summary of Miscellaneous Faunal Remains: MaDv-11 - Houses.

House	Species	Element	No.
2	Dog	Tooth	3
		T. Vertebra	1
		Rib	2
		Scapula	1
		Humerus	1
		Pelvis	1
		Patella	2
		Tibia	3
		Metatarsal	1
9	Dog	Tooth	2
		Radius	1
		Ulna	2
		Tibia	1

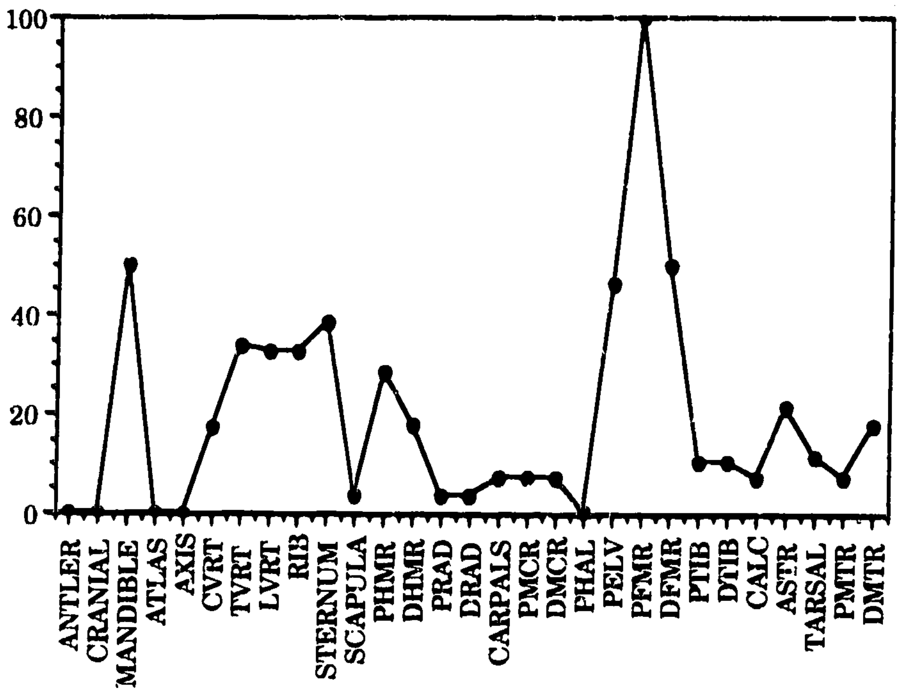

Figure 70a. %MNI frequency of caribou elements: MaDv-11, House 9.

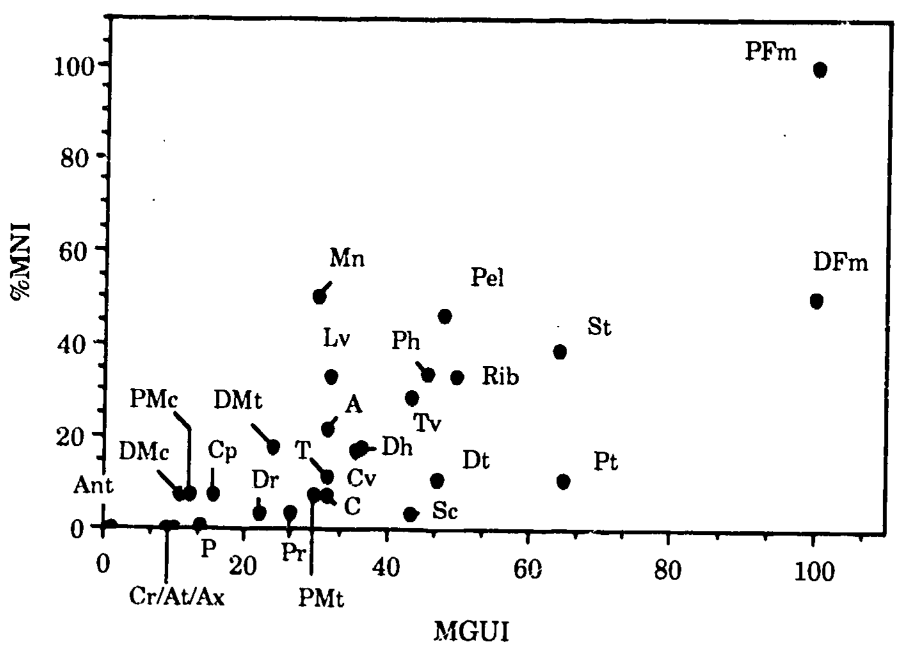

Figure 70b. MaDv-11 House 9 %MNI/MGUI.

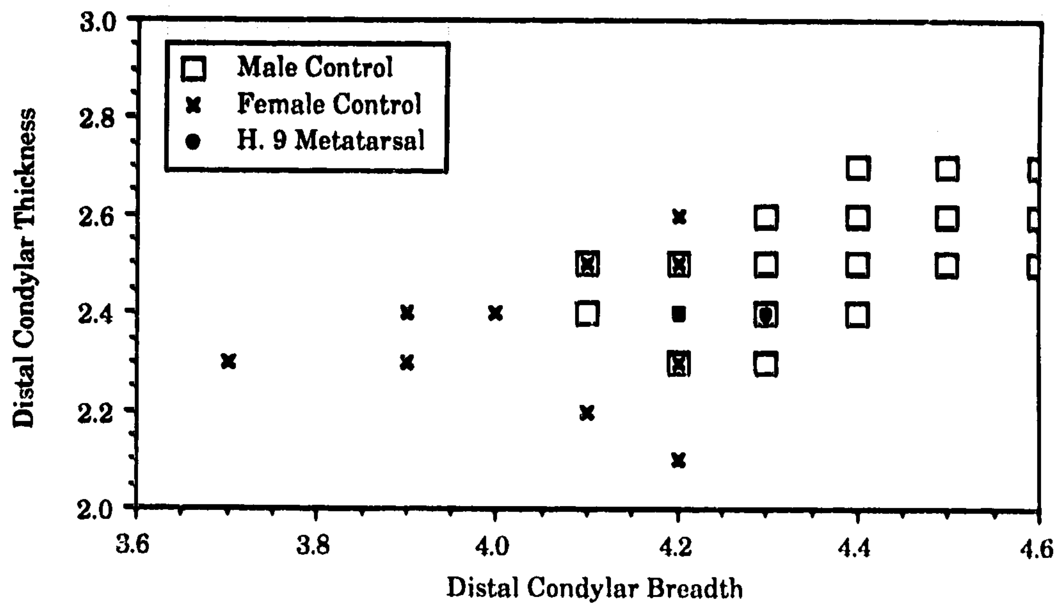

Figure 71a. Scatterplot of distal metatarsal measurements, MaDv-11: House 9 (n=4).

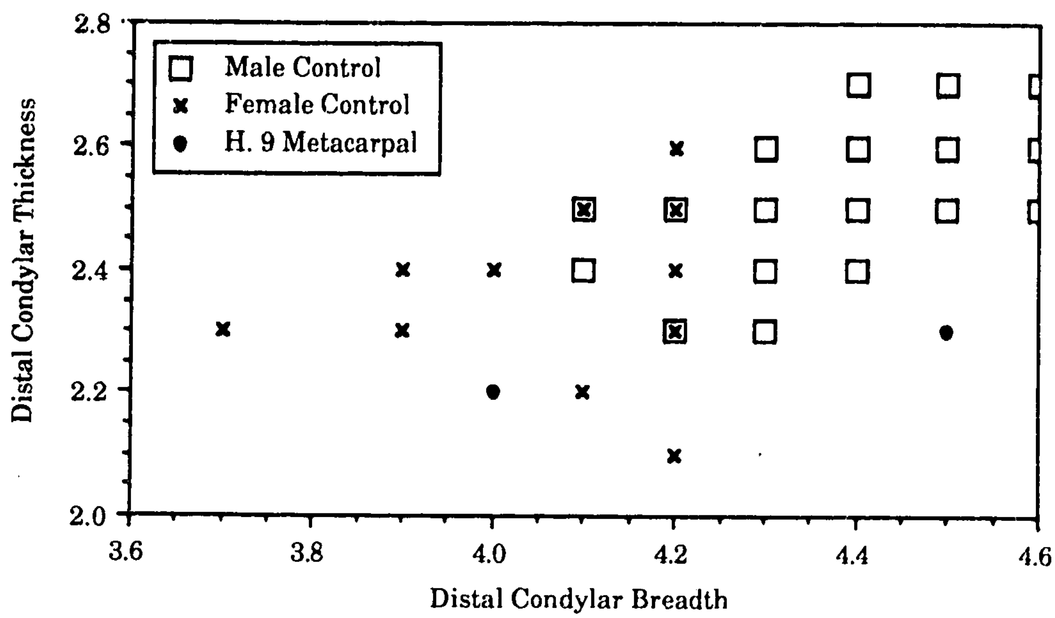

Figure 71b. Scatterplot of distal metacarpal measurements, MaDv-11: House 9 (n=2)

Discussion

The combined evidence from MaDv-11 suggests that it functioned as a residential site. The shallow semi-subterranean features clearly indicate residential use during the fall, and the single winter house points to at least occasional use during the winter. Occupation during the summer months is indicated by the tent rings, although the size and number of groups resident at the site at any one time is unknown.

Although the faunal assemblage cannot be linked clearly with a particular season of use, the limited seasonal information yielded by the faunal remains is consistent with the structural evidence and hints at a late summer or fall occupation. The main difference between the MaDv-11 fauna and the other site samples is in the smaller number of lower fore and hind limb elements, which have generally low ranks on the MGUI but relatively high ratings on the marrow index. In the other assemblages marrow bones are fairly common and often overrepresented in terms of their general value. If the suggestion that the faunal remains from MaDv-11 were generated by a late summer/fall occupation is correct, the comparatively small number of these elements is somewhat surprising since the nutritional state of caribou is high at this time and they would, presumably, yield high quality marrow in addition to meat and fat.

Two factors might account for the nature of this assemblage. The first is the location of the site relative to the main axis of the West Burwash Moraine. MaDv-11 is located approximately 3 km east of the feature, near the end of a short extension of it that runs

different component of the interior subsistence base with seventy-five percent of the House 2 fauna represented by snow goose remains (MNI=52). As discussed earlier geese can be harvested in large numbers during July and would have been an important source of food for groups residing on the lake in summer, possibly in advance of the southward movement of caribou.

perpendicular to the main axis. During the brief period of time spent at the site (11 days) no caribou were observed in its vicinity. Animals were only seen during the course of surveys along, and west of, the main axis of the West Burwash Moraine between LlDw-4 at the southern end, and MaDv-15 in Tikeraq Bay. Caribou undoubtedly move along this extension, but they may not have done so on a regular basis. One reason to expect caribou to avoid this particular location for at least part of the summer is the fact that it is at a slightly lower elevation than the West Burwash Moraine. During the mosquito season, caribou tend to move to higher ground where some relief from insect harassment may be provided by the wind. The section of moraine on which MaDv-11 is located is in the lee of the West Burwash Moraine and is not, as was discovered, an ideal location during the peak of the mosquito season (and hence the name of the site: "Mosquito Ridge").

A second factor may be the season during which the faunal remains were generated. If in fact the assemblage is derived from a late summer or fall occupation, and groups planned to remain at the site until freeze-up it would make sense to accumulate supplies of meat if possible. The availability of several "secondary" resources is reduced by early autumn (e.g., migratory waterfowl), and caribou apparently begin to move out of the area to the highlands east and south of the lake at this time and are virtually absent from the Great Plain of the Koukdjuak during the winter (Soper 1928). According to Soper (1928:66) few, if any, caribou are available between approximately November and May due to the low relief of the area and the subsequent depth and hardness of the snow cover. In Manning's (1943) view, most animals leave well before the snow cover was deep or hard-packed. In 1938 and 1939, for example, caribou had departed by mid-October, and Manning (1943:52) suggested that earlier movements may be prompted by a lack of lichen forage and/or the freezing of grasses and other plants to nearly half their height in the low, wet tundra of the plain. In any event, if a number of families planned an extended stay on the west side of the lake the accumulation of meat might be expected. Marrow from some elements may have been consumed at the kill location, others returned to the site and, possibly, the remainder abandoned.

The MaDv-11 assemblage also appears to differ to a certain extent from the other assemblages in terms of the ages of the animals represented. Approximately two-thirds of the animals fall into the 3 to 5 year age class, whereas animals generally younger than three years are more common in the other sites. This may indicate a preference for larger animals (i.e., more meat and fat), consistent with the conjecture that they might have been attempting to accumulate a food surplus. We might, therefore, expect selective hunting of adult males over females and calves. Unfortunately, the elements that might be used to test this proposition are those that are missing. Of the small number of metapodials that are present little more can be said except that both males and females are present.

CHAPTER 11

DISCUSSION AND CONCLUSIONS

This research has been directed toward understanding certain aspects of the organization of terrestrial land use by eastern Arctic coastal hunter-gatherers, as influenced by the population dynamics of a key terrestrial resource. Using ethnographic and historic sources two patterns of land use were distinguished, each related to a different level of resource availability. Contrasting hypotheses were then framed concerning changes in the degree of logistical and residential mobility as one form of response to a specific type of environmental stress. Environmental stress has been defined in the present context as the effect on human populations of long-term reductions in caribou herds both in quantitative (size) and qualitative (distribution) terms. To evaluate the model developed for episodes of caribou decline during the late prehistoric (Thule) period, survey and excavation data were collected from the Nettilling Lake district and two study hypotheses were proposed. The first (or null hypothesis) stated that the occurrence of long-term, regional declines in caribou populations on southern Baffin Island spatially modified the settlement pattern associated with their procurement, resulting in a shift in the distribution of summer/fall camps from coastal-upland areas to the interior region surrounding Nettilling and Amadjuak lakes, but with no significant change in the patterns or scale of residential or logistical mobility.

The alternative hypothesis stated that in addition to the spatial relocation of the summer caribou hunting procurement system brought about by low resource abundance, the scale of residential and particularly logistical mobility were reduced as groups positioned their camps in locations having the best potential for caribou procurement, as well as for secondary resources.

Dealing first with the question of residential mobility, the results confirm the expectation that groups would not have found it necessary to shift their residence frequently during the course of a single season of occupation at the lake. Bearing in mind that the classifications of a number of sites are tentative due to chronological and other uncertainties, the archaeological record is nevertheless consistent with ethnographic and informant data indicating that specific residential camps were occupied for most or all of a hunting season. In the Burwash Bay district, five Thule-era residential sites have been identified. These are of variable size, and are not all assumed to have been occupied contemporaneously, but they share a number of characteristics that other sites lack. First, each site is strategically located to harvest both primary (caribou) and secondary food (fish, geese) and non-food (building supplies, fuel) resources. With the possible exception of MaDv-11, the sites are situated to take advantage of the southward movement of caribou at water crossings, and along eskers and moraines.

Second, each of the sites contains habitation features related to both summer and autumn occupations, with winter houses present at three of the sites. This need not imply that a group would remain in precisely the same location for an entire season. At Tikeraq Bay, for example, twelve of the sixteen sites recorded are located along a 2 km stretch of esker, and camps may have occasionally been moved short distances along this feature during a single season. Such a move would not, however, change the relationship between the group and a specific resource as is typically intended by the concept.

In addition to these characteristics suggesting low residential mobility, the complexity of feature construction at the sites implies stability in the mobility pattern. As discussed by Chatters (1987; cf. Eder 1984), repetetive use of specific localities from year to year is often associated with increased expenditures of energy in the construction and maintenance of dwellings. In the present context, this behaviour is reflected in several structural attributes of dwellings including multiple coursed exterior walls, paved floors and/or sleeping platforms, and special purpose activity areas (cooking and storage alcoves). Once established, such locations may have been preferred for residential purposes. The predictability of specific interior locations in terms of subsistence resources and construction materials, especially for individuals or groups with little if any, personal experience in the region, may have contributed further to a pattern of low residential mobility.

Between Tikeraq Bay and Mosquito Ridge (MaDv-11) only four sites were found, of which only two (those nearest to Tikeraq Bay) may have been residential camps. Not all of the sites at Tikeraq Bay are residential, but the concentration and type of cultural features there indicates that it was a focal point of the inland settlement system. An analogous situation was found at MaDv-11, and near the mouth of the Amadjuak River, which is also associated with residential sites. Between these areas are a variety of smaller sites, containing features of lighter construction and which are completely lacking artifacts or faunal debris. These are interpreted to be travel camps, monitoring stations or other special purpose locations

In addition to their locations relative to resources, and evidence for multiseasonal use, these sites have been re-occupied over long time periods beginning with use by early Paleoeskimo cultures and continuing through to the modern era. Continuous occupations are not suggested, but it is interesting that the same places have been used by both Paleoeskimo and Neoeskimo cultures. Evidence of Pre-Dorset and/or Dorset occupations has been found at LlDv-5, MeDv-3, MaDv-11 and MaDv-18. Together with the evidence for repeated use by Thule and historic Inuit, these findings provide interesting data regarding the importance of specific locations in the Nettilling Lake region over long periods of time.

The discovery of Pre-Dorset sites and components at Nettilling Lake is not surprising in view of the archaeological evidence for a relatively strong economic commitment to terrestrial resources (Maxwell 1985). The presence of Dorset sites so far in the interior is more intriguing. Among the traits marking the transition from Pre-Dorset to Dorset is an economic re-orientation from an emphasis on terrestrial resources to one focussing on marine ice-edge hunting. This change is reflected to some extent in the location of Dorset sites, but particularly in the artifact assemblages. Included are snow knives used to construct winter snow houses, bone sled shoes, bone ice creepers, ice chisels and other items reflecting the importance of sea-ice hunting (Maxwell 1985:136 ff.). In addition, the bow and arrow, which was an important component of most terrestrial subsistence economies, is not found in Dorset hunting technology. The only Dorset site studied in detail is on the north shore of the Amadjuak River (LlDv-4). No faunal remains were found and the single organic artifact has incised lines at one end suggesting bilateral barbs, and it may be a fragment of an unfinished fish spear (cf. Maxwell 1985:Figure 6.9). The stylistically late lithic artifacts recovered from LlDv-4 (ca. 1000 A.D.) also raise interesting questions about interior land use by Paleoeskimo cultures. Given their coastal-maritime economic orientation, the discovery of Late Dorset settlements deep in the interior of southern Baffin Island would not be anticipated. Most of the small sample of Dorset materials recovered, however, date from the period of Thule eastward expansion, a time during which in most Arctic regions the Dorset culture virtually disappears. Hantzsch (Neatby 1977:216-217) mentions Inuit oral traditions that suggest the Tunit (i.e., Dorset) on Baffin Island withdrew to and subsequently became extinct in, the interior upon the arrival of the Thule. Given the continued lack of knowledge concerning the nature of contact between the two cultures, there may be an element of truth to this conjecture. Moreover, Amadjuak ("large lake where flint is found") Lake is reported by Inuit to contain many Tunit sites, and the small Dorset finds from Nettilling Lake may not be isolated ones.

Concerning the role of logistical mobility, it is clear from a general perspective that the decision to travel to the lake is tactical or logistical in nature: groups are moving to a particular area to harvest specific primary and secondary resources. They are not moving to just any location in the interior, but to more or less specific places prejudged on the basis of experience or tradition to be in direct proximity to the desired resource(s).

The degree of logistical mobility once in the interior has been assessed in two ways. First through a provisional classification of sites according to function, assuming that the presence of field camps, caches and other special purpose locations would provide a partial measure of the importance of logistical hunting tactics. Overall, logistical hunting behaviour, in the sense of groups of males hunters being absent from the base camp for extended periods of time, does not appear to have played a key role in the procurement strategy. This conclusion must be weighed against the fact that the function of many sites remains unclear. A small number of sites do appear to have functioned as field camps but these fall within the foraging radius of most or all of the residential sites. Cache structures typical of collector systems and interpreted to indicate high bulk procurement and seasonal incongruities in resource availability, are common in the Nettilling Lake sites, occasionally in large numbers. Most of these features appear to be of prehistoric age, but it has been argued that only a small proportion may originally have functioned as food storage receptacles. Consideration should be given, however, to the fact that information was not obtained from the Qarmang site which, at least from ethnographic accounts, would seem to approximate more closely the coastal-upland model. As discussed by Boas (1964) male hunting parties were absent from the base camp at Qarmang for several weeks during the caribou hunting season and only arrived there late in August at the conclusion of the hunt. This suggests that at certain times or in certain locations, it was either necessary or more productive to organize the hunt in a pattern similar to that followed in coastal areas where the scale of logistical mobility was higher. It is interesting in this regard that Qarmang is (apparently) located near the zone of contact between two geomorphological regions. The topography along the north shore of Mirage Bay consists of rugged bedrock hills and discontinuous valleys. To the west is a low, flat plain broken by a series of raised beaches away from the bay, but few eskers. The topographic characteristics of both areas present few of the hunting advantages found at the southern end of the lake, and may have been an additional factor influencing procurement strategies in the Qarmang district.

The assessment of logistical mobility using faunal remains has also yielded interesting results. The small size of many samples limited their suitability for certain analyses. Nevertheless, a general trend was found in the cache assemblages in which certain low utility elements were consistently absent (e.g., crania, phalanges), while others were often overrepresented (e.g., metapodials). Faunal assemblages from the houses at LlDv-5, however, are characterized by higher frequencies of those elements that are missing from the caches at that site. It is concluded from this, as well as the information available on herd ethology, the locations of the residential sites, and the typically small number of animals represented in the various assemblages, that radical culling of low utility anatomical parts as a means of accommodating transport difficulties was not practiced to any great extent.

This conclusion must be balanced against two factors. First, it can be assumed that the vicinity around a residential camp would be regularly monitored for game. Information regarding the number and general direction of movement of caribou, for example, would be just as important if not more so, during periods of low abundance. The fact that most hunting is considered to have taken place relatively close to residential camps (i.e., within a 10 km foraging radius) does not obviate a need for regularly updating such information. Hickey (1984:18) has termed such behaviour "frontier scanning", in which hunters undertake long trips to evaluate the condition of resou in adjacent hunting ierritories. While this may not have occurred on a similar spatial scale by groups residing in the Nettilling Lake area, it is possible that many of the smaller sites of unknown age but indicating brief episodes of use may have been associated with this type of monitoring behaviour. Alternatively, these sites may not relate to the activities of family groups during a period of summer residence at the lake. Assuming that scanning was a routine part of hunting behaviour it might be expected that when summer camps were established at the heads of fiords, hunters would occasionally extend their journeys further inland to either of the interior lakes to monitor conditions there. Such behaviour could have been initiated by reduced local productivity and the anticipation of a move the interior camps in the near future. Even if this were not the case, these trips would serve an important function by providing younger hunters with personal knowledge about an area they may never have seen but of which they might require knowledge at some point. Thus, while in many ways the pattern of interior land use approximates a foraging strategy of "mapping on" to terrestrial and riverine resources in specific locations, a tactical or logistical element remains active.

This is consistent with the argument that no pure collector/forager production strategy exists.

The second factor, and one for which the present model may not adequately account, is the possibility of changing priorities and, therefore, strategies on a seasonal basis. Unfortunately, we are unable to estimate the length of occupation at any particular site. It is unclear, for example, whether certain sites were occupied only during the fall, and whether groups arrived at these locations directly from the coast or from summer camps located elsewhere around the lake. Nevertheless, important differences in the character of certain faunal assemblages were found. The assemblage from MaDv-11 differed from the other samples studied in the emphasis placed on meat-yielding anatomical parts and greater degree of element culling. As previously discussed, this assemblage may have been generated during early autumn by groups intending to stay at the lake late into the fall or possibly through the winter (although the site contains only one winter dwelling). If so, logistical mobility may have played a more important role in the fall rather than earlier in the summer, perhaps due to the fact that accumulating food rather than other byproducts was the main concern. The conclusion that logistical mobility consistently played an overall minor role is weakened by this possibility, and a more complex pattern may thus exist. Corroborative evidence for logistical strategies may exist in the autumn components at MaDv-18 as well as at the important Qarmang site in Mirage Bay.

Inland Settlement Systems in West Greenland

There are few archaeological studies with which to compare the pattern of inland settlement and subsistence reconstructed for the Nettilling Lake district. One of the most detailed is the analysis by Grønnow et al. (1983; Grønnow 1986) of the prehistoric hunting camp Aasivissuit, in central West Greenland. As on Baffin Island, caribou populations in West Greenland have undergone dramatic fluctuations in size (Meldgaard 1986) which did not introduce food shortages *per se*, since the traditional subsistence economy of the

Greenlandic Inuit also had a maritime foundation. Instead, it presented shortages of important raw materials for which it was difficult to find adequate substitutes. At a general level similarities exist between the land use patterns for the two regions. Family groups travelled on foot and by boat to specific interior locations along traditional routes. A variety of special purpose sites (e.g., travelling camps, departure camps, etc.) were generated, and the archaeological records, with some exceptions (e.g., winter houses at Nettilling), can be considered to be quite similar. The length of stay in the interior was variable in both regions, but typically from a few weeks to months between about June and September. Slightly longer periods of occupation at Nettilling are indicated by qarmat and semi-subterranean houses at a few sites. At the end of the hunting season families returned to coastal settlements with skins, dried meat and other raw materials. Finally, a long history of use of the interior camps in West Greenland, beginning at least as early as the Dorset period, if not before, has also been demonstrated in both areas.

The Thule era occupation at Aasivissuit also differs in a number of ways from that at Nettilling Lake. The most intensive period of traditional use of Aasivissuit corresponds with the last caribou population maxima during the 17th and 18th centuries. At this time, large numbers of families from different regions apparently moved into the site area, which is located near a topographic constriction through which caribou must pass while migrating to their winter range near the coast. Large-scale, cooperative hunts were organized and included several different procurement strategies. (e.g., Inuksuit drive systems, shooting blinds, hunting by kayak). An abundance of food and raw materials is evident in the faunal remains from the site. During this period animals were not extensively processed, and Grønnow et al. (1983:83) report that the degree of bone fragmentation was low and that many bones were found articulated. The composition of the large midden fauna at Aasivissuit suggests it functioned as a base camp with nearby processing locations, in which most highly-valued bones were underrepresented.

During periods of reduced availability of caribou, small groups of hunters apparently moved further inland, beyond Aasivissuit, to the edge of the inland ice where small numbers of animals were taken using stalking techniques. In a general sense, the pattern of terrestrial land use described for central West Greenland is a reversal of that reconstructed for southern Baffin Island. In West Greenland, large numbers of people hunt in the interior when caribou are abundant, with small groups of hunters making forays inland when animals are scarce. For southern Baffin Island, it has been argued that generally smaller social groups hunted caribou out of coastal settlements when animals were in good supply, and moved to the interior during periods of decline. The potential for large-scale, communal caribou hunts in West Greenland appears to have been made possible by the concentration of animals in the topographic constriction along their migration route. This location would be highly productive during periods when caribou were in good supply, but less predictable during declines when migratory behaviour is modified. In the Nettilling Lake region, the rugged terrain and low density of animals along the east side of the lake offer few opportunities for such organized hunts. The flat topography of the terrain bordering the west side of the lake, coupled with the apparent absence of large-scale migrations also provides few advantages for large-scale hunts and, presumably, could not support large groups of people. The networks of moraines and eskers serve to attract caribou, but their movements are not controlled by these landforms and animals can easily avoid or escape attempts to direct their movement. At a few sites, short rows of Inuksuit have been recorded, but overall there are few indications that controlling the movement of large numbers of animals was ever attempted, or in fact feasible. This may partially explain why the largest site (i.e., in the sense of being repeatedly occupied through time) recorded thus far at Nettilling lake is associated with a river crossing location. It may be that hunters were able to exercise the greatest control over the animals while they were in the water (cf. Arima 1975). If hunting at river crossing points was an important procurement technique, as it appears to have been at LlDv-1, LlDv-5, and perhaps sites in the Padlei Narrows district, the relative absence of cultural remains at the Koukdjuak River is interesting. This river, however, is very wide (> 5 km at some points) and shallow along its banks. For a small group of hunters it may have been difficult both to monitor and direct the movements of animals. Given the width of the river and the current, it might also have been difficult to control the animal carcasses, which might drift downstream for considerable distances. The time of year when the caribou crossed may have been another factor. Ethnographic information suggests that the Koukdjuak River was a stopping place for families en route to Mirage Bay. These groups arrived at the river before break-up, and when it was sufficiently clear of ice to permit boat travel (by about early July) the male hunters moved to the Foxe Basin coast and then north to an inland hunting district. The remainder of the group followed the northwest shore of the lake to Mirage Bay. In recent years, caribou begin to cross the Koukdjuak River in early July while the river is clear but the lake is still frozen. In most years, by the middle of August the river contains large amounts of candled ice from Nettilling Lake which makes it difficult and dangerous for the animals to cross. Crossing locations may thus be highly unpredictable at this time, and attempting to manoeuvre a kayak under such conditions may have been extremely hazardous if not altogether impossible. This argument is clearly speculative, but the available archaeological and ethnographic data are in agreement that families appear not to have regularly settled in the vicinity of the river. Since only a short section of the river has been surveyed for archaeological sites, larger settlements might exist in this area. It is interesting, nevertheless, that the majority of sites recorded thus far are at opposite ends of the lake and well away (up to 50 km) from the Koukdjuak River.

Discard Behaviour

One of the most interesting aspects of the archaeology of Nettilling Lake is the evidence for the consistent practice of disposing of bone refuse in small stone features. These structures vary in their size and form; several appear to have been originally intended for use as storage caches (presumably for food) while others were apparently constructed for disposal purposes, either from previously unused materials or those possibly derived from existing or abandoned features. Faunal remains were also deposited in natural crevices in bedrock. Refuse disposal is one of the most important and complex forms of cultural deposition contributing to the formation of the archaeological record (Schiffer 1976, 1983; Rathje 1974; Murray 1980). Schiffer (1987:58) has distinguished three types of refuse. Primary refuse is that which is discarded at its location of use. Secondary refuse refers to those materials discarded in areas of a site which are unrelated to their use. A third type of refuse, called "de facto", refers to a range of materials items (tools, weapons, utensils, etc.) that are still usable but are left behind when a camp, dwelling or other area is vacated (Schiffer 1987:89). De facto refuse production and deposition is the central theme of investigations into a particular site formation process known as abandonment (Schiffer 1987; Stevenson 1982).

The majority of the faunal material recovered from site features at Nettilling Lake can be classified as secondary refuse, assuming that the location of use (in this case preparation and consumption) was originally in or adjacent to dwellings. The small samples of bone recovered from the dwelling structures constitute primary refuse, assuming again that the material was not dumped into an abandoned feature by the occupants of a structure nearby (cf. Murray 1980).

Before discussing the several interrelated factors which are thought to have influenced the form of refuse discard, it should be noted that from a purely utilitarian or functional perspective several alternative methods of disposal were available. The potential options include dumping refuse materials downslope which would move it well away from the habitation areas in the majority of sites. In addition, at LlDv-5 and MaDv-11, there are small ponds nearby into which the bone could have been dumped. This practice has been documented at coastal Thule sites near Cape Dorset and Iqaluit (Stenton n.d.) and at MaDv-11 a piece of sawn antler was recovered from one of one of the ponds. No faunal remains were observed, however, in the series of ponds immediately south of the LlDv-5 site. This could relate to that fact that unless a camp was established near the eastern end of the

South Burwash moraine, where it is cut by the Amadjuak River, the ponds represent the closest supply of drinking water and groups might be expected to avoid contaminating it. Finally, it would also have been possible to dump the bones into rivers or the lake itself.

In the present context, in which the focus is on caribou remains (other species represented in the cache assemblages occur in minor amounts relative to caribou), the observed pattern of discard behaviour implies a fairly strict ideology governing the human relationship with this species. The importance of the land or nuna in Inuit cosmology has been well-documented by ethnographic studies and is reflected in Inuit oral traditions. As Arima (1976:219) notes:

> "Nuna as a kind of protean being supporting all existence was to be respected and left undisturbed. In the central Arctic this attitude was codified in the tabu rules surrounding the caribou which... originally came from within the earth."

Behavioural proscriptions associated with caribou hunting were briefly reviewed in chapter three. Caribou river crossings were reported to be particularly sensitive locations, where marrow bones were not to be broken or bone refuse left on the ground. Even caching meat near rivers could potentially affect animal behaviour:

> "Meat cached by a river turns caribou back. Hunters always watched for these things and they will keep the river clean where the caribou route is, just so the caribou will continue to use the same route." (Mumgark 1982:40)

Ethnographic accounts and informant testimony clearly indicate that ideological factors served to control man's interaction with caribou, and these could easily have motivated the specific form of discard process adopted within the range of suggested alternatives. The fact that caribou remains received similar treatment at all inland prehistoric sites, including those well away from highly sensitive locations is also noteworthy. It might be speculated that specific rituals/tabus would be more carefully observed or performed during periods of reduced availability of resources, in an attempt to ensure that the animals would continue to frequent specific locations during an episode of decline that might extend for a decade or more. Such an explanation is certainly consistent with the archaeological remains at LlDv-5, near the mouth of the Amadjuak River, and several other sites along the West Burwash Moraine.

What is surprising, however, is that in sites dating to the last fifty or sixty years caribou bones were not afforded the same treatment. Where present, they were consistently discarded on the surface with other forms of debris. Paradoxically, these historic occupations generally coincide with the last episode of caribou decline on southern Baffin Island. What factors might have contributed to this change in discard behaviour? One explanation for the implied change in attitude is that it is an expression of the acculturative influences of European contact, particularly the secularization of hunting that evolved as a result of technological developments (e.g firearms) widely introduced during the whaling era and intensified through the expansion of the fur trade industry (e.g., Williamson 1974:71 ff.). Changes of this nature were undoubtedly amplified by Christian missions established in the eastern Arctic at about the same time. During the much of the historic era, caribou on southern Baffin Island may also have become an interior resource of reduced importance due in part to its relative scarcity, but also as a result of the greater emphasis on fox trapping activities. Economic factors such as this may also have contributed to the manner in which bone refuse was treated during this period.

In terms of specific formation processes, the discard pattern associated with caribou faunal remains can be characterized as maintenance and/or abandonment behaviour. Murray (1980:498) has noted the difficulty of distinguishing cases in which discard and abandonment behaviour function independently to structure the archaeological record, from those in which they may have operated together. I suggest the Nettilling Lake sites represent examples in which these behaviours have converged. The "waste streams" (Schiffer 1987) specific to the inland settlements cannot as yet be reconstructed, thus the frequency and, therefore, type of maintenance performed (i.e., regular or "ad hoc"; Schiffer 1987:64 ff) cannot be determined from the available evidence. It is conceivable nevertheless, that site maintenance in terms of caribou bone refuse (and perhaps bone refuse in general) was practiced on a fairly regular basis during a hunting season at least partially for the ideological reasons previously discussed. Other factors, including the rate and loci of refuse generation, and the extent to which it may have interfered with other activities could also have influenced maintenance decisions (Schiffer 1987:65). Although the relative influence of maintenance versus abandonment behaviour in the formation of the faunal assemblages is difficult to assess, I consider the assemblages to have accumulated largely as a result of site abandonment behaviour, which in the present context can be conceptualized as a form of "long-term" maintenance. Regular maintenance and abandonment strategies both involve planning, but the careful and consistent manner in which the faunal remains have been discarded in the prehistoric sites suggests to me the intent to re-occupy these specific camp locations on a regular (annual?) basis over an unspecified period of time. If reuse was not anticipated maintenance standards might have been relaxed or even discontinued prior to site abandonment (see Schiffer 1987:97). Such behaviour is not consistent with aspects of the traditional Inuit belief system as it pertains to caribou, but may reflect a modified ideology associated with historic occupations discussed previously.

Whether principally the result of maintenance activities during the course of a site's occupation or at the time of its abandonment, the observed pattern of refuse disposal implies the reuse of specific locations and therefore low residential mobility, consistent with the model expectations. The role of caribou shortage as the principal catalyst for this behaviour remains unresolved. Presumably some subsurface faunal remains are present in sites yet to be investigated, but the fact that the same general pattern was identified in all of the prehistoric inland sites examined (including several on Amadjuak Lake), when combined with informant testimony and ideological considerations suggests that reduced availability of caribou was an important factor influencing site formation. This influence was expressed in general terms through the shift from a coastal to interior caribou procurement strategy, and specifically through the time and energy invested in discard behaviour.

The characteristics of the faunal assemblages recovered from the Nettilling Lake sites have important implications for the analysis of Thule settlement and subsistence systems. The attributes of cache structures (i.e., their size, number, location and contents), for example, can provide insight regarding the organization of resource procurement and how it may have changed over time. The presence of features considered to have been used for food storage, for example, implies that procurement strategies were tactical or logistical in nature (*sensu* Binford 1980) and, therefore, that the resource base was characterized by spatial and temporal variability in supply. In many cases, however, the function of caches in Arctic archaeological sites is considered self-evident, particularly where they occur in large numbers. Consequently, they may not be thoroughly investigated and resulting classifications of sites or locations as "high bulk" versus "low bulk", together with the implications of such categorizations may be incorrect. Similarly, if formation processes (e.g., successional use of site location and individual features) are not considered organizational changes in the procurement system may not be recognized.

Future Research

For reasons already outlined certain of the interpretations made concerning the nature of Thule settlement and subsistence on Nettilling Lake are necessarily speculative. As such, they are intended more as a basis for discussion and to encourage the investigation of a subject area that has received comparatively little archaeological attention.

Thus far, the investigations on Nettilling Lake have focussed only on a subset of the data related to patterns of terrestrial land use on southern Baffin Island during the Thule period. While a complete understanding of interior land use is not possible at present, and indeed may never be achieved, a partial base of information now exists which can be expanded and improved upon through additional study. At the present time, we lack specific archaeological data concerning other components of the interior-lake model, particularly the travel routes from the coast and the special purpose sites they contain. This information is required before individual sites can be linked plausibly into inland "systems"" Additional surveys in the interior are also required, as are further excavations at habitation sites. The material culture data base is currently very small, and the information provided by further excavations would not only expand the general data inventory, but may also permit the development of a more refined chronology of both Paleoeskimo and Neoeskimo occupations.

Comparisons should also be made between the Nettilling Lake interior archaeological record with that of coastal-upland settlements. If the model presented accurately describes the pattern of hunting from coastal sites, the archaeological record from these areas should reveal contrasts with the interior record, not only in the patterns of settlement but also in the faunal remains. A higher degree of element culling in the faunal remains from coastal summer camps would be expected, for example, if male hunting parties did in fact venture inland along river valley systems to hunt caribou. This can only be confirmed by further archaeological studies. Relationships between the archaeological records of Nettilling and Amadjuak Lakes should also be explored. Preliminary reconnaissance in the southeast corner of Amadjuak Lake has revealed both similarities and differences with the record from Nettilling. Bone refuse has been treated in the same manner at prehistoric and historic sites in both regions, but differences in the sex structure of the kill as well as procurement techniques (i.e., evidence for hunting with bow and arrow) have been found at Amadjuak Lake sites.

The linking of climatically-derived modifications in resource structure with changes in human adaptive strategies has been a central theme of much hunter-gatherer research. In the study of prehistoric Arctic hunter-gatherers the influence of changing climates on both the marine and terrestrial resource bases is seen as the principal catalyst for explaining a range of cultural developments (Taylor 1966; McGhee 1969/70; Fitzhugh 1972; Schledermann 1976; Maxwell 1985). Most explanations of Thule culture development have been based on archaeological data recovered from winter sites only, and thus do not provide a balanced perspective concerning the range of Thule adaptive strategies. This study shows that adaptations to changes in the terrestrial environment may not be adequately explained using data from coastal Thule winter sites. Since the Arctic terrestrial ecosystem was most productive and, therefore, important during the summer and fall months, greater attention needs to be given to the archaeological record produced by human behaviour during this time (McCartney 1980; McGhee 1984b). Examination of the nature and potential for change in the structure of the key terrestrial resource also shows that climatically-induced explanations may be too simplistic. Caribou populations fluctuate in size and alter their patterns of range use due to a number of variables, and in what appears to be a cyclical fashion. Thus the sustained decrease in frequency of caribou remains in coastal sites dating from the middle and late Thule periods may not be adequately explained by climatic change alone.

One of the original goals of the investigation in the interior of south-central Baffin Island was to demonstrate that the archaeological record produced by summer and fall terrestrial land use is amenable to study, and has the potential to inform us about the organization of past subsistence behaviour. Although essentially exploratory in nature and with many questions unanswered, the results of the study argue for a more creative role for the terrestrial ecosystem in the development and maintenance of flexibility in Arctic hunter-gatherer adaptations than is usually recognized. They also show the terrestrial environment to be a productive setting not only for Arctic archaeological research in general, but also for the testing of climate impact models and theories of human adjustments to changing resources. It is hoped they contribute to a better understanding of northern prehistoric hunter-gatherer settlement and subsistence systems, and will promote additional research into the nature of terrestrial land use by coastal Arctic cultures.

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