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Variability in Traditional and Non-Traditional Inuit Architecture, AD. 1000 to Present

by

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Abstract

This dissertation presents a history of house forms used by Inuit in the Eastern Canadian Arctic, from AD.1000 to present. I focus on three particular types of dwellings; the semi-subterranean whale bone house, the composite snow house, and the government subsidized prefabricated house. I attempt to correlate changes in house selection, design, and use, with environmental and social factors which have impacted on Inuit families over the past one thousand years.

A statistical analysis of semi-subterranean whale bone houses from two Thule sites in the Canadian High Arctic reveals architectural variability which reflects the use of two distinctive building strategies. I argue that these two strategies reflect attempts by Thule builders to accommodate 1) fluctuations in the availability of key building materials, and 2) differences in the anticipated use-life of a dwelling.

The spatial analysis of semi-subterranean whalebone houses and composite snow houses demonstrates that the spatial organization of each house form is generated by a different space syntax, or set of 'rules' which define how spaces are combined together. I argue that each space syntax reflects the distinctive socioeconomic configuration of Thule and Historic Inuit families.

The implication that social processes are reflected in the spatial organization of traditional Inuit architecture is then used as a baseline for understanding the impact that Euro-Canadian architecture has had on traditional Inuit households during the Settlement Era (1950 to present). I argue that the spatial organization of traditional Inuit houses and

Euro-Canadian houses are generated by different space syntaxes; each reflecting the differing socioeconomic configuration of Inuit and Euro-Canadian families. As a consequence of this, I contend that Euro-Canadian house designs and housing programs effectively undermined the solidarity of the traditional Inuit extended family (*Ilagiit)*, and fostered the ascendancy of the nuclear family; a household form favored by the Canadian Government for administrative purposes.

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For My Mother and Father

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"In the olden days, people could move their houses. All that was needed was just to wish whenever one wanted to go. Then, the whole house went off through the air with everything in it. But then, one day someone complained that the noise of the houses rushing through the air was painful to the ears, and after that, houses lost the power of traveling through the air"

(Told by Kibkarjuk to Knud Rasmussen, while on the Fifth Thule Expedition).

"First we shape our buildings and afterwards our buildings shape us"

(Winston Churchill, quoted in Parker-Pearson and Richards (1994:3)

CHAPTER ONE: INTRODUCTION

Introduction

This dissertation presents a history of house forms used by Inuit in the eastern Canadian Arctic, from AD.1000 to present. I focus on three particular types of dwellings; the semi-subterranean whale bone house, the composite snow house, and the Government subsidized prefabricated house. I attempt to correlate changes in house selection, design, and use, with environmental and social factors which have impacted on Inuit families over the past one thousand years.

Modern Inuit are the cultural and biological descendants of the Thule; a prehistoric culture that has been defined archaeologically throughout parts of Greenland, Alaska, and the Canadian Arctic (Mathiassen, 1927; Van Stone, 1962). Many Neoeskimo archaeologists have viewed the 'Classic' phase of Thule culture as structured largely around the hunting of bowhead whales (Mathiassen, 1927; McCartney, 1980; McCartney and Savelle, 1993; Savelle and McCartney, 1991, 1994; Schledermann, 1979 [but see Freeman, 1979 for an alternative view]). From the bones of these large mammals, Thule people constructed robust semi-subterranean dwellings for use during the winter months. These houses were commonly located within semi-permanent villages; many of which dotted the coastlines of various Arctic Islands. With the advent of the Neo-Boreal climatic episode between AD. 1400-1600, a general cooling of annual temperatures generated ice conditions that prevented open water whaling in many areas of the eastern and central Arctic (Maxwell, 1985; McGhee, 1983; Savelle, 1987; Savelle and McCartney, 1991; Schledermann 1976a, 1979). In response, bowhead whaling was gradually abandoned in favor of the hunting of smaller marine mammals such as walrus and ringed seal (Maxwell, 1985; Savelle, 1987; McGhee, 1983; Savelle and McCartney, 1991 Schledermann 1976a, 1979). The abandonment of whaling appears to have altered the socioeconomic arrangements and subsistence-settlement systems of Post-Classic Thule groups (Maxwell, 1985; Savelle, 1987; Schledermann, 1976a). In many areas of the central and eastern Arctic, this change was accompanied by the progressive replacement of terrestrially-situated semi-subterranean whalebone houses with communal snow house villages ensconced on the sea ice (Maxwell, 1985; Savelle, 1987; Schledermann, 1976a)[1]. Snow houses continued to function as principal winter house forms among many Inuit groups until the 1950's (Duffy 1988:26).

Following the Second World War, the Canadian Government began attempts to assimilate Inuit families into a broader Canadian economic and social reality (Tester and Kulchyski 1994:4). Traditional hunting camps were gradually abandoned as Inuit families were centralized into nearby settlements, or sent off to colonize 'artificial communities' created in the Canadian High Arctic (Damas, 1988; Duffy, 1988; Marcus, 1995; Mitchell, 1996; Royal Commission on Aboriginal Peoples, 1994; Tester and Kulchyski, 1994). During this time period, however, another type of resettlement also occurred; one that, until recently, has been largely overlooked. Almost overnight, Inuit families were moved

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The semi-subterranean house was retained among Thule groups in areas such as the Bache Peninsula, and Northeastern Hudson Bay, but these dwellings were now constructed using sod and stone rather than whalebone (Boas 1964; Mathiassen 1927; Schledermann 1976a).

from traditional dwellings to Government subsidized prefabricated houses. These new houses were designed and built primary by people the Inuit had never met, and were constructed using materials that were unfamiliar to them. Furthermore, the interior placement of walls and rooms circulated and segregated family members in new and unaccustomed ways (Dawson, 1994). The Euro-Canadian house was but one of several new building types introduced to Inuit through the experience of settlement life. Nursing stations, schools, band offices, and recreation centers, for example, soon became prominent features in many Inuit communities throughout Arctic Canada (Strub, 1996). However, it was not long before serious flaws in architectural designs, the use of improper building materials, and deficiencies in construction practices became apparent (Strub, 1996). Poorly placed entrances were frequently blocked in winter by drifting snow, windows perpetually iced up, and drafts found their way into houses through floorboards, door frames, and walls (Strub, 1996). In addition, by using houses in ways that facilitated their unique northern lifestyles (e.g. storing seal meat in bathtubs, repairing snow machines in kitchens), Inuit families frequently defeated the intentions of Euro-Canadian designers (Dawson, 1994; Thomas, 1969; Thomas and Thompson, 1972). The expensive 'utopian' designs of such visionary architects as Ralph Erskine and Moshe Safdie, for example, now lie abandoned in many northern communities because they failed to anticipate the rigors of northern climates, and the values, traditions and customs of Inuit families.

The 'Duality' of Traditional and Non-Traditional Inuit Houses

Traditional Inuit houses and Euro-Canadian houses exist simultaneously as 'artifacts' and as 'containers of space' (*sensu* Hillier and Hanson, 1984). As artifacts, these houses possess a series of attributes which, when combined together, generate a specific exterior architectural form. This exterior architectural form also contains, encloses, and shapes a volume of space into a specific pattern. It is within these patterns that human activities and interactions are situated, modulated, and given meaning in everyday life (Bourdieu, 1977; Foucault, 1982; Giddens, 1984; Goffman, 1959,1974; Hillier and Hanson, 1984; Levi-Strauss, 1963; Markus, 1993; Mauss 1979[1906]; Morgan (1965[1888]; Rapoport 1969; Sibley, 1996). Houses do not exist in and of themselves. Rather, they are the products of human decisions which reflect the attempts of their builders to realize certain 'goals' through design (McGuire and Schiffer 1983:232). While these goals take into account such practical considerations as the minimization of manufacturing and maintenance costs, size requirements, and necessary insulation properties (McGuire and Schiffer 1983:232), attempts are also made to design houses which reflect and sustain the lifestyles and cultural values of the resident household. Hypothetically then, one should be able to discern the intentions or 'goals' of any architect through the objective analysis of design outputs (Ward 1996:40).

If the intentions of an architect are comprehensible through the analysis of design outputs, then it seems reasonable to assume that different 'intentions' should generate different *types* of buildings - with each *type* exhibiting unique interior and exterior architectural properties. For example, some houses may have been designed around different 'goals' of use (long term versus short term occupation); others around the need to accommodate different social environments (separate versus communal living arrangements), and still others around the challenges created when key building materials are only available in limited quantities. With these ideas in mind, I intend to explore the variability inherent in the interior and exterior architectural properties of three specific *types* of houses used by prehistoric and ethnographically known Inuit groups; the semi-subterranean whale bone house, the snow house, and the Euro-Canadian Government house. If architectural variability can be identified and isolated, then it may be possible to 'work backwards' and extrapolate the different design strategies and construction practices they reflect. I will then attempt to ascertain why certain design strategies and construction practices were selected over others by 'contextualizing' them within the changing environmental and socioeconomic conditions experienced by Inuit groups in the Canadian Arctic, over the past one thousand years. This study will be accomplished within the context of three case studies.

Case Study# 1: The Semi-subterranean Whale Bone House: Architectural Variability at Two Thule Sites.

The first case study addresses the following questions:

- Were all Thule semi-subterranean whale bone houses designed and built in similar ways? or
- Were some houses designed and built differently, so as to accommodate different concerns or 'goals' of use?

In order to address these questions, the architectural attributes of Thule whale bone houses recorded at two archaeological sites in the Canadian High Arctic will be examined using computer-aided drafting and design tools (C.A.D.D), and multivariate statistical analysis. In Chapter 6, I will argue that because arctic environments frequently demand high levels of group mobility, and create regional and temporal disparities in the availability of important construction materials such as driftwood and whalebone, the goals of architectural design were occasionally constrained. To illustrate, under circumstances of high mobility, groups may have had to decrease their investment in architecture because of a shorter anticipated use-life for dwellings. Likewise, Thule builders may have had to periodically alter the designs of their dwellings in order to accommodate for shortages in the availability of important construction materials such as whale bone. I will demonstrate that such restrictions are discernible through the objective analysis of various architectural attributes recorded from semi-subterranean Thule winter houses.

Case Study# 2: The Composite Snow House: Spatial Organization and Socioeconomic Change, AD. 1000-1940.

The second case study examines the following question:

- ❑ Are the socioeconomic changes which accompanied the abandonment of whaling in the Canadian Arctic reflected in the spatial organization of semi-subterranean whalebone houses, and the snow houses which replaced them?

Estimates of Thule hunting band sizes (20-25 people)(McCartney, 1979; McGhee, 1976) stand in vivid contrast to ethnohistoric accounts of aggregations of over 100 Persons living in traditional Netsilingmiut and Iglulingmiut snow house villages located out on the sea ice during *aglu* (breathing hole sealing)(Mathiassen, 1928; Maxwell, 1985). This would seem to suggest that when permanent winter villages were abandoned in favor of snow houses between AD. 1300 and 1500, there may also have been a major change in the social system. Maxwell (1985:288), for example, states:

> .... the large snow house aggregates would have led to significant social change. The sphere of social interaction, including more non-kin dyadic meat sharing contracts and an increased mating universe, would certainly have widened. In many settlements, the role of *umialiq* (whaling boat captain) would have changed to that of *isumatak* (the "thinker" who in winter controlled the division of meat taken on the sea ice).

A number of anthropologists, architects, and human geographers have suggested collectively that various social processes are reflected in the floor plans of houses and other buildings (Blanton, 1994; Bourdieu, 1977; Foucault, 1982; Giddens, 1984; Goffman, 1959,1974; Hillier and Hanson, 1984; Levi-Strauss, 1963; Markus, 1993; Mauss 1979[1906]; Morgan (1965[1888]; Parker-Pearson and Richards, 1994; Rapoport 1969; Sibley, 1996). This would imply that social change should also be accompanied by changes in the spatial organization of house forms. In Chapter 6, I will argue that changing socioeconomic relations in the Canadian Arctic between AD. 1300-1500 correlate with changing patterns of spatial organization observed within semi-subterranean whale bone houses, and the snow houses which eventually replaced them. This will be accomplished via the comparative graphical analysis of floor plans derived from a sample of Thule whalebone houses (obtained from archaeological fieldwork) and snow houses (obtained from drawings made by missionaries and explorers in the 19th and early 20th century).

Case Study #3. The Government House: The Transformation of the Traditional Inuit Household through Euro-Canadian Architecture.

If social processes are reflected in the spatial organization of dwellings, then the floor plans of traditional Inuit houses and Euro-Canadian houses should reflect the different social systems of their intended occupants. But, what happens when houses change <u>before</u> the people living within them do? Case study# 3 addresses the following questions:

- How is the spatial organization of the traditional Inuit house form different from that of the Euro-Canadian house form? and
- How have these differences impacted on the socioeconomic configuration of traditional Inuit households ?

In Chapter 8, I use concepts acquired from studies of space syntax (Hillier and Hanson, 1984) and Frame Analysis (Goffman, 1974), to compare analytically the spatial organization of each house type. I argue that the floor plans of traditional Inuit houses and Euro-Canadian houses are generated by different social processes; each of which reflect the differing socioeconomic relations that characterize Inuit and Euro-Canadian cultural praxis. I will demonstrate that as a consequence of this, Euro-Canadian house designs and housing programs effectively undermined the solidarity of the traditional Inuit extended family, and fostered the ascendancy of the nuclear family; a household form favored by the Canadian Government for administrative purposes.

Organization of Chapters.

This dissertation is organized in the following way:

Chapter 2 provides an overview of various theoretical methodological approaches that have been used to develop an understanding of the built environment and its ability both to influence, and be influenced by cultural praxis. I begin with a brief history of the study of built forms in archaeology and anthropology. I then discuss a variety of theoretical approaches that have been used to study the built environment. I end the chapter by summarizing the basic tenets of approaches which have relevance for the architectural analysis of traditional Inuit house forms and Euro-Canadian house forms, from AD. 1000 to present. The purpose of Chapter 2 is to establish the theoretical and methodological approaches taken in Chapter 5 (Case Study#1), Chapter 6 (Case Study#2) and Chapter 7 (Case Study#3).

Chapter 3 provides an overview of the climate and biogeography of the eastern Canadian Arctic, and a discussion of how these features interrelate with one another at the local and regional level to influence northern architectural praxis. Climatic change, with specific reference to the Neo-Boreal climatic episode of the 16^{th} century (Little Ice Age) is also discussed. The purpose of Chapter 3 is to familiarize the reader with environmental factors which bear on the design of both traditional Inuit and Euro-Canadian house forms.

In Chapter 4, the origins of Thule culture and its subsequent expansion into the eastern Canadian Arctic are discussed. This is followed by an examination of the socioeconomic configuration of Thule culture. The shifting of socioeconomic alliances associated with the emergence of historically known Inuit cultures in the 16^{th} century are next summarized, and theories pertaining to these changes outlined. The purpose of Chapter 4 is to familiarize the reader with the socioeconomic arrangements of Neoeskimo groups inhabiting the eastern and central Canadian Arctic since AD. 900.

Chapter 5 (Case Study#1) begins with a brief overview of the architectural attributes of the semi-subterranean whalebone house; the *qarmat* (autumn house), and the snow house. This is followed by a description of the location, environmental setting, and history of investigation of the two Classic Thule sites drawn upon for this study; the

Deblicquy site (QiLe-1) and the Black Point site (QkLe-1). The methodology employed for recording and analyzing whale bone house architecture at each site is next outlined. An analysis and interpretation of architectural variability among houses within each site is then provided, using digitized plan drawings of these dwellings, and the multivariate statistical analysis of selected architectural attributes. This is followed by the analysis and interpretation of architectural variability between houses at the Deblicquy site and the Black Point site.

Chapter 6 (Case Study #2) begins with a brief overview of historical explanations for variability in Neoeskimo architecture. Concepts acquired from studies of space syntax, outlined in Chapter 2, are then used analytically compare the spatial organization of semi-subterranean whale bone houses and the snow houses which eventually replaced them.

Chapter 7 (Case Study#3) begins with an overview of the history of the development of the Canadian North since European contact. This is followed by a discussion of the history of the Government housing programs which have been implemented in the Canadian Arctic since the 1950's. The spatial properties of traditional Inuit and Euro-Canadian house forms are then compared using information gathered from interviews with Inuit tenants in the Hamlet of Resolute Bay; and concepts realized from studies of space syntax (Hillier and Hanson, 1984) and Frame Analysis (Goffman, 1977).

Chapter 8 summarizes the results of all three case studies, and makes recommendations for future research.

CHAPTER TWO. THEORETICAL AND METHODOLOGICAL APPROACHES TO UNDERSTANDING HUMAN SPATIAL BEHAVIOR

Introduction

Chapter 2 provides an overview of various theoretical methodological approaches that have been used to develop an understanding of the built environment and its ability to both influence, and be influenced by cultural praxis. I begin with a brief history of the study of built forms in archaeology and anthropology. I then discuss a variety of theoretical approaches that have been used to study the built environment, which I have broadly grouped into the following categories: ergonomics, proxemics, structuralism, grammatical approaches, dramaturgical models, and approaches which concern themselves with the relationship between buildings and power. I end the chapter by summarizing the basic tenets of approaches which have relevance for the spatial analysis of traditional Inuit house forms and Euro-Canadian house forms, from AD. 1000 to present. The purpose of Chapter 2 is to establish the theoretical and methodological approaches taken in Chapter 5 (Case Study#1), Chapter 6 (Case Study#2) and Chapter 7 (Case Study#3).

A Brief History of the Study of the Built Environment

The spatial organization of dwellings and settlements has long been a subject of interest among social scientists because of the relationship that exists between daily activities, social life, and the built environments they occur within. The term 'built environment' is an abstract concept often used to describe the physical alteration of the natural environment in such a way that open spaces become defined and bounded, but not necessarily enclosed (Lawrence and Low 1990:454). To illustrate, buildings (public and private) enclose and shape a volume of space in ways that situate, define, and facilitate the various interactions and activities of their occupants. Uncovered and less rigidly bounded spaces such as plazas, courtyards, and compounds, provide similar spatial contexts for human activities and social intercourse. Domination, resistance, territoriality, appropriation, and metaphor represent just a few of the ways that anthropologists, archaeologists, and human geographers have conceptualized the relationship between human beings and the built environment. There is no doubt that a dynamic relationship exists between the two; one continually acting back on the other, and this is perhaps best summarized by Winston Churchill, who stated "first we shape our buildings and afterwards, our buildings shape us" (cited in Parker-Pearson and Richards 1994:3).

Early Anthropological Studies

Studies of the relationship between space and culture have a remarkable time depth in archaeology and anthropology, with some of the earliest research being carried out in the 19^{th} century. In 1881, for example, Lewis Henry Morgan published the now classic monograph *Houses and House-Life of the American Aborigine*. Morgan's book concerned itself primarily with the examination of the relationship between social structure and space in North American aboriginal societies. In outlining the consanguinity between the domestic unit and the use of space within dwellings, Morgan (1965 [1888]) concluded that the house forms he had analyzed from an exhaustive number of ethnographic examples reflected an adaptation to the collective economic endeavors of several coresident families. Morgan referred to this as "communism in living" (Morgan 1965 [1888]: 105). Like Morgan, Marcel Mauss (1906) and Emile Durkheim (1893) also saw a strong relationship between the built environment and social life. Mauss's *Seasonal Variations of the Eskimo: A Study in Social Morphology*, written in collaboration with the French ethnographer Henri Beuchat, rejected functional explanations for variations in the sizes of historic Inuit winter and summer dwellings. To Mauss, technological and raw material considerations, and the need to conserve heat, did not satisfactorily explain why Inuit groups built large, spatially complex houses in the winter, and smaller, less complex dwellings in the summer (Mauss 1979[1906]:53). Instead, Mauss recognized that Inuit social life did not continue at the same level of intensity throughout the year, and that winter was a period of concentrated social interaction (Mauss 1979[1906]:53). Mauss concluded that it was these periods of collective ritual intensification that the larger winter dwellings had been designed to accommodate. Mauss's conclusions were extraordinary for their time, and Levi-Strauss has written of the remarkable 'modernity' of his thought (Fox 1979:11). It is unfortunate that Mauss's insightful ideas have been largely forsaken by later generations of polar ethnographers and archaeologists.

The general sociology of Emile Durkheim, although not explicitly about space, was nevertheless profoundly spatial in its implications. In his book *The Division of Labor in Society*, Durkheim (1893) outlined two fundamental processes of social cohesion; mechanical and organic solidarity. In mechanical solidarity, the "social molecules" (members of society) are precisely defined by the collective life in such a way that individuals have little autonomy (Hatch 1973:190). Consequently, members of society feel a strong attraction to others who share their own sentiments and beliefs. Alternatively, in organic solidarity the daily activities performed by people create specialized beliefs and rules. Like the organs in a body, each individual performs a distinctive role and is dependant on the contributions of others to make the social organism function (Hatch 1973:191). To Durkheim, organic solidarity differed from mechanical solidarity because of its basis in differentiation, rather than likeness. Hillier and Hanson (1984:18) have outlined the spatial consequences of Durkheim's two forms of social solidarity, stating that organic solidarity requires an integrated and dense space, while mechanical solidarity demands segregated and dispersed space.

In viewing the built environment as integral to the social and symbolic aspects of society, one cannot help but see the links between Mauss and Durkheim, and the British structural-functionalist tradition (Lawrence and Low 1990:457). Levi-Strauss's later work echoes the sentiments of Morgan, Mauss and Durkheim, in that he states:

> "...in many parts of the world there is an obvious relationship between the social structure and the spatial structure of settlements, villages, or camps", partially because "...spatial configuration seems to be almost a projective representation of social structure" (Levi-Strauss 1963:533-534).

To Levi-Straus, houses possessed a "fetishistic" quality that allowed them to function as illusory objectifications of the unstable alliances that existed within households (Carsten and Hugh-Jones 1995:12). Levi-Strauss felt that the built environment brought unity to such opposing principles as filation/residence, patri-/matri-lineal decent, hypergamy/hypogamy, and close/distant marriage (Carsten and Hugh-Jones 1995:8). In order to demonstrate his position, Levi-Strauss likened the house forms of pre-Industrial societies such as the Kwakiutl and Yurok, to those of the 'Noble houses" of medieval Europe (Carsten and Hugh-Jones 1995:8). In his consideration of the built environment as a social form, Levi-Strauss claimed that house forms "naturalized" rank differences and competition over wealth and power through the subversion of the language of kinship (Carsten and Hugh-Jones 1990:10). Out of these views emerged his classification of some cultures as *"societies a maison"*; or "house societies". While Levi-Strauss's concept of house societies was originally defined using hierarchical societies, a number of anthropologists have attempted to refine and formalize the term in such a way that it can also be applied to egalitarian societies (see MacDonald *et al.* 1987; Waterson, 1995).

Levi-Strauss's view of the built environment as a metaphor for complex social and symbolic relationships represents one of three dominant patterns which emerged from early ethnographic research (Lawrence and Low 1990:457). A second pattern focused on the relationship between culture-areas and formal variations in house style (e.g. Kroeber, 1939). Unfortunately, when variations were observed, they were often couched within simplistic models of diffusion (Lawrence and Low 1990:457). The third and final pattern concerned itself with the rigid documentation and description of built forms, material uses, and methods of construction. For example, the "salvage anthropology" practiced by many early North American ethnographers (a number of whom were former students of Franz Boas) led to some of the most extensive and detailed documentation of built forms among aboriginal groups in the new world (Lawrence and Low 1990:457). Nevertheless, while such studies were extremely systematic, they seemed largely unconcerned with explaining the variations they observed (Lawrence and Low 1990:457).

Design Methods and the Emergence of Difference

Following the end of the Second World War, western architects became increasingly dissatisfied with the "Architecture as Art Object" paradigm that had dominated design theory since the 15th century (Ward 1996:36). After 1945, science quickly replaced simple aesthetics in the establishment of criteria for architectural design. Systems analysis, for example, was now used actively by many architects to design public and private buildings which optimized the movements of the people within. Derived from wartime strategic research, this approach allowed the architect to minimize the use of walls and doorways, thereby reducing building costs (Ward 1996:37). Unfortunately, this systematizing of space denied any social and symbolic significance for the built environment, and therefore ran the risk of culturally alienating its inhabitants (Ward 1996:37). The application of systems theory to architectural design illustrated a desire among building professionals to 'universalize' the design process; reducing it to a series of basic principles which could be employed dependably and with regularity (Ward 1996:38). The idea that 'basic' human needs existed beyond the influence of culture, gender, and age, represented another axiom upon which architects attempted to establish ubiquitous design principles (Ward 1996:38). However, it was soon realized that in relation to human need, there were no absolutes, and social context came to be recognized as a far more important criterion (Ward 1996:38). In an attempt to explore this concept further, and out of disappointment with other solutions in solving architectural design problems, western architects began to search for design principles among pre-industrial societies in the archaeological and ethnographic records (Lawrence and Low 1990:458). Foremost among these was Christopher Alexander, who in a 1964 article entitled *Notes on the Synthesis of Form*, postulated that over time traditional societies had shaped their built environments to provide a perfect "fit" for their own social needs. According to Alexander, the ability of western societies to achieve such a "fit" had been lost because of increases in social complexity and tempo of environmental change (Ward 1996:39).

In a similar vein, Amos Rapoport, in his influential 1969 publication *House Form and Culture*, pointed out that because individuals in many aboriginal societies design and construct their own dwellings, they are able to ensure that the built environment suits their needs and requirements perfectly (Rapoport 1969:4). Like Mauss, Rapoport (1964:18) rejected mono-causal explanations in favor of a more holistic cultural approach to understanding architectural design. However, while both scholars stressed the importance of sociocultural factors in determining design, Rapoport (1969:13) went further, arguing that these factors are frequently modified by architectural responses to both climatic conditions and limitations imposed by materials and construction techniques. To Rapoport (1969), climate, technology, and raw materials did not determine the built environment, so much as constrain it. Groups worked around such limitations through compromises; eliminating those design elements which were of *peripheral* importance in defining group identity, and safeguarding those *core* elements important in maintaining cultural integrity (Rapoport 1980:16). In may ways, McGuire and Schiffer's (1983:279) *Theory of Architectural Design* restates many of Rapoport's (1969;1980) sentiments, in so much as it argues that in order to achieve an "ideal" built form, compromises must be made between the goals of use, production, and maintenance of the structure. Such compromises are achieved through decisions made by the group as to what design criteria are important, and what can be sacrificed. McGuire and Schiffer (1983) define two particular 'goals of use'. The first goal mediates between humans and the natural environment, and includes such functional considerations as the use life of the dwelling, its size requirements, necessary insulating properties, etc (McGuire and Schiffer 1983:280; see also Rapoport 1980:27). The second goal involves the delineation of space for the performance of activities by various social units (McGuire and Schiffer 1983:280; see also Rapoport 1980:27). Unlike Rapoport (1980), however, McGuire and Schiffer

(1983) point out that decisions made during the course of planning and constructing a dwelling can result in conflicts among participants. In other words, individuals and/or groups may sometimes disagree over what aspects of design should be compromised and what should not. McGuire and Schiffer (1983) move on to state that in non-differentiated societies, dwellings are constructed by the same individuals who reside within them; commonly a single nuclear family or several coresidential families. In differentiated societies, however, separate task groups specializing in the design, construction, maintenance, and even demolition of house forms, often emerge. Consequently, McGuire and Schiffer (1983:279) state that as users become increasingly disenfranchised from design and construction processes, the potential for conflict and dissatisfaction in house form increases substantially.

Theories such as those of Rapoport (1969, 1980), McGuire and Schiffer (1983) and others had substance for architects, in that they provided examples of traditional societies employing rational choices in the design and construction of dwellings. Furthermore, in situations where the designer/builder and end user are different entities, such studies stressed the absolute necessity for the former to understand the needs, values, and requirements of the latter. Consequently, architects became increasingly interested in spatially 'programming' built environments in ways that addressed the values and requirements of the end user which were, in turn, defined by culture, gender, and age. Jaunlin (1972), Hamilton (1972), and Chant and Brydon (1989) present excellent examples which illustrate the importance of developing what Rapoport (1980) refers to as "culturally sustaining" built environments. The replacement of thatched communal dwellings known as *Bohio* with modern dwellings among the Motilone Indians of Columbian and Venezuela, for example, resulted in the destruction of their culture, leading Jaunlin (1972) to the conclusion that the introduction of these new dwelling types constituted a form of "ethnocide". Likewise, Hamilton (1972) has outlined the disruptive effect that the introduction of artificial light has had on the mediation of interpersonal conflicts in Australian aboriginal society; the resolutions of which were traditionally dependant on darkness. Finally, Chant and Brydon (1989) provide a particularly tragic example of the consequences of imposing dwellings that are culturally inappropriate on other societies. In Tunisia, the United States Agency for International Development (USAID) introduced European- style dwellings as a replacement for the traditional Tunisian *dar arbi*, a structure which consists of several rooms enclosing a small court yard. Chant and Brydon (1989) state that the internal courtyard had extreme cultural and gender significance for Tunisian women because it provided a context for socialization with female kin and other acquaintances. The houses which were introduced, however, lacked internal courtyards, thereby undermining the social networks of women living within the community. This resulted in many cases of depression, psychoses, and even suicide among women in the community (Chant and Brydon (1989:217). Such examples sounded the death knell for the pursuit of so-called "ubiquitous" design principles in architecture once and for all.

While architects came to recognize and appreciate the cultural specificity of the built environment, a second revelation was yet to arrive; one which would redefine architectural discourse in an essential way. Up until the end of the 1960's, the personal and cultural histories of the designer were viewed as entirely inconsequential to design work (Ward 1996:40). Hence, architects were 'black boxes'; entities who were largely unknowable, except in terms of what could be inferred through their design outputs. In 1967, however, Christopher Jones suggested that, in reality, architects were self-monitoring and self-reflexive human beings, "with all of the existential and political responsibilities that this might suggest" (Jones, 1967 cited in Ward 1996:40). The influence of ideology and western capitalist power structures on design had finally been recognized. Such power was commonly expressed through the monopolization of space, and opaque instances of exclusion; ones that are not immediately apparent because they are taken for granted as part of the routine of daily life (Sibley 1995:1). In his book *Geographies of Exclusion*, David Sibley (1995) convincingly argues that forms of spatial inclusion and exclusion manifest in built environments such as houses and shopping malls were due largely to the fact that, prior to the post-modern critique of architectural practice, the kind of public which populated architects designs were mainly white middle-class nuclear families (Sibley 1995:xi). With this growing realization, architects are now attempting to grant those rendered powerless by capitalist ideology an 'architectural voice' (Ward 1996:61).

Theoretical Approaches to Understanding Human Spatial Behavior

The literature on human spatial behavior is vast and spans a number of different disciplines, including anthropology, archaeology, sociology, psychology, biology, and human geography. Consequently, in order to present meaningful overviews of many of the major theories that have been put forward, I have arranged them in terms of 6 major categories. These are 1) Ergonomics, 2) Proxemics, 3) Structuralism, 4) Grammatical approaches, 5) Dramaturgical approaches, and 6) Approaches which examine the relationship between space and power. While several of the theories which will be discussed could technically be placed into more than one category, the classification scheme used here nevertheless provides a useful framework for their presentation. I outline the basic tenants of each approach, illustrated with ethnographic and/or archaeological examples.

Ergonomics

The central premise of ergonomics is that the mechanics and socio-technological constraints associated with a specific activity determine where it will occur in space (Binford 1978; Oswald 1984). Consequently, the frequency, periodicity, and duration of an activity tethers it to a specific location within a site (hearth, midden) or building (room). According to Oswald (1984), mechanical properties will determine the location and size of the space used to contain the activity, and whether or not that space will be used as a transient or permanent locus for its repeated execution (Oswald 1984:299). When different activities have similar spatial needs, they sometimes conflict with one another (Oswald 1984:299). For example, bad weather may require the temporary relocation of unrelated activities to sheltered localities. This might result in crowding, competition for equipment (hearth, grinding stone, etc), noise, and excess waste accumulation. Such disruptive conditions often force the termination or relocation of certain types of activities. To illustrate this concept, Binford (1978) reports that Nunamiut hunters occupying a hunting blind would either abandon or relocate craft-related activities when noisy and/or distractive activities were initiated by other individuals (Binford 1978:354). In order to prevent such conflicts from occurring, humans modify the basic spatial requirements of activities by scheduling them at different times. Oswald (1984) refers to this as "schedule embedding". The random fluctuations in modal group size at the Nunamiut hunting blind, however, made such activity scheduling impossible (Oswald 1984:301). As an alternative solution, discrete spatial locations (eating and talking areas, craft areas) were established at the site to prevent activity conflicts from occurring (Binford 1984:349). From the perspective of ergonomics then, it is the mechanical properties of an activity and not its "social context", that dictate the spatial needs of that endeavor. Furthermore, when the spatial needs of activities clash, humans intervene through solutions like "schedule embedding" and the circumscription of activities to discrete spatial areas (Anderson, 1982; Binford, 1978; Dodd, 1984; Oswald, 1984).

A variety of ethnoarchaeological studies have attempted to define how ergonomic considerations contribute to the structuring of activity areas within dwellings and camps/settlements (Bartrum, Kroll and Bunn, 1991; Binford, 1978; Gould and Yellen, 1987; Hitchcock 1987; Kent, 1984; O'Connell, 1977,1987; Yellen, 1977). Kent (1984), for example, documented the scheduling and location of daily activities within households of differing ethnic and socioeconomic compositions. Kent (1984) found that the spatial organization of the households she examined fell along a continuum of segmentation to unity. Households which maintained sex-specific and mono-functional activity areas tended to segment and compartmentalize them in space, thereby re-enforcing attitudes towards sexual division of labor, individuality, and a need to keep various activities ordered and separated (Kent 1984:196-97). In contrast, households in which different activities were conducted by the same individuals tended to unify such activities in space. This, in turn, reflected a weaker differentiation of labor, and fewer differences between male and female activities (Kent 1984:204). Kent's (1984) study is interesting because it demonstrates that perceptions of how compatible or incompatible two or more activities are is socially conditioned and culturally specific. Furthermore, these differing perceptions bear on where members of a household will choose to situate activities in time and space. The Euro-American families in Kent's (1984) study, for example, were far less tolerant of 'lumping' activities together in the same spatial context than Hispanic and Navajo families.

Unlike Kent (1984), Binford (1978,) and Gould and Yellen (1987) reject entirely the idea that ergonomic considerations of space are influenced by social factors. For example, in an examination of the variables determining household spacing in contemporary hunter-gatherer bands, Gould and Yellen (1987) compared ergonomic constraints such as duration of camp occupation and fear of predation, with social factors like degree of sharing and relatedness between households (Gould and Yellen 1987). In regions where large predators still roam, Gould and Yellen (1987) concluded that the arrangement of space and degree of inter-household distance was a response to fear of predation, rather than a reflection of economic, social, and/or ideological relations held between inhabitants. In much the same way, Binfords' (1978) study of spatial organization at a Nunamiut hunting stand stressed the deterministic nature of factors like wind direction, hearth use, and group size, in structuring the location and use of space. That Binford (1978) denies any role for social factors in the demarcation of space is evident in his statement:

> "We can build a theory of space use, and we can understand spatial patterning without recourse to vague notions of *social context* (my emphasis)(Binford 1978:354).

In her discussion of the socio-technological determinants of space, Oswald (1984) states that economic relations can, however, influence the arrangement and functional use of space within a site or building. Citing examples from Sahlins (1957), Oswald (1984) explains that resource distribution and the diverging character of labor pools among two groups in Moala, governed how space was organized within their respective sites. For example, groups that cooperatively exploited aggregated resources tended to occupy compounds consisting of closely grouped nuclear families. These groups, in turn, would all share a common cook house; a symbol of their shared labor and cooperative effort. In contrast, groups that exploited dispersed resources on an individual basis frequently occupied dispersed nuclear residences, each of which contained its own cook house (Oswald 1984:304).

Nevertheless, whether one talks about the mechanical properties of activities, or the socio-technological variables imposed upon them, ergonomics implies that the arrangement of space within the site or dwelling is being determined by some constant that cross cuts all ethnic or social affiliations. The problem with ergonomic approaches is that they fail to account for the extreme variability in the spatial behaviors expressed by different ethnic groups. This is partially because anthropologists and archaeologists have tended to use them to formulate mono-causal explanations for human spatial behavior. It is obvious that ergonomic constraints can sometimes influence the organization of space. However, other factors must also be taken into consideration. Fear of predation, for example, is only one explanation for the "circular" spatial organization of a !Kung wet season camp. Whitelaw (1983) provides an equally compelling 'social' reason, stating that because !Kung huts all face towards the center of the circle, the spatial organization of the site also affects individuals by deterring instances of hoarding (Whitelaw 1983:59). Consequently, I suggest that social scientists have frequently turned to ergonomics as a means of achieving an ecumenical theory of space. While ergonomics is a useful tool for understanding some of the factors governing the organization of space, it simply cannot be used to explain all forms of spatial behavior in the archaeological and ethnographic record.

Proxemics

Within any culture, the need for privacy is often considered as a biological universal, with individuals developing mechanisms for modulating and controlling encounter rates with others (Altman 1977; Goffman, 1959,1974; Hall 1959,1966; Portnoy 1981). This is usually achieved through the erection of social and/or physical boundaries that pattern and organize space within a site or building, thereby controlling access to an individual or social group (Altman 1977; Hillier and Hanson, 1984). Hence, proxemics suggests that territoriality and boundary maintenance, important biological impulses in all living organisms, have the potential to influence human spatial behavior. Animal ethologists such as Konrad Lorenz (1964) recognized that aggression is often used as a mechanism for regulating space between animals. When population levels increase to the point where a particular habitat becomes saturated or "crowded", increasing encounter rates between individuals produce levels of greater and greater stress. According to Lorenz (1964), escalating levels of interaction between individuals eventually result in subtle, yet powerful changes in body chemistry. The outcome is a dramatic decrease in birth rates and an increase in death rates, all of which eventually lead to large-scale demographic collapse (Hall 1966:5). At the level of the individual, Altman (1977) suggests that in all human beings, privacy plays an important role in the development and maintenance of self-identity, personal autonomy, and self-esteem (Altman 1977:68). Consequently, the need for privacy is seen as a biological and cultural universal. Proxemics then, is concerned with the strategies (ethnomethodologies) developed and implemented by individuals to regulate encounter rates with others. A cross-cultural consideration of privacy regulation indicates that this is commonly achieved through the erection of physical and social barriers that control access to the individual or social group. Cashdan (1983), for example, has suggested that hunter/gatherers occupying large regions with patchy and/or unpredictable resources will often defend access to the social group rather than the territory itself. This is because information crucial to the location of important resources can only be achieved through discourse with the social group. Two examples of the use of physical barriers to regulate privacy include the erection of "spite fences" by the Ba Mbuti of central Africa, and the use of secret paths by the Mehinacu of Brazil (Altman 1977:74). Social strategies for achieving privacy also include the imposition of cultural norms against entering a dwelling unannounced or without permission. Among the Mehinacu of central Brazil and the Inupiat of the Alaskan North Slope, religious sanctions were imposed to prevent women from entering communal mens' houses (Altman, 1977; Sheehan, 1985). In addition, Paine (1970) explains that among the Lapps of Northern Europe, the desire for privacy was signaled to an unwanted visitor via the act of feigning falling asleep (Altman 1977:78).

Redefining a model originally proposed by Goffman (1959), Portnoy (1981) suggests that in order to regulate encounters with others, people divide spatial environments into front regions and back regions. Within each region, space is further subdivided into family and communal areas (Portnoy 1981:221). In the contemporary American home, for example, front regions might include a front yard, porch, or living room. In contrast, bedrooms, bathrooms, backyards, and back porches would all be classified as back regions (Goffman 1959:123). Thus, Portnoy (1981) states that when human beings require privacy, they actively seek out back region spaces. In communal living situations where few back regions exist, individuals will frequently develop alternative strategies to obtain privacy. In many aboriginal Brazilian groups, for example, Gregor (1974) states that individuals will often leave the village in order to engage in such "back region" activities as personal hygiene, spousal disputes, and extramarital affairs. The absence of back spaces at Binfords'(1978) Nunamiut hunting stand may explain why individuals were forced to abandon craft-making activities when the modal group size of hunters increased. Likewise, Jett and Spencer (1981) state that in the traditional hogan, Navajo individuals would often refrain from engaging in such personal activities as dressing/undressing and personal hygiene until total privacy could be achieved. Such overtly modest and shy behavior most likely stems from a lack of back space in the traditional Navajo forked-pole hogan. Alternatively, if back region behavior cannot be avoided in a communal setting, then other individuals will often act as though they do not notice what is going on (Portnoy 1981:218). Thus, as front and back regions appear to be associated with a discrete range of activities unique to those spaces, Portnoy (1981) has suggested that the modified Goffman model may have important implications for archaeologists (Portnoy 1981:224). Oetelaar (1993), for example, has recently applied Portnoy's (1981) model to the spatial analysis of a late-prehistoric settlement in south-central Illinois. Oetelaar (1993) found that when the settlement was divided into four major activity regions; family and communal front and back regions, each zone contained different facilities, and generated contrasting types of archaeological refuse (Oetelaar (1993:681). This information was then used to establish a duration of occupation for the site, as well as infer the social and economic organization of the Mississippian community at large.

To summarize, like ergonomics, the field of proxemics attributes human spatial behavior to a constant that cross cuts all ethnic and social affiliation. Thus, the biological/psychological need for privacy in all humans is achieved through the regulation of encounter rates with other individuals. Indeed, Altman (1977) states that individual and cultural survival is predicated on the ability to regulate interpersonal interaction. While the need for privacy may be universal, Altman (1977) does suggest that the means by which privacy is secured is often culturally specific. Nevertheless, while treating the necessity of privacy as a social-psychological process explains why individuals sometimes choose to segregate themselves in space, it still attributes all forms of human spatial behavior to a single factor. Clearly, combinations of other economic, social, and ideological factors must also influence certain forms of human spatial behavior.

Structuralism

Structural interpretations of human spatial behavior fall under the broader rubric of symbolic approaches, which examine the built environment as a product of shared sets of mental and structural processes. Symbolic approaches include the analysis of how built environments reflect cosmological principles, communicate status and political information, and how they serve as mnemonic devices in the socialization of individuals through the praxis of daily life (e.g Bourdieu, 1973; Fienup-Riordan, 1983; Lawrence, 1987; Levi-Stauss, 1983; Moore, 1986; Yates, 1989). The use of structuralism to interpret the built environment was pioneered by Levi-Strauss, who operationalized the technique by wedding linguistic theory to Durkheimian synchronic holistic analysis (Low and

Lawrence 1990:466). Levi-Strauss postulated that the universal sets of binary oppositions which characterized the collective human unconscious were capable of patterning the built environment. In addition to reflecting important cosmological principals, these patterns served to mask and reconcile such contradictions as married/unmarried, filation/residence, and patri-/matri-lineal decent (Carsten and Hugh-Jones 1995:6; Lawrence and Low 1990:496). Levi-Strauss (1963), for example, argued that among the Winnebago, the contrasting perceptions of the spatial organization of the village held by different moieties were reconciled through a third "structure" which mediated the differences between the two groups. As mentioned previously, Levi-Strauss's (1963) brand of structuralism is largely a synchronic endeavor, and as such, it has been widely criticized because of its failure to account for social and historical change (Bourdieu, 1977; Giddens, 1984). Other criticisms include its overt concentration on human cognition to the exclusion of social action, its sensitivity to the imposition of the researchers own 'orders' on ethnographic data, and a lack of concern in explaining the logic underlying the oppositions that are identified (Doxtater, 1984; Kronenfeld *et al.*, 1979). Finally, Levi-Strauss (1963) himself has stated that the limitations of the structural approach to space stems mainly from its inability to explain the cultural diversity of space type, and degree of ordering, among living societies.

As a means of addressing such criticisms, Bourdieu (1973,1977) and Giddens (1984) have attempted to incorporate social action (praxis) into a structuralist framework. In his book *Theory of Practice,* Bourdieu (1977) liberates the cultural 'rules' that make up symbolic structures from the human unconscious through the concept of *habitus*. *Habitus* is defined by Bourdieu (1977) as a principle which generates and structures the collective strategies and social practices of individuals. The built environment represents an objectification of these generative schemes which are used by individuals to reproduce existing structures - structures which they are only partially aware of. Thus, structures are generated, act back on individuals, and are regenerated again. Bourdieu's (1973) earlier analysis of the Berber house illustrates many of these concepts. Bourdieu (1973) suggests that Berber dwellings are spatially organized according to sets of homologous oppositions, and that these same oppositions exist between the house and the external world (Bourdieu 1973:102). Within Bourdieu's structural interpretation, the low and dark part of the house is set in opposition to the high part of the house. While the former is associated with nature (cows, oxen, and donkeys) and natural activities (sleep, sex, and death), the latter is associated with human beings and culture (Bourdieu 1973:99). Bourdieu (1977) has suggested that such structural oppositions serve as mnemonic devices that provide people with a means of recalling important schemes governing social discourse. As the upper part of the house is considered the home of the weaving loom - the symbol of all protection, and "the place of the guest", an honored visitor is made to sit facing the loom (Bourdieu 1973:100). Hence, the "meaning" of the relationship between space (upper area of the house) and object (weaving loom) is understood by both the inhabitant and the visitor, and subsequently determines how the visitor will be situated in space. However, if this meaning is misinterpreted or ignored, then social discourse is disrupted, and the visitor considers himself/herself badly received. In such situations, Bourdieu (1973) states that it is customary for the visitor to reply "He made me sit before his wall of darkness as in a grave" (Bourdieu 1973:100).

Reiterating Bourdieu's (1973) notions of the Berber house as *habitus*, Fienup-Riordan (1983;1994) suggests that a basic structural opposition between inside and outside influences human spatial behavior and gender relations in traditional Yup'ik Eskimo society. While the concept of "inside" is synonymous with fabrication and reproduction, Fienup-Riordan (1983) explains that the "outside" is synonymous with tearing and gathering. In Yup'ik society, this spatial dichotomy gains meaning through the seal party; a ceremonial gathering in which the profits of a young boy's first seal kill are redistributed throughout the entire community (Fienup-Riordan 1994:184). After the seal is butchered by the boy's mother in her own house, the woman carries the meat through the doorway and throws the prepared portions into the air, where they are caught by other women in the village (Fienup-Riordan 1983,1994). Thus, the material transformation of raw material (seal carcass) into finished product (packets of meat), and the social transformation of the child emerging into adulthood as a successful hunter, serve to give the house an important symbolic function in the socialization of individuals within Yu'pik society (Fienup-Riordan, 1983). The symbolic association of 'house" and "womb"', and its subsequent identification as an exclusive domain of women, also acts to re-enforce a matrilocal pattern of residency, in which men lived separately from their wives and children in communal male dwellings known as *qasgiq* (Ackerman 1990:214).

Like Bourdieu (1977), Giddens (1984) argues that in order to be rendered meaningful, space must be incorporated into social theory. In his theory of structuration, Giddens (1984) sees *routinization* - the daily activities and behaviors of people, as the key to understanding the relationship between space and society. Daily activities and social encounters occur in spatially and temporally discrete *locales*. Borrowing from Goffman (1974), Giddens (1984) explains that these *locales* constitute *frames*; in that they contain clusters of 'rules' which help to integrate and regulate such activities and encounters. Over the *longue durée,* the interactions of individuals within *frames* reproduces the social structure of society. Social reproduction, then, is simply a process based on the performance of everyday activities and behaviors. Giddens (1984) explains that individuals acquire competency in these activities and behaviors through the process of socialization. Thus, in structuration theory, social reproduction and socialization become complementary processes, in that individuals reproduce the social structure through daily activities and behaviors which, in turn, socialize them into society. Like Bourdieu (1977), Giddens' (1984) structuration theory represents an innovation over Levi-Strauss's structuralism because it manages to link social action at the level of the individual to the social structure, via human agency (Lawrence and Low 1990:489). Furthermore, because individuals enter into a variety of new activities and locales during their lifetimes, social practice becomes a mechanism for social change (Lawrence and Low 1990:489). An illustration of this second point can be found in Giddens' (1984) summary of Bettelheim's (1960) book *The Informed Heart.* In the book, Bettelheim recounts his own experiences, as well as those of other Jews interred in two Nazi concentration camps during the Second World War. The author states that the daily routines of the camp's occupants had been severely disrupted as a result of their incarceration, and the constant threats of violence from camp guards (Bettelheim 1960:108). Those most affected were middle class Jews who had no previous experience with forced confinement (Bettelheim 1960:120). At first, such individuals attempted to distance themselves from the realities of the camp by attempting to maintain the modes of conduct of their previous lives. When this proved impossible, these individuals would become withdrawn, moody, and depressed (Bettelheim 1960:121). While many prisoners died shortly after, Bettelheim (1960) states that as the new routines of camp life became entrenched into the surviving prisoners, a process of resocialization took place. Bettelheim states that old prisoners began to adopt the activities, mannerisms, and behaviors of their captors, not to curry favor with them, but because of an introjection of the normative values of the SS (see Bettelheim 1960:169-175).

A third type of structuralist approach to understanding space involves a consideration of the built environment as metaphor; that is, a symbolically encoded system of cultural meaning (Lawrence and Low 1990:473). In this context, houses can be considered as animals, aspects of the sky and/or landscape, or people. Carsten and Hugh-Jones (1995:2) state that the anthropomorphizing of houses is almost an architectural universal. When asked to sketch a house, for example, many western children will often draw a door and two windows - a mouth and two eyes. Carsten and Hugh-Jones (1995:2) maintain that such practices represent a projection of self into the dwelling. Examples of houses used as metaphors for humans abound in the ethnographic record (Blier, 1987; Hugh-Jones, 1979, Johnston, 1988). To illustrate, the spatial layout of houses among the Dogon are understood by inhabitants to represent a man lying on his side in the act of reproducing (Griaule 1954:97). Likewise, Blier's (1987) study of Batammaliba architecture revealed that houses were treated as humans, and possessed "anatomical" characteristics of both sexes. Consequently, Blier (1987) states that, like young women in Batammaliba society, dwellings were cicatrized at the end of their construction, and were "dressed up" in clothes for funerals.

Among the Zafimaniry of Madagascar, the superstructures of houses exist as metaphors for the emerging solidarity of the married couple living within. Bloch (1995) states that upon reaching sexual maturity, young people in Zafimaniry society are encouraged to engage in sexual encounters with other members of their age-cohort. Out of this chaotic promiscuity, Bloch (1995:72) states that unstable unions between two young people will often form. If the two decide to marry, the instability of their new found union is expressed in the flimsy character of their house; usually a loosely thatched structure (Bloch 1995:78). As the marriage gradually solidifies, however, Bloch (1995:78) explains that the superstructure of the house is re-enforced with planking, and its banal facade is decorated. To the Zafimaniry, this process of "house hardening" symbolizes the increasing solidarity of the marriage, which is gradually reenforced throughout the life cycle of the domestic unit by such events as childbirth.

Lowenstein (1993) provides examples of architecture as a reflection of important cosmological principles and mythological stories among the Inupiat of Point Hope (*Tikigaq*), Alaska. The whale bone superstructures of dwellings in Point Hope, Alaska, for example, were often decorated with carved scenes of whaling, and oral histories refer to whale bone houses as if they were stages upon which many moral and supernatural events were played out (Lowenstein 1993:32-33). According to such myths, Alaskan

Inupiat shamans often gathered together the skeletal elements of dead animals and birds for use in sorcery (Lowenstein 1993:42). Fantastic creatures were then constructed using these materials, re-animated, and sent out to perform specific tasks (Lowenstein 1993:42). The practice was called "tupitkaq". To Inupiat shamen, the whale bones that formed the Tikigaq house represented ready made "tupitkaq" creatures (Lowenstein 1993:41). In one story, a shaman re-animates the sharpened whale jaws used to construct the entrance tunnel of a semi-subterranean house. Then, in deadly competition, two hunters leap repeatedly into the house until one of them is torn to pieces (Lowenstein 1993:43). In another tale, a young apprentice shaman hides amongst the whale bones of a semi-subterranean house and witnesses the immoral actions of a fraudulent shaman (Lowenstein 1993:43). Similarly, North Alaskan mythology indicates that Inupiat semi-subterranean houses, and the whale bones used to construct their entrance passages, were symbolically resonant of women. In the Inupiat myth of the Raven and the Whale, Raven flies into the mouth of a whale and finds a brightly lit iglu (Lowenstein 1993:42). Within the iglu, Raven is greeted by a young woman on a sleeping bench, tending a lamp (Lowenstein 1993:42). In the Raven story, the whale is the iglu, and the young woman is the whale's soul, thereby emphasising the strong association that exists between women, the traditional house, and the whale - the single most important source of cultural identity to Alaskan Inupiat (Lowenstein 1993:44).

In summary, the use of metaphor in the symbolic analysis of the built environment represents a powerful technique for examining the expression and communication of cultural meaning through the concrete reality of architecture (Lawrence and Low

1998:473). While this approach has had great success in anthropology, the need for corroborating ethnographic data in the interpretation of architectural forms makes its use in archaeology much more limited.

Grammatical Approaches

Grammatical approaches treat the spatial organization of buildings and settlements as a 'language'; complete with syntactic 'rules' which generate and modulate how spaces, and the people within them, are connected together. One of the earliest attempts to define the 'generative grammars' that underlie the spatial organizations of buildings is Henry Glassie's seminal work *Folk Housing in Middle Virginia*. In his book, Glassie analyzed diachronic variation in the floor plans of historic houses, in terms of the ways in which spaces were combined into formal geometries. Through time, Glassie observed that these formal geometries had changed, reflecting the shifting symbolic oppositions generated by changing values and lifestyles in Virginian society. Hence, the asymmetrical, socially open houses of pre-18th century Virginia were replaced by the more symmetrical, spatially enclosed houses of later times (Glassie 1975:193). To Glassie, the spatial syntax which generated this change in spatial patterning was the rise of individualism in American society (Glassie 1975:193).

A more explicit and mathematical approach to understanding spatial syntax has been attempted by Hillier and Hanson (1984) and Hillier, Leaman, Stansall, and Bedford (1978). Hillier *et al.* (1978) contend that all forms of spatial organization are comprised of an elementary lexicon of spatial elements. Relations between these elements (local rules) allow them to be manipulated in pseudo-grammatical ways. Using this lexicon of elements, Hillier *et al.* (1978) have generated 8 basic syntactic forms of space. The syntaxes themselves are nothing more than combinations of local rules and spatial elements which modulate the structuring of space, thereby giving rise to a recognizable "global pattern". Syntax#1 - the simplest of the 8 syntaxes, is illustrated by Hillier and Hanson (1984:34) through the behavior of a cloud of gnats. The cloud, an emergent property of a simple local rule which places a restriction on the random movements of gnats due to their mutual attraction to each other, gives rise to the global pattern which shapes it. According to Hillier and Hanson (1984:34), the pattern does not exist in and of itself; instead, it is "distributed" throughout the system (see also Hillier *et al.* 1979:359). Syntaxes 2 through 8 introduce new local rules which incrementally increase the non-distributiveness of the emerging global pattern, creating spaces which become bounded and enclosed by other spaces. As spaces become increasingly non-distributed and bounded, they become deeper and less accessible. Syntax#3, for example, consists of a clustering of elementary units which form an open space linked to an enclosed cell, and resemble a house with a space adjacent to its doorway. In contrast, Syntax#4 generates spaces which enclose other spaces; the effect being that one has to pass through a primary open space in order to gain access to the second interior one (Hillier *et al.* 1979:362). Hillier *et al.* (1979:362) state that buildings such as English Churches and the Forbidden City in Peking make extensive use of the Syntax#4 rule in order to control access to sacred areas. In a recent article, Banning (1996:514) makes interesting use of Hillier et al's (1979) space syntax to classify various types of Neolithic settlements in the Near East.

When applied to buildings, the space syntax of Hillier and Hanson (1984), suggests that the spatial organization of a dwelling is simply a global pattern; an emergent property of local rules which govern the clustering of spatial elements. These clusters of spatial elements, in turn, generate and modulate a system of encounters among inhabitants, and between inhabitants and outsiders. Hillier and Hanson (1984) maintain that in all human societies, these local rules consist of different forms of social solidarity. They then essentially translate Durkheim's concepts of organic and mechanical solidarity into strictly spatial terms. Transpatial solidarity is a solidarity of analogy and isolation, an arrangement of space based on exclusion and the systematic control of encounters with others (Hillier and Hanson 1984:145). In transpatial solidarity, the inhabitants of dwellings emphasize relations with each other and downplay relations with individuals residing within the community (Hillier and Hanson 1984:145). In this way, transpatial solidarity is equivalent to Durkhiem's mechanical solidarity. Transpatial solidarity is manifest spatially in the maintenance of strong boundaries separating the interior of the dwelling from the community outside (Hillier and Hanson 1984:145). In contrast, spatial solidarity is a solidarity of contiguity and encounter. Inhabitants built relations with other community members by encouraging interactions with individuals within the larger community (Hillier and Hanson 1984:145). Hence, spatial solidarity is equivalent to Durkheim's organic solidarity, and is manifest spatially in the weakening of the control of movement between community and dwelling (Hillier and Hanson 1984:145).

Transpatial and spatial solidarity imply the differential control of movement through space, both within settlements and buildings. Consequently, Hillier and Hanson (1984) utilize network analysis; a graph-based theory of nodes and links, to quantify the relative accessibility of spaces within dwellings. Although they do not formally acknowledge it, this approach borrows heavily from the field of transportation geography (see Taaffe and Gauthier, 1973). Transportation geography concerns itself with the particular linkages and flows that comprise a transportation network, the centers, or nodes, connected by those linkages, and the entire system of hierarchical relationships associated with the network (Taaffe and Gauthier 1973:1). Taaffe and Gauthier (1973:1) state that the transportation geographer's analysis "starts with these patterns, then moves to the processes that have brought these patterns about". These are essentially the same goals as those of Hillier and Hanson (1984), and suggest that buildings can be conceptualized as "transportation systems". In network analysis, buildings are depicted as justified permeability graphs, where all of the spaces (nodes) within a structure are lined up horizontally above the carrier space (point of entrance). The carrier space contains and surrounds the building, and is formally defined as the domain of non-inhabitants. In contrast, dwellings exist as the domain of inhabitants, with every building - even an elementary single cell - identifying at least one inhabitant: a person with special access to, and control over, that particular bounded space (Hillier and Hanson 1984). Justified permeability graphs map the accessibility of a building by representing paths through the building as lines (links) connecting spaces. The spaces, in turn, are represented by closed circles. The accessibility of different spaces within a dwelling can then be measured, using an index of relative asymmetry (RA) and relative ringiness (RR) (Hillier and Hanson (1984:108). Blanton (1994), however, provides a much simpler and less time-consuming way of calculating accessibility patterns. Blanton (1994) uses a pathway matrix to summarize the shortest paths between conjoined spaces, and then ranks each space according to its relative accessibility.

By providing a method of identifying inclusionary and exclusionary arrangements of space, Hillier and Hanson's (1984) theories suggest that one can learn how built environments not only express, but direct and shape social process concerned with sociability and control (Lawrence and Low 1990:471). A number of important criticisms, however, have been leveled against the formal analysis of space syntax (Lawrence and Low, 1990; Leach 1978). Anthropologist Edmund Leach (1978), for example, has questioned the ability to make inferences about social structure through the spatial patterning of the built environment, in the absence of corroborating ethnographic data. Likewise, Hillier and Hanson's (1984) technique assumes that all cultures share similar strategies for privacy regulation, and that depth of space is equivalent to the power that occupants of those spaces might wield over others within the household (Parker-Pearson and Richards 1994:30). Regardless, as Parker-Pearson and Richards (1994:30) state, there is little doubt that space syntax will continue to serve as a useful tool in archaeological analysis.

Dramaturgical Approaches

A dramaturgical approach to the analysis of human spatial behavior was first proposed by Erving Goffman, in his 1959 landmark publication *The Presentation of Self in Everyday Life*. Goffman (1959) suggests that the activities and events of daily life occur in differing regions of space. Adopting the language of the theater, Goffman (1959) states that people, like actors, present themselves differently when placed on stage and in front of an audience, than they do when they are back stage preparing for a performance. Each of these types of presentation require a specific spatial setting; a front region for carefully composed public presentations of self, and a back region for privacy, intimacy, and to prepare for collective social appearances. Like the theater, Goffman (1959:121-123) maintains that the typical American family home can be divided into front and back regions. Back regions, for example, include back yards, bedrooms, washrooms, and kitchens, while front regions include any spaces in which individuals present themselves to people who are not members of the immediate household. Using this model, (Goffman (1959) attempts to analyze social interactions within and between American families.

Goffman (1974) further defines the concept of front regions and back regions in his 1974 publication *Frame Analysis*. Using sociologist Harold Garfinkel's argument that individuals generate their "worlds" by following "rules" of a given kind, Goffman (1974:5) redefined spaces as "frames": rule-bound spatial settings which govern social events. Spatial settings are "strongly framed" when individuals must conduct themselves in very specific ways, and "weakly framed" when the behaviors and activities of individuals are less formal. According to Goffman (1974:345), the clusters of rules associated with frames bring meaning to activities, and organize the involvement of participants. Participants "break frame" when they engage in an activity or act in a way which is deemed inappropriate for a specific spatial setting (Goffman 1974:345). Examples of "breaking frame" might include situations in which an individual lacks competence at a specific activity, is unable to sustain an appropriate activity or behavior, or engages in an activity or behavior which compromises the rules of the frame (e.g. laughing at a funeral, eating in a bathroom, etc) (Goffman 1974:378). Following Goffman's (1959;1974) logic, it becomes apparent that front regions form strongly framed settings, while back regions form settings which are weakly framed.

While Goffmans' (1959) dramaturgical model has been successfully used in anthropology and archaeology (see Portnoy, 1981; Oetelaar, 1994), criticisms have nevertheless been directed at its focus on middle class white American families, and for its emphasis on the behavior of the individual at the expense of larger social groupings (Lawrence and Low 1990:481).

Space and Power

The post-modern critique of design theory has argued vehemently that architecture is largely a product of the ruling power, and as such, it serves and builds society in the image of the dominant group (Ward 1996:12-18). Hence, variations in the control and manipulation of spatial environments reflect the different power relations present in society (Sibley 1995:76). Foucault (1980) summarizes these sentiments nicely, writing:

> "A whole history remains to be written of spaces - which would at the same time be the history of powers (both of these terms in the plural) - from the great strategies of geopolitics to the little tactics of the habitat.

Within the context of any built environment, power manifests itself in the presence of hierarchical spatial structures, control of movement, surveillance, and the possession of resources (Markus 1993:23). The space syntax of Hillier and Hanson (1984) demonstrates how asymmetrical distributions of space can segregate individuals, thereby regulating and controlling their accessibility to others. In a bank, for example, the manager typically occupies a space which is deeper than those of the tellers and customers (Markus 1993:16). In order to gain access to the manager, one must first pass through a series of intermediate spaces which are monitored and controlled by other bank employees. In this instance, depth clearly equals power. This is an augmentation of an elementary property inherent within many types of buildings and one which defines the relationship between inhabitant and visitor. Inhabitants occupy the deeper, non-distributed areas of the building and interface with visitors in shallower, distributed spaces (Hillier and Hanson 1984:185). Hillier and Hanson (1984:187), however, point out that this relationship is sometimes reversed. The hospital, for example, represents an inversion of the elementary relation outlined above. The least powerful individuals (patients) now occupy the deepest, most non-distributed spaces in the building, while those empowered (doctors) circulate in shallow, distributed spaces where they can interface with the sick and initiate treatment

(Hillier and Hanson 1984:186). Thus, the spatial organization of a hospital sustains a pattern of the isolation, segregation, and continual surveillance of the sick. Foucault (1982:195-228) has suggested that such practices emerged through the discipline of anti-plague measures in Europe, and have since served as a model for the power exercised in prison systems. In his book *Discipline and Punish*, Foucault (1982) examined the evolution of power and control in historic and contemporary penitentiaries. Foucault (1982) specifically focuses on the development of the Panopticon, a form of spatial arrangement which allows one group of individuals (guards) to monitor the actions of another group of individuals (prisoners), thereby reenforcing a particular power structure (Foucault 1982:200). Developed by Jeremy Bentham in 1789, the Panopticon consisted of a tower placed in the center of a circular building in which all prison cells faced inwards (Markus 1993:122). The cells were back-lit so that prisoners were continually visible to guards in the tower, and listening tubes were installed within the cells so that guards could eavesdrop. Bentham felt that cellular solitude was essential to preventing solidarity between prisoners (Markus 1993:127). Consequently, each cell was self-contained, with its own sanitary facilities and heating/ventilation systems (Markus 1993:127). Because of the architectural configuration of the Panopticon, prisoners could never be sure if they were under surveillance at any given moment, and therefore had to act appropriately at all times. Thus, the Panopticon became a machine for creating and sustaining a power relation independent of the person who exercised it (Foucault 1982:202).

While Panopticonism represents an overt expression of power through architectural design, domination and marginalization can also be achieved at much subtler levels.

However, because they are masked by the routines of everyday life, such opaque instances of exclusion often go unnoticed. Examples of these forms of what could be called 'spatial discrimination' include architectural designs which fail to accommodate physically disabled individuals, gender differences, class differences, the aged, and people from different cultural backgrounds (see Sibley, 1995). With the realization that architecture, as it had been traditionally practiced in western capitalist societies, served as a way for the privileged to reproduce their hegemonic structure, many design professionals have called for "an architecture that takes seriously its social vocation...one that must be based on direct contact with the public it serves" (Foucault, cited in Ward 1996:57). This has resulted in the formation of community-based design projects, in which people who were once marginalized by design are given an architectural voice. Examples include the so-called "Mad Housers" project at the University of Illinois in Chicago, in which architectural students interact with low-income families to design more dignified low cost housing solutions, and the Otara Town Center Project, a collaborative project between Maori and architects at the University of Auckland in New Zealand (Ward 1996:59).

In summary, studies focusing on the relationship between space and power have been used to critique buildings and communities which reenforce the hegemonic structures of ruling powers. By understanding how architecture can be used to facilitate surveillance, control of movement, and the selective integration and segregation of individuals, anthropologists and archaeologists can gain valuable insight into patterns of domination and resistance in society.

Summary

While sociocultural factors are important in determining design, these factors are frequently modified by architectural responses to both climatic conditions and limitations imposed by materials and construction techniques. Groups work around such limitations through compromise; achieving an "ideal" built form by reconciling the different requirements associated with the use, production, and maintenance of the structure. Not surprisingly then, as users become increasingly disenfranchised from design and construction processes, the potential for conflict and dissatisfaction in house form increases substantially.

The six approaches to the study of human spatial behavior reviewed here represent complementary, rather than competing methods for understanding the built environment. Ergonomics and proxemics, for example, share a paradigmatic view of space in which some cross-cultural constant (mechanical properties of activities, biological impulses like territoriality/privacy) determines how humans organize space. Likewise, the neo-structural approaches of Bourdieu (1977) and Giddens (1984), the grammatical approaches of Hillier and Hanson (1984), the dramaturgical approaches of Goffman (1959, 1974), and the 'space as power' approaches of Foucault (1982), Markus (1993), and Sibley (1996) maintain that local 'rules' frame human activities and interactions which, in turn, reproduce the social structure. Furthermore, this process is both facilitated by, and reflected in, the spatial organization of the built environment.

The basic tenets of these last four approaches can be summarized as follows: 1) daily routines and activities serve to 'socialize' people into society, 2) daily routines and activities are governed by local 'rules' which generate and reproduce the social structure, 3) these local 'rules' are anchored to specific spatial and temporal contexts, 4) the spatial organization of built environments are designed to meet the requirements of specific clusters of local 'rules' and the activities/interactions they frame, 5) the degree to which spaces are 'rule-bound' can vary within a single building, and across different building types, and 6) the degree to which spaces are rule-bound or framed is determined largely by cultural factors (e.g power relations, notions of sacred and profane, etc)

These suppositions have a number of implications for understanding the relationship between culture change and the changing nature of the built environment. First, because local 'rules' and the activities and encounters they frame require specific spatial contexts, the introduction of new rules and routines should also be accompanied by the introduction of new spatial orders within the built environment. Second, the disruption of existing daily routines through the introduction of new local 'rules' should result in the re-socialization of individuals, and the production of new social structures (see Bettelheim (1960).

CHAPTER THREE. ARCTIC ARCHITECTURE AND THE PHYSICAL SETTING

Introduction

Chapter 3 provides an overview of the climate and biogeography of the eastern Canadian Arctic, and a discussion of how these features interrelate with one another at local and regional levels to influence northern architectural praxis. Climatic change, with specific reference to the Neo-Boreal climatic episode of the 16th century (Little Ice Age) is also discussed. The purpose of Chapter 3 is to familiarize the reader with environmental factors which bear on the design of both traditional Inuit and Euro-Canadian house forms.

Climatic Variables in the Eastern Canadian Arctic

The climatic character of the Canadian Arctic Islands is largely reliant upon solar energy input (Maxwell, 1980; Maxwell, 1981; Woo and Young, 1996). While primarily determined by latitude, solar energy input is also influenced by a number of factors that are commonly referred to as climatic controls (Edlund and Alt, 1989; Maxwell, 1981; Maxwell, 1980; Woo and Young, 1996). Among these, the most important are cyclonic/anticyclonic activity (responsible for the generation of storm tracks); the sea ice-water regime (the distribution of sea ice relative to open water); broad scale physiographic features (mountains, glaciers, bare rock); and spatial and seasonal factors (extended periods of daylight and darkness influencing solar energy gains and losses) (Edlund and Alt, 1989; Maxwell, 1981; Maxwell, 1980; Woo and Young, 1996). These climatic controls serve to influence climatic variables such as temperature, dew point, relative humidity, wind, and precipitation. Acting either alone or in combination, climatic variables can alter the behaviors of various building materials, thereby constraining construction and/or design practices (Strub, 1996; Zrudlo, 1975:38).

1) Temperature

According to Maxwell (1980), the most striking aspect of temperature in the Canadian Arctic Islands is the arctic temperature inversion. The extreme regimes of continuous day and night, high albedo, and low solar angle, result in a negative energy balance over snow and ice covered surfaces (Maxwell 1980:137). While this inversion is deepest in the winter, it is somewhat weakened during the summer months. Seasonal temperatures are usually affected by latitude, elevation, and relative proximity to sea ice and/or large bodies of open water (Maxwell 1980:141). The coldest weather usually occurs during the months of December, January, February, and March, where temperatures can drop as low as -35^{0}C (Maxwell 1980:141). While the coldest weather can occur at any time during these four months, coldest mean temperatures are usually observed in February (Maxwell 1980:141). Variability in the frequency of cyclonic activity, open water conditions, and surface radiation loss, complicate temperature patterns in the Canadian Arctic Islands. This sometimes results in higher temperatures occurring in the interior areas than in coastal locales (Maxwell 1980:141). By May, daily temperatures in the Arctic Islands are modified by as much as 20°C over winter conditions. However, because so much of the incoming solar radiation is being used to melt snow and ice covered surfaces, daily temperatures rarely rise above freezing (Maxwell 1980:142). With the onset of the short arctic summer, daily temperatures rise to near 10°C (July Maximum), although sheltered localities may experience daily maxima up to 5°C higher (Maxwell 1980:142). A noticeable compression of temperature ranges also occurs during summer months, with few locations diverging from the 5°C isotherm. This is due somewhat to the moderating influences of partially ice-covered channels and straits. As September approaches, average daily temperatures extend from 10°C in Northern Ellesmere Island, to 5°C over Ungava Bay (Maxwell 1980:143). By mid-October, winter conditions have returned to the Arctic Islands, and are only delayed in areas where open water still exists.

The Effect of Temperature on the Design and Construction of Northern Buildings.

Temperature affects buildings in four main ways: 1) heat loss; 2) phase changes of water (gas to liquid to gas) in concealed spaces; 3) freeze-thaw cycles on exposed surfaces; and 4) dimensional changes of exposed materials (contraction) (Strub 1996:45).

The greater the difference between temperatures inside and outside of a building, the greater the rate of heat loss (Strub 1996:45). Heat loss within a building is determined largely by the design and construction of the *building envelope;* those assemblies of construction materials (windows, walls, floors, roofs, doors) that act together to separate the enclosed environment of the building from the outdoors (Strub 1996:155). When the 'fit' between construction materials is tight, heat loss is reduced, and energy costs associated with keeping the interior of the building comfortable are curbed. However, when the 'fit' between construction materials is poor, the integrity of the building envelope is compromised and heat loss increases - making the building uncomfortable, and sometimes even uninhabitable.

Low temperatures condense the water vapor component of air to liquid (water) and solid (ice) phases. When such phase changes occur in stagnant air spaces, they can accelerate the deterioration of the building envelope by reducing the thermal resistance of materials used in insulation (i.e sod blocks; snow; fiberglass batting [Strub 1996:45]). The freeze/thaw expansion cycles of 'ponded' water can also mechanically separate construction material assemblies, thereby allowing interior heat to escape through cracks and other openings (Strub 1996:45). Likewise, air temperature changes can bring about the dimensional shrinkage of construction materials which can result in the formation of cracks, and the buckling of construction materials (Strub 1996:45). Finally, water contained within the foundation zones of buildings situated in polar regions will often heave when frozen by low winter temperatures. The resulting movement can compromise the integrity of the building envelope; as doors, windows, roof beams, and floors shift and separate from one another (Strub 1996:45).

2) Dew Point and Relative Humidity

Dew point and relative humidity are measures of the amount of moisture in the air close to the surface of the earth. In general, the moisture content of arctic air is very low. Data collected from weather stations in the Canadian Arctic Islands indicate that maximum dew point values are reached in July, while minimum values tend to occur most often during the winter months of January to March (Stager and McSkimming 1984:30). This would seem to indicate that in arctic regions, low temperatures produce low rates of humidity (Maxwell 1980:150). On a daily basis, relative humidity values display a great deal of variability. This variation is attributable to such factors as wind direction, and number of daylight hours (Maxwell 1980:150).

The Effect of Humidity on the Design and Construction of Northern Buildings.

For the polar architect, humidity poses problems from both technical and health perspectives. As warm, moist air created by exhalation and body heat rises within a building, it comes into contact with the ceiling and condenses. Water is a poor thermal insulator, and when this process occurs within a snow house, the condensed water invades the insulating air spaces present in the snow blocks and freezes (Kershaw *et al.* 1996:334; Strub 1996:53). Subsequently, the insulation value of the snow blocks; usually equal to that of a well insulated 2 x 4 house wall, is decreased and the interior of the dwelling becomes increasingly difficult to keep warm. This process eventually leads to the abandonment of the snow house (Kershaw *et al.* 1996:334; Strub 1996:53). When water vapor condenses within the roof-ceiling assembly of a prefabricated Euro-Canadian house, the essential conditions for wood rot often result. Wood rot can ultimately lead to the collapse of the entire roof section; thereby necessitating the reconstruction or abandonment of the house (Strub 1996:53).

As the air temperature within a snow house usually hovers around the freezing mark, the interior relative humidity is commonly quite high (Strub 1996: 53). While warm traditional clothing helped circumvent the health risks associated with this type of cool, damp environment, the increasing use of store-bought cotton clothing in the early 20th century lead to an increase in respiratory ailments among Inuit (Duffy, 1989). In contrast, the oil-heated prefabricated buildings used in the Canadian North are extremely dry environments which can stress lung surfaces and result in respiratory illness (Strub 1996: 53). Such buildings often require artificial humidification in order to prevent eye, skin, and respiratory ailments caused by exposure to excessively dry air (Strub 1996: 53).

3) Wind

When combined with other climatic factors such as temperature and precipitation, the effect wind can have in arctic regions is dramatic. Surface winds carrying snow and sleet can seriously impair visibility, thereby posing restrictions on human activities (Maxwell, 1980). The chilling effect of wind and temperature can also result in extreme drops in outside temperatures. Prevailing surface winds are controlled by such topographic features as slope angle, surface roughness, elevation, and the orientation of mountain and valley systems. Katabatic (up slope) and adiabatic (downslope) wind speeds, for example, tend to increase when they flow up or down long, steep slopes (Maxwell 1980:153). Likewise, constricting topographic features such as narrow straits and mountain passes also act to intensify wind speeds. A high percentage of wind speeds exceed 25 km/h in the Arctic, with maximum wind speeds occurring when cyclonic activity is at an optimum (Maxwell 1980:157).

Seasonally, the highest surface winds speeds in the Canadian Arctic occur in winter, and are confined to areas around the northern islands and along the southeastern coast of Baffin Island (Maxwell 1980:157). Temperature gradients, formed through contrasts between land and sea temperatures, also produce lighter sea and land breezes which occur throughout the year. Weather station data indicates that arctic winds usually blow from a "preferred direction" throughout most of the year (Maxwell 1980:155). However, during summer months, the differential heating of land and water/ice does create some directional variability. To a certain degree, wind patterns also shape aspects of the arctic land and sea scape, through the ablation of arctic glaciers (Fohn winds), and the movement of sea ice (Maxwell 1980:150).

The Effect of Wind on the Design and Construction of Northern Buildings

When arctic winds blow at high speeds for sustained periods of time, the leeward and windward faces of buildings are pressed and sucked in ways that can both distort and damage the integrity of the building envelope (Strub 1996:48-49). Air turbulence, created when wind strikes the leading edges of eaves, often produces powerful uplift forces which can tear the roof off of a building (Strub 1996:48). The building envelope can also be damaged by wind in much more subtle ways, as seals and building joints become fatigued through constant stress and lever action (Strub 1996:49). Under either circumstance, once the building envelope is ruptured, heat and water vapor are allowed to pass between the interior and exterior of the building and problems ensue (Strub 1996:48-49).

4) Precipitation

When compared with levels of precipitation in more temperate latitudes, the amount of rain and snow experienced in the Canadian Arctic Islands is extremely low. Persistent low temperatures, the patterning of weather systems, and the presence of terrain effects, all serve to restrict the amount of annual precipitation received. Consequently, much of the Canadian High arctic is classified as "polar desert" (Maxwell 1980:343).

The accumulation of moisture in arctic air masses is primarily attributable to the thawing of permafrost, evapotranspiration of plants, and the warming of water surfaces during the autumn months (Hare and Thomas 1974:36). Annual rates of precipitation tend to vary both seasonally and spatially, with most precipitation occurring during the months of July and August (Hare and Thomas 1974:36). Rates of precipitation are generally lowest during the months of February and March, where most moisture falls in the form of snow. Observations made at High Arctic weather stations indicate that precipitation levels have a tendency to decrease with increases in latitude. Anomalous weather patterns, however, can sometimes produce exceptions. In 1939, for example, Papanin (1939) reported heavy rainfall at the north pole.

Annual precipitation rates also vary with local topography and elevation. Precipitation levels reported for mountainous areas of Baffin Island range between 500 mm to 700 mm, while those reported for Alert are frequently less than 60 mm (Maxwell 1980:348). Long term data collected from observation sites in the High Arctic Islands indicate that the total amount of precipitation varies from year to year. To illustrate, coefficients of variation calculated for different regions range from 10% for Resolute Bay to nearly 50% for such sites as Clyde, Eureka, and Holman Island (Maxwell 1980:350).

As with rainfall, large variations in snowfall occur from year to year. Amounts of snowfall received on an annual basis range from 50 mm for Queen Maude Gulf, to 320 mm on southeast Baffin Island, and 620 mm for Cape Dyer (Maxwell 1980:356). In most regions of the arctic, the month of October is associated with the most measurable snow days (Maxwell 1980:356). While the duration of snowfalls rarely lasts beyond 6 hrs, snow storms with considerably longer durations have been reported. Station reports from Cambridge Bay, for example, cite an instance of 442 consecutive hours of snowfall (Maxwell 1980:357). The characteristics of snow cover change the thermal properties of surfaces, eliminate evapotranspiration by plants, and redirect solar radiation back into space, thereby impacting on the exchange of heat and moisture between surface and air (Stater and McSkimming, 1984; Maxwell, 1980; Hare and Thomas, 1974).

The Effect of Precipitation on the Design and Construction of Northern Buildings.

The thickness, density, and longevity of snow are largely determined by sun and wind. In fact, almost all tundra snow has been moved by wind to some degree. As a result, snow deposits vary in thickness and density, and are almost always unevenly distributed (Stager and McSkimming 1984:33). In constructing snow houses, Boas (1888[1964]:131) explains that central Arctic Inuit groups sought out snow drifts which would provide cut-blocks of a fine grain and uniform consistency. This type of snow block was desirable because it was less likely to break apart when cut with a snow knife. While snow drifts produced by a single storm event frequently satisfied such criteria (Boas 1888 [1964]:131), efforts to locate suitable snow drifts may have been considerable when winter conditions were less than optimal (Kershaw, Scott and Welch 1996:334). Consequently, the distribution of thick and dense snow often influenced the location of winter snow house villages out on the sea ice (Jenness 1922:76-77). In situations where access to suitable snow was limited, considerable stress may have been placed on Inuit groups (Kershaw *et al.* 1996:334). Snow can also pose problems for polar architects who must design and orient buildings in such a way as to prevent the blockage of windows, entrances, and water/heating oil/sewage tanks by drifting snow (Strub 1996:49). Likewise, blowing snow and rain can accelerate the weathering and degradation of building materials when surfaces are exposed and untreated, resulting in increasing maintenance costs, or the abandonment of the structure (Strub 1996:49).

The Biogeography of The Eastern Canadian Arctic

Unlike ecosystems found in more temperate regions of North America, arctic ecosystems are characterized by extremely low species diversity. This lack of diversity may be attributable to either 1) the relatively recent origin of various arctic biomes, following the retreat of the Wisconsin glacier 8-10 000 years ago, or 2) assorted climatic and physiographic factors such as soil chemistry, precipitation, wind, cloud cover, snow cover, temperature, geomorphological processes, and anthropogenic disturbance (Forbes, 1996; Edlund and Alt, 1989; Freeman, 1984).

Plant Communities

In general, plant communities found in the Canadian High Arctic consist of either cryptogamic plants, vascular plants, or some combination of the two. Cryptogamic plants are non-flowering, spore producing plants, and include various species of moss and lichen. In contrast, vascular plants produce flowers and seeds, and usually fall into one of three categories; woody plants, herbaceous plants, and sage/grass plants. Regions that are characterized by persistent cloud, fog, and low temperatures are associated with low percentage cover of vascular plant species of limited species diversity, and are dominated almost entirely by herbaceous species (Edlund and Alt 1989:15). In areas where climatic factors are less harsh, plant communities demonstrate a much greater diversity. Woody species, for example, tend to dominate the warmest sectors of the Canadian Arctic

Islands. (Edlund and Alt 1989:15). However, as temperatures fall, the dominance of woody species is lost to herbaceous and grass species, which tend to thrive in cooler areas (Edlund and Alt 1989:15).

In addition to climatic factors, soil chemistry can also have a dramatic effect on the diversity and density of plant communities. On Bathurst Island and Cornwallis Island, for example, large areas of weathered silt and rock fragments are derived from highly alkaline carbonates. The surface materials that form from these deposits are excessively high in calcium and magnesium ions, but lack many nutrients essential to plant growth (Edlund and Alt, 1989:6).Consequently, large portions of these islands are completely devoid of vascular plant species.

While other types of arctic soils produce nutrient ranges within the tolerance of many vascular plant species, minimum nutrient requirements vacillate across species, and the degree of acidity or alkalinity in soils varies on a regional scale. Soils that are weakly alkaline commonly support calciferous species such as *Dryas integrifolia* (arctic avens) and *Saxifrage oppositifolia* (purple saxifrage) (Edlund and Alt 1989:6). In contrast, weakly acidic soils support a different suite of vascular plants which include herbs such as *Luzula confusa*, and fox tail grass (*Alopecurus alpinus)*. Finally, the weakly acidic to neutral ranges of wetland soils make them ideal locations for many species of sedges, grasses, and woody plants (Edlund and Alt 1989:6).

Animal Communities.

Like plants, animal communities in the Canadian Arctic are characterized by low species diversity, and their distributions are influenced by the nature of the particular ecological "subsystem" they inhabit. Within the arctic ecosystem proper, Freeman (1984) distinguishes between three such subsystems; marine, freshwater, and terrestrial. Each subsystem is characterized by a number of distinct climatic and physiographic controls that serve to influence the distribution and abundance of animals, birds, and fish that dwell within it. Of these three, the marine subsystem contains the largest biomass of animal species; fish, sea birds, seals, walrus, whales, and polar bears, to name some of the most abundant (Freeman 1984:36).

Marine subsystem. Arctic oceans are approximately 1/2 to 1/4 as productive as oceans located in more temperate regions of the world (Freeman 1984:37). Consequently, the food chain that exists within the marine subsystem is extremely short, and heavily reliant upon zooplankton production (Freeman 1984:37). The abundance of planktids varies spatially in the arctic oceans, with the most productive areas associated with ice edges, water mass boundaries, local turbulence, and up welling of currents (Dyke *et al.* 1996:238; Freeman, 1984:37). Zooplankton forms an integral part of the diets of various pinniped and cetacean species of economic importance to Inuit groups, both past and present. Arctic Cod (*Boreogadus saida)* also serve as an important marine food source for arctic mammals and birds (Welch *et al.* 1993:331). Large schools of arctic cod form during the open water season in the Barrow Strait. Such schools can contain up to 4 x 10^8 fish weighing approximately 12 000 tonnes, and are subjected to intense predation by various sea birds, harp seals (*Phoca groenlandicus)*, beluga (*Delphinus leucas)*, and narwhal *(Monodon monoceros)* (Welch *et al.* 1993:331).

Many animal species living in arctic regions tend to grow and reproduce at extremely low rates (Freeman 1984:37). Whales and polar bears, for example, reproduce only once every three years. Similarly, seals only produce young every two years, and pups take a long time to mature (Freeman 1984:37). Slow growth and reproductive rates likely represent an evolutionary stable strategy for organisms living in environments with limited production capacities (Freeman 1984:37). When animals mature and reproduce slowly, larger populations can be supported by the same level of food production as would smaller populations of animals with greater metabolic requirements for growth and reproduction (Freeman 1984:37).

Physiographic conditions also influence the abundance of sea mammals living within the marine subsystem. Pioneering studies by Smith (1973) and MacLaren (1961) demonstrate that ringed seals tend to thrive in areas with irregular coastlines and protected shoreline locations. According to MacLaren (1961) the early autumn formation and late spring breakups of sea ice in such regions provide conditions favorable for ringed seals. Likewise, the formation of pressure ridges and the accumulation of drifting snow in areas such as Prince Albert Sound, on Victoria Island, provide ideal locations for birth lairs (Smith 1973:7). As one moves into such optimal locales, noticeable increases in both seal abundance, and adult body size/weight occur (MacLaren, 1961; Smith, 1973).

A second species of arctic fauna sensitive to ice conditions is the bowhead whale

(Balaena mysticetus). Bowhead whales are the largest of all arctic whale species, and are closely related to the pelagic northern right whale *(Eubalaena glacialis)* (Dyke *et al.* 1996:236). These animals spend most of their lives within, or adjacent to, the loose edges of polar sea ice (Braham *et al.* 1980; Brueggeman, 1982; Marquette, 1986; Reeves and Leatherwood, 1985) . Bowheads utilize sea ice as a means of escaping from predators, and usually swim under ice sheets when alarmed. Although bowheads can break ice between 30-60 cm in thickness, ice entrapment is a common cause of natural mortality (Dyke *et al.* 1996; Maxwell, 1985). Consequently, these animals generally avoid ice-choked regions in favor of ice leads and the open water beyond. The sensitivity of bowheads to ice conditions results in a distinctive pattern of seasonal migration which is largely determined by the autumn and spring movements of the floe edge (Dyke *et al.* 1996:236). The distributions and migration patterns of smaller arctic whales (narwhal, and beluga), and walruses are remarkably similar to those of the bowhead, and are also likely governed by patterns of ice formation and break-up (Dyke *et al.* 1996:236).

Freshwater subsystem. According to Freeman (1984:40), the freshwater subsystem is the least productive sector of the arctic ecosystem. Anadromous fish species such as arctic char *(Salvelinus alpinus)* and pacific salmon *(Oncorhynchus* spp.) move seasonally between fresh water lakes and rivers, and the arctic sea (Freeman 1984:40). Freshwater species such as lake trout *(Salvelinus namaycush)* and landlocked lake char are found in many of the interior lakes of the Canadian Arctic Islands (Freeman (1984:40). Other freshwater species include pike *(Esox lucius)* and several species of whitefish *(Coregonus* spp.). Seasonal variability in sediment loads and nutrient values for arctic river and lake systems, however, can affect the abundance of anadromous and fresh water fish (Freeman (1984:40). Nevertheless, when sediment levels are low, the estuaries and deltas of rivers such as the MacKenzie, Firth, and Back can be exceedingly rich in freshwater fish species during the summer months. The extensive collection of fishing equipment found in both historic and prehistoric hunting kits, attests to the important economic contribution various fish species make to northern aboriginal diets (Freeman, 1984; Maxwell, 1985).

Terrestrial subsystem. Within the terrestrial subsystem, the abundances and distributions of animal species are largely congruent with those of plant communities, upon which all forms of life in the arctic ultimately depend (Freeman 1984:41). The distributions of large grazing herbivore such as musk-ox and caribou, for example, closely follow areas in which soils are suitable for plant growth (Freeman 1984:41).

Three species of caribou inhabit the Canadian Arctic; Peary, barren ground, and woodland caribou. Peary caribou are the most diminutive of arctic caribou species, and are found throughout the Queen Elizabeth Islands. Peary caribou redistribute themselves between or among different arctic islands during annual seasonal migrations. Inter-island migrations can also occur when unusually heavy snowfalls prevent caribou from reaching grazing vegetation, necessitating a move to more favorable foraging locations (Freeman 1984:41; Miller 1995:11). Interestingly, Miller (1995) has attributed some inter-island movements to an "innate restlessness" that he feels is characteristic of this species. While island crossings are usually made over sea ice in winter, Miller (1995) has documented a number of instances in which Peary caribou of various ages (adults and calves) have swam such crossings; sometimes covering strait line distances of up to 2.5 km (Miller, 1995:8). Studies of the spatial distributions of shed antlers demonstrate that bulls and cows aggregate in coastal areas during the short autumn rutting season. Miller and Barry (1992) suggest that by situating themselves coastally, rutting bulls increase their chances of encountering cows in estrus. Ranges of the barren ground and woodland caribou are more southerly, with the latter species inhabiting primarily coniferous forests and muskeg (Burt and Grossenheider 1980:220).

Like caribou, muskox are herbivores that range over large areas in search of favorable foraging conditions (Burt and Grossenheider 1980:226). Muskox are generally found throughout the Canadian Arctic Islands, and along areas of the mainland coast (Burt and Grossenheider 1980:226). While some muskox are solitary, they more commonly occur in small herds (Freeman 1984:41). Perhaps the most distinctive characteristic of muskox is their penchant to form tight circles when alarmed; orienting themselves with their horns facing outwards towards their aggressors (Burt and Grossenheider 1980:226).

Other mammalian species that inhabit the terrestrial subsystem include the Arctic Hare *(Lepus arctus);* Arctic Fox (*Alopus lagopus);* Wolf (*Canis lupus)*; Wolverine *(Gulo gulo)*; Least Weasel (*Mustela erminea)*; Ground Squirrel *(Spermophilus parryi)*; and various species of lemmings, mice, and shrew (Freeman 1984:42).

The polar bear (*Ursus maritimus*) is somewhat unique among arctic mammals in that it inhabits both the terrestrial and marine ecosystem (Freeman 1984:39). While polar bears spend considerable amounts of time hunting seals out on the sea ice, individuals will often comb beaches in search of scavengeable carcasses (Taylor and Lee, 1995). Polar bears have also been sighted in the interior regions of islands such as Bathurst island;

many miles from the coast (F. Miller; pers.comm). Recent estimates suggest that 12,700 polar bear presently occupy a habitat covering 3.1 million km^2 of the Canadian Arctic (Taylor and Lee 1995:147). Furthermore, the average range of a single male polar bear can extend up to 1000 km^2 (Taylor and Lee 1995:147). Females construct maternity dens either along mainland coasts, or out on the sea ice, and usually give birth to 2 cubs once every three years (Freeman 1984:39; Sterling and Andriashek 1992:363). Ice conditions and anthropogenic disturbances can influence both the seasonal movements and locations of maternity dens by females. Sterling and Andriashek (1992), for example, report that oil and gas exploration in the Beaufort sea during the 1970's discouraged female polar bears from denning along the mainland coast.

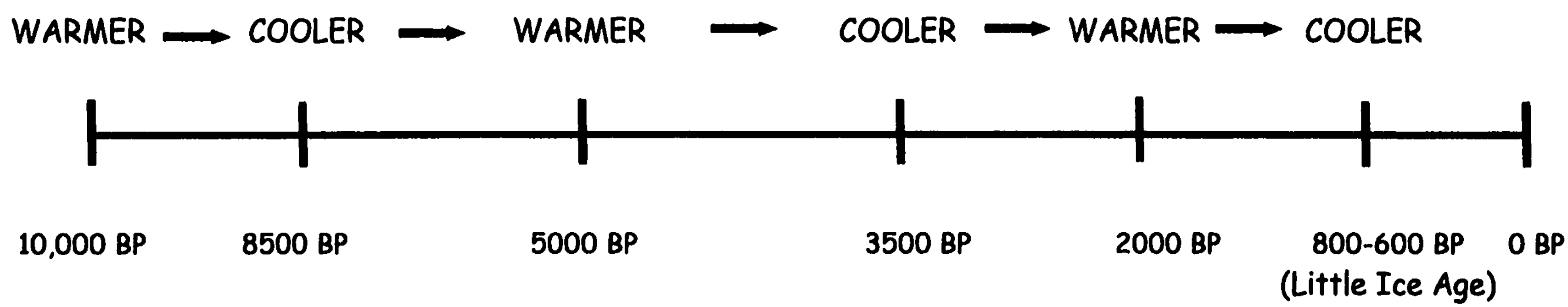
Paleoclimatology and Paleogeography of the Eastern Canadian Arctic

The reconstruction of past climates in arctic regions has played an important role in the development of theoretical perspectives on culture change among Paleoeskimo and Neoeskimo groups. In the 1960's and 70's, a number of arctic archaeologists made attempts to move beyond the realms of culture history and regional chronology through the adoption of such paradigms as cultural ecology and systems theory (e.g. Barry *et al.*1977; Dekin, 1972,1969; Fitzhugh, 1972; McGhee, 1969/70; Schledermann, 1976a,1976b). However, many of these pioneering studies were naively deterministic, in that they frequently overemphasized environmental factors as agents of culture change. The uncritical use of paleoclimatic and, in some cases, historic climatic data, has further hindered attempts to establish a link between environmental change and culture change in the eastern Canadian Arctic (Helmer, 1981, 1987). The fact that climatologists, like archaeologists, are often forced to base their reconstructions of entire regions on the extrapolation of data collected from a few well studied localities was largely overlooked. In addition, the relationships thought to exist between climatic factors and data such as vascular plant ranges are not completely understood (Ovenden, 1988). Consequently, while climate is highly influential in the development of circumpolar societies, the impact of climate change remains both causative and coincident with other factors - economic, social, and ideological, which also influence culture change.

The reconstruction of arctic climates is commonly based along the following lines of evidence: 1) the ranges, extensions and contractions of vascular plants (Ovenden 1988); 2) lichenometry and the measurement of peat deposits on Arctic Islands (Grove, 1988; Ives, 1962; Ovenden, 1988); 3) eolian deposition and deflation (Short and Jacobs, 1982); 4) thermokarst and thaw (Ovenden, 1988); 5) changing sea ice conditions (Dyke *et al.* 1996); 6) isotopic analysis of ice cores (Dansgaard *et al.* 1982; Koerner *et al.* 1977); and 7) historic accounts (Grove, 1988; Lamb). Based on these lines of evidence, a summary of the major warming and cooling trends which have occurred during the Holocene in the Canadian Arctic is presented in Figure 1.

Studies of thermokarst deposits indicate that from roughly 10,000 BP to 8500 BP, the Canadian Arctic experienced environmental conditions which were warmer than those of today (Ovenden 1988:7). Climatic conditions began to deteriorate after 8500 BP, as

FIGURE 1. Summary of Major Warming and Cooling Trends During the Holocene in the Canadian Arctic.



* Trends summarized using evidence from: 1) vascular plant extensions and contractions (Ovenden, 1988); 2) lichenometry and the measurement of peat deposits on Arctic Islands (Grove, 1988; Ives, 1962; Ovenden, 1988); 3) eolian deposition and deflation (Short and Jacobs, 1982); 4) thermokarst and thaw (Ovenden, 1988); 5) changing sea ice conditions (Dyke *et al.*, 1996); 6) isotopic analysis of ice cores (Dansgaard *et al.*, 1982; Koerner *et al.*, 1977); and 7) historic accounts (Grove, 1988; Lamb).

evidence for the restricted spatial distribution of bowhead whale populations suggests increasing sea ice severity, and therefore a change to cooler environmental conditions (Dyke *et al.* 1996:236). Detailed palynological investigations of the Late Quaternary displacement of the boreal forest-tundra ecotone in Keewatin and MacKenzie regions indicate that climatic conditions improved again between 5000-3000 BP (Nichols 1975:70). Fossil evidence for the return of bowhead populations to the central channels of the Canadian Arctic Islands from 5000-3000 BP corroborate these palynological data (Dyke *et al.* 1996:235). The displacement of coniferous forests by arctic tundra illustrates that between 3500 - 2000 BP, climatic conditions began to deteriorate for a second time (Nichols 1975:70). Evidence for the exclusion of bowheads from the inter-island channels of the central Arctic at 3000 BP again corroborate these palynological data, and support the notion of cooler, drier summers during this period. However, warmer climatc conditions return in the Canadian Arctic between 2000 BP and 800-600 BP - a period in which forests migrated northward to limits beyond their present range (Nichols 1975:70).

After 800-600 BP, environmental conditions deteriorate yet again, and the Canadian Arctic moved into a period referred to as the 'Little Ice Age'. Lichen free rock areas on Baffin island suggest that as much as 70% of the island was covered by the Barnes icecap during the Little Ice Age. As only 2% of Baffin Island is presently covered by glacial ice, this would imply that much cooler conditions prevailed in the eastern Canadian Arctic during the 16th century (Grove 1988:255). Evidence for the climatic severity of the Little Ice Age can also be found in 16th century art. Pieter Bruegel the Elder, for example, depicted the visit of the three kings to the infant Jesus in two paintings; one painted before the great winter of 1564-5, and one painted after (Lamb 1982:224). Lamb (1985) suggests that the hardships suffered by Bruegel that season caused him to recast the second painting in the middle of a severe Flemish winter, as a means of emphasizing the poverty of Christ and his mother. Likewise, Lamb (1985) states that Charles Dickens' portrayals of "old fashioned winters" in many of his novels may have something to do with the fact that the first nine winters of his life (1812-20) were among the coldest Europe had seen since the 1690's (Lamb 1985:238). The 'Little Ice Age' also had a tragic impact on the Norse colonies of West Greenland. By the 14th century, the provisioning of the Greenland colonies was becoming increasingly difficult due to deteriorating ice conditions. In 1492, Pope Alexander VI spoke of his concern for the plight of the Greenlanders, because of the extensive freezing of the seas (Grove 1988:400). Ships visiting Greenland were few, and usually involved vessels that had been blown off course (Grove 1988:400). By the 15th century, historic accounts indicate that climatic conditions had deteriorated dramatically. Reports mention that the Denmark Strait separating Iceland and Greenland was frequently blocked by ice, and accounts also exist of Icelandic farms being overrun by advancing glaciers. Lamb (1985) suggests that the increased use of polar bear hides as carpets in Icelandic churches during the 14th century also implies increasing coastal sea ice, and the onset of cooler conditions. By AD.1540, the Norse settlements of West Greenland had been completely abandoned[2], and Greenland remained unoccupied by Europeans until the early 18th century, when trading posts were once again set up by

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2 For a more detailed overview of the abandonment of the West Greenland settlements, see McGovern (1981).

the Danish/Norwegian state (Lamb 1985:179).

The Effect of Biogeography and Climate Change on Arctic Architecture

Under certain circumstances, restricted access to construction materials important for building Thule semi-subterranean winter houses due to such factors as ice conditions, and the biogeographical distribution of bowhead whales, may have occasionally placed limitations on the design and construction of such dwellings. The bones of bowhead whales served as important construction materials for Thule groups living in driftwood-poor regions of the Canadian Arctic (Mathiassen, 1927). However, because bowheads are extremely sensitive to sea ice conditions, access to these animals (and the construction materials they provided) may have been more restricted during periods of environmental cooling, when ice conditions would have been more severe (Dyke *et al.* 1996). Likewise, Thule groups living on the margins of the ranges of bowhead whales would also have had more limited access to whale bone than Thule groups living within the areas adjacent to the summer feeding grounds of these mammals (McCartney and Savelle, 1993; Savelle and McCartney (1991,1994). Such factors may have required the alteration of the design and construction practices associated with Thule semi-subterranean winter houses, as their builders were forced to cope with less whale bone.

Among Thule and later Inuit groups, variability in the biogeographical distributions of focal animal resources such as the ringed seal, bowhead whale, and Peary caribou, necessitated the adoption of differing strategies of group mobility (see Savelle, 1987 for a detailed example). Mobility strategies impact on dwelling designs and construction practices in that semi-sedentary groups are much more likely to make greater investments in architecture than groups which are highly mobile (Kent, 1991; McGuire and Schiffer, 1983). Consequently, the semi-subterranean whale bone houses constructed by Classic Thule groups occupying semi-sedentary winter communities ostensibly represent a much greater investment in construction materials and labor than the transient snow house villages which later replaced them.

Summary

Climatic and biogeographic variables in the eastern Canadian Arctic bear on the design of both traditional Inuit and Euro-Canadian house forms. Climatic variables such as temperature, relative humidity, wind, and precipitation stress building materials in ways which can compromise the integrity of the building envelope. The degradation and distortion of the building envelope increases the heating and maintenance costs associated with keeping the building comfortable and inhabitable. Climatic variables such as relative humidity can also reduce the insulating properties of building materials such as sod, snow, and fiberglass batting. Precipitation (snow, rain) - especially when driven by wind, can restrict access to buildings by blocking entrances with drifting snow, seriously degrade the exposed surfaces of untreated construction materials, and limit the availability of snow suitable for the construction of *iglus*. Furthermore, the seasonal freezing and thawing of active layers above the permafrost table can severely alter the load-bearing capacity of the ground. In response, Euro-Canadian architects and engineers have devised a variety of strategies for supporting and stabilizing building foundations in arctic regions with varying degrees of success. These building strategies range from "space frame" steel piles and gravel pads to the artificial refrigeration of sites using buried blocks of carbon dioxide (minus 70^{0}C) (Strub 1996:119).

Climatic variables and climate change can influence the abundance and spatial distributions of animal species which serve as important sources of food and construction materials for prehistoric Inuit groups. Sea ice severity, an important factor determining the location and abundance of bowhead whales, may have occasionally placed limitations on the design and construction of such dwellings. As the bones of bowhead whales served as important construction materials for Thule groups living in driftwood-poor regions of the Canadian Arctic (Mathiassen, 1927), access to these mammals (and the construction materials they provided) may have been more restricted during periods of environmental cooling, when ice conditions would have been more severe (Dyke *et al.* 1996). Such factors may have required the alteration of the design and construction practices associated with Thule semi-subterranean winter houses.

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CHAPTER FOUR: NEOESKIMO PREHISTORY

Introduction

In Chapter 4, theories relating to the origins of Thule culture and its subsequent expansion into the eastern Canadian Arctic are summarized. This is followed by an examination of the socioeconomic configuration of Thule culture. The shifting of socioeconomic alliances associated with the emergence of historic Inuit cultures in the 16th century are next outlined, and theories pertaining to these changes reviewed. The purpose of Chapter 4 is to familiarize the reader with the prehistory of Neoeskimo groups inhabiting the eastern and central Canadian Arctic.

The Origins of Neoeskimo Culture.

Canadian Thule Culture emerged from two antecedent Alaskan cultures; Birnirk and Punuk, at about AD 900. Some researchers have suggested a stronger Punuk influence in Thule (Collins 1951, 1955, 1964; McCullough 1989; Schledermann and McCullough 1980; Yamaura, 1984), while others have argued that Thule is more consanguineous with Birnirk (Ford 1959; Stanford, 1976; Taylor 1963). If one takes the position that the affinities shared differ more in degree than in kind, then Canadian Thule culture can be viewed as an amalgamation of culture traits from both of these progenitors. Population pressure (Bandi 1969:80), trade opportunities, acquisition of valuable raw materials

(McGhee, 1984b), and/or ameliorating climatic conditions (McGhee 1969/70) resulted in the progressive eastward migration of Thule groups into the Canadian Arctic at about AD.1000 (McGhee 1969/70). Thule groups appear to have moved rapidly through this area, reaching Greenland by approximately AD.1200 (McGhee 1984:373). Based on the distribution of Sicco open-socketed harpoon heads, the Thule appear to have followed a northerly route through the Canadian High Arctic (McGhee 1969/70). However, strong affinities shared between Alaskan Thule and Canadian Thule Cultures in the Coronation Gulf region suggests the occurrence of a second migration out of Alaska, which appears to have followed a more southerly coastal route (Morrison 1983:271).

The "Classic" phase of Thule is characterized by large, coastally situated settlements organized around the pursuit of large baleen whales (Mathiassen 1927:87). However, regional surveys of the Canadian Arctic have revealed different degrees of whaling dependancy among Thule groups (McCartney and Savelle, 1985; Morrison, 1983; Savelle,1987; Savelle and McCartney, 1990,1988; Yorga, 1979). While Thule peoples inhabiting areas rich in bowheads appear to have engaged in active whaling, groups occupying regions such as King William Island and the Coronation Gulf area were far more reliant on caribou and seal (McCartney and Savelle, 1985; Savelle,1987; Savelle and McCartney, 1990,1988).

At about AD. 1500, a major shift in the subsistence-settlement systems of Thule groups occurred. Subsequently, whaling was abandoned in many regions of the Canadian Arctic, in favor of an increasing economic focus on ringed seals (Maxwell, 1985; McGhee, 1983; Savelle, 1987; Savelle and McCartney, 1991; Schledermann 1976a, 1979). The large coastally situated villages of Classic Thule times were replaced by snow house villages situated out on the sea ice. The semi-subterranean house was retained among Thule groups in areas such as the Bache Peninsula, and Northeastern Hudson Bay, but these dwellings were now constructed using sod and stone rather than whale bone (Boas 1964; Mathiassen 1927; Schledermann 1976a). The abandonment of whaling and the adoption of winter breathing hole sealing by Post-Classic Thule groups ostensibly changed socioeconomic relations in Thule society (Mathiassen, 1927; Maxwell, 1985; McCartney, 1977; Sabo and Jacobs, 1980; Schledermann, 1979) The flexible, community-based social relations of the whaling crew were replaced by a more rigid and complex set of dyadic sharing partners which were generally structured by kinship (Maxwell 1985:288). Contingent with this change may have been the replacement of the *community* with the *household* as a primary unit of economic production. These changes are associated with the emergence of ethnographically known Inuit cultures (Mathiassen, 1927; Van Stone, 1962), and have been variously described as an adaptive response to deteriorating climatic conditions (McGhee, 1983; Maxwell, 1985; Savelle and McCartney, 1991 Savelle, 1987 Schledermann, 1976a, 1979), and to centuries of exposure to European disease (McGhee 1994).

Thule Economic Systems

In his original definition of Thule Culture, Mathiassen (1927) viewed the hunting of Baleen whales as a principal component of many Neoeskimo economies. As proof of this, Mathiassen (1927:87) cited the large numbers of whale bones found within excavated semi-subterranean winter houses and middens, and the extensive use of whale bone in the manufacturing of Thule implements. However, Mathiassen's (1927) statement that Thule economies must also have included other marine mammals, "especially seals and walruses", as well as terrestrial mammals such as caribou, was generally overlooked in later years. Instead, the hunting of large sea mammals, specifically bowhead whales, became a persistent theme in discussions of Canadian Thule economic systems. This fact was not lost on Taylor (1966), who, in a David Doyle Memorial Lecture given at the University of Toronto, criticized studies of prehistoric and contemporary Inuit/Eskimo economies for having overemphasized sea mammal hunting. Taylor (1966) stated that a detailed review of ethnographic and archaeological data revealed that Inuit/Eskimo economies were actually "omnivorous" in character, emphasizing terrestrial mammals in some locales, and sea mammals in others (Taylor 1966:119).

A number of archaeologists have attempted to follow Taylor's (1966) lead by focusing their attention on both whaling and non-whaling variants of Canadian Thule Culture (McCartney and Savelle, 1985; Morrison, 1983; Savelle,1987; Savelle and McCartney, 1990,1988; Yorga, 1979). In some regions of the eastern Canadian Arctic, non-whaling and whaling variants of Thule Culture appear to have existed contemporaneously with one another. Thule groups inhabiting the western coasts of Somerset Island, for example, appear to have engaged primarily in whale hunting, while groups living on the Boothia Peninsula and King William Island relied much more heavily on the exploitation of caribou (McCartney and Savelle, 1985 Savelle,1987; Savelle and McCartney, 1990,1988).

Variability in prey selectivity among Thule groups that practiced whaling has also prompted Savelle and McCartney (1991) to distinguish further between "core", "intermediate" and "peripheral" whaling areas. After AD. 1500, whaling activities were abandoned in many areas of the eastern Canadian Arctic, in favor of winter breathing hole sealing (Mathiassen, 1927; Maxwell, 1985; McCartney, 1977; Sabo and Jacobs, 1980; Schledermann, 1979).

Whaling Systems

Thule whaling is perhaps one of the most contentious issues in Neoeskimo archaeology (see Freeman, 1979 versus McCartney, 1980). Vigorous debates surround estimations of the dietary significance of bowhead whales; the active hunting of whales versus the scavenging of whale bone from relic beach ridges; and the use of historic Alaskan whaling societies as analogues for interpreting the social and ideological facets of Canadian Thule society. McCartney and Savelle (1985) have suggested that the confusion over Thule whaling lies partially in the inconsistent ways in which Thule groups have been classified by Neoeskimo archaeologists (McCartney and Savelle 1985:39). For example, the Thule period (AD. 1000 to historic contact) has been variously subdivided into "Classic" and "Post-Classic" phases (McCartney, 1971), "early", "developed", and "late" phases, a "baleen" period (Schledermann, 1979), and a "Ruin Island, Resolute, Learmonth, Silumiut, and Clachan" phase (McGhee, 1984b; McCartney and Savelle, 1985:39). Not surprisingly, such inconsistencies in Thule nomenclature have generated a certain amount of confusion in the literature. The Thule type site of Naujan, for example, has been alternately referred to as "very early", "early", relatively early", "early Classic", "late Classic", "well established", "well developed", "fully developed", and "late Thule" (McCartney and Savelle 1985:39).

Within McCartney's (1977) classification scheme, it is hypothesized that whaling activity occurred most frequently in the eastern Canadian Arctic during the "Classic" phase, beginning at about AD 1000, and lasting until AD.1400-1700[3] (McCartney and Savelle, 1985; Schledermann, 1975). This idea has been challenged by Freeman (1979), who suggests that Neoeskimo archaeologists have failed to demonstrate adequately that Thule peoples ever engaged in the active hunting of whales. Essentially, Freemans's (1979:279) arguments can be broken down into four main points:

> 1) the notion of Classic Thule as a homogeneous whaling tradition is a generalization that stems from the excavation of only a few large winter village sites abundant in whale bone.
>
> 2) whaling communities require a diverse economic base, so that food and raw materials can be acquired during non-whaling periods, or in the event of unsuccessful whaling endeavors. Freeman (1979) claims that such economic diversity has been largely ignored by Neoeskimo archaeologists.
>
> 3) many researchers have failed to distinguish between a "whale hunting" and a "whale bone utilizing" society.
>
> 4) the demographic and cultural correlates present among ethnographically known whaling societies are largely absent in the Thule archaeological record.

3

The later date of AD. 1700 applies to areas adjacent to more open waters, such as southeastern Baffin Island, Labrador, and western Greenland (McCartney and Savelle, 1985:39)

The validity of the first two points is now widely accepted, and different degrees of whaling dependancy among Thule groups has been described (McCartney and Savelle, 1988; Morrision, 1983, Yorga, 1979). However, Thule archaeologists have contested Freeman's (1979) suggestion that there is little evidence that Thule groups ever engaged in active whaling. Freeman (1979) has suggested that whale meat and bones were likely acquired through the scavenging of drift carcasses and whale skeletons, stranded along relic beach ridges. That Thule groups engaged in the collection of naturally deposited whale bone for raw material is doubtless; whale bone is an extremely durable and long-lived material in the arctic (see McCartney, 1979). However, it seems less likely that drift carcasses served as the only source of whale meat/blubber for Thule groups. Rancid blubber can be associated with the formation of a deadly neuro-toxin produced by a strain of bacteria known as *Clostridium botulinum*. In 1908, for example, Stefansson (1908) reports that, upon returning to the Mackenzie Delta following a two year absence, eight of his Inuvialuit acquaintances had died following the consumption of a beached beluga whale carcass.

Recent work by Allen McCartney and James Savelle also demonstrates that at least some Thule groups were engaging in active whaling in the eastern Canadian Arctic (McCartney, 1980,1995; McCartney and Savelle, 1993; Savelle and McCartney,1991;1994). Savelle and McCartney (1991,1994) reasoned that the active hunting of bowheads versus the scavenging of whale bone from stranding locations should be reflected in the mortality profiles constructed from whale bones found at Thule sites. Using multiple regression formulae derived from the skeletons of bowheads of known length, estimations of the live lengths of whales represented at Thule sites were calculated based on a total of 354 crania and 784 mandibles (Savelle and McCartney 1994:289). Live lengths were then estimated from a sample of 231 Holocene-age bowhead specimens measured at a number of natural stranding localities (Savelle and McCartney 1994:289). Finally, the mortality profiles constructed for the Thule-derived and stranding-derived samples were compared with live whale length estimates from a living population of bowhead whales inhabiting the Beaufort sea (Savelle and McCartney 1994:293). Results indicate that the Thule-derived mortality profiles differed significantly from both the Holocene stranding population, and the live Beaufort sea population. The Thule profile demonstrated a marked preference towards yearling whales (6-9.4 meters) (Savelle and McCartney 1994:294; 1991:212). If Thule groups had obtained the majority of their whale bone from natural strandings, then the archaeological bowhead profile should have more closely resembled that of the Holocene stranded bowhead profile. In addition, the over-representation of yearling whales in the archaeological population suggests that Thule whalers were selectively hunting these younger, smaller whales (Savelle and McCarntey 1994:305). Such prey selectivity has been documented among ethnographically known whaling communities in Alaska - even though modern whaling equipment (bomb guns and block and tackle) allow for the taking of larger whales (Krupnik, 1993; McCartney, 1995; Worl, 1980). Within these communities, whalers state that yearlings are preferable to adults because of taste and high oil content, and are less risky to pursue, harpoon, and tow than older, larger whales (Krupnik 1993:6; McCartney 1995:92). The juvenile whale-biased mortality profile represented at Thule archaeological sites may also reflect the fact that young whales feed closer to shore, thereby making them easier targets to locate and harpoon (McCartney and Savelle 1985:45).

Savelle and McCartney's (1991,1994) biometric data is supported by similar work completed on the Chukchi Peninsula by Krupnik (1993). Krupnik (1993) adds, however, that the selective hunting of yearling bowheads represents an evolutionarily stable strategy, in that it would have ensured the survival of reproductively active adults. Given that the gestation period of bowhead whales is quite long, and that it takes many years for young bowheads to reach sexual maturity, the hunting of reproductively active adults could potentially have reduced the viability of local bowhead stocks. Krupnik (1993) asks if the deliberate hunting of yearlings represents fortuitous ecology, or a deliberate act by aboriginal whalers to ensure the continued availability of a critical resource. Regardless, evidence for the selective culling of yearling bowheads is perhaps the strongest line of evidence for active whaling among Thule groups in the eastern Canadian Arctic.

It should be mentioned that Savelle and McCartney (1991,1993) also identified variability in bowhead age selectivity among Thule sites located within the northern portion of their study area. While mortality profiles derived from Thule sites lying within the Crozier Strait; Barrow Strait; Lancaster Sound region still favored yearlings, higher overall frequencies of sub-adults and adults were recorded (18% of the sample, as compared with 7% of samples from other areas [Savelle and McCartney 1991:215]). Savelle and McCartney (1991) equate this variability with a lower whaling success rate; whaling success being defined as the ratio of "total number of bowheads to total estimated Thule populations" (Savelle and McCartney, 1991:214). Savelle and McCartney

(1991:215) speculate that the small numbers of Thule people inhabiting these northern areas would have had limited whaling opportunities due to labor shortages and poor ice conditions. Consequently, this would have forced them to be less selective in the ages/sizes of whales they hunted; taking more adult whales than groups living in areas where bowheads were more abundant (Savelle and McCartney 1991:215).

A more parsimonious explanation might be that Thule groups occupying "peripheral" whaling areas were forced to supplement the limited amount of whale bone they obtained through hunting, with whale bone collected from beach terraces. Unlike active whaling, where small whales were pursued because of low risk and taste preference, scavenging activities would have been far less selective, thereby resulting in the recovery of a much wider range of element lengths and sizes. Such a practice would conceivably generate a mortality profile similar to the one derived by Savelle and McCartney (1991;1994) for peripheral whaling regions. The hunting versus scavenging debate has definite implications for explaining variability in Thule architecture, and I return to this issue in Chapter 5.

In concluding this discussion of the debate over Thule whaling, it is worth outlining more direct lines of evidence for whale hunting in the eastern arctic. First is the occurrence of specialized whale hunting equipment in Thule archaeological sites. These include large harpoon heads armed with ground slate end blades and foreshafts (McCartney 1980:521). The association of such implements with whaling is based primarily on their size and, secondarily, on their stylistic similarity to whaling gear known ethnographically from Alaska (McCartney 1980:521). The direct association of *kayak/umiaq* parts, and drag float technology with whaling is more tenuous, in that such equipment is also necessary for the pursuit of smaller marine mammals (McCartney 1980:525). A second, somewhat less direct line of evidence for whaling exists in the form of whale hunting scenes carved into a number of Thule artifacts. Such engravings variously depict whalers in *umiaq*s pursuing, harpooning, and towing bowheads (Maxwell 1985:268; McGhee 1984b:76; McCartney 1980; 522-524). Five such illustrations are known from sites in the Canadian Arctic (Resolute Bay, Arctic Bay, Cape Dorset, Cumberland Sound, and Brooman Point [Maxwell 1985:268; McGhee 1984b:76]). While an argument can be made that these engravings represent only a familiarity with whaling, it seems more likely that they document scenes from Thule life.

The Whaling Crew as a Socioeconomic Unit

Prehistorically, the adoption of bowhead whaling among Punuk/late Birnirk groups and their Thule descendants required the reorganization of previously existing hunting roles. Among the Alaskan Inupiat, Spencer (1959) states that specialized task groups (whaling crews), formed through the establishment of economic and social relationships that cross-cut kinship boundaries, increased whaling efficiency by permitting whaling captains (*umialiq*s) access to skilled whalers outside of the confines of their own kin group. Damas (1972) refers to such arrangements as "voluntary associations", and he suggests that these forms of economic confederation are much more fluid in composition and membership than associations that are kin-based (Damas 1972:40). As an illustration of the type of social fluidity that characterizes volunteer associations, Spencer (1972) states that because *umialiq*s were in possession of capital, they could initiate bribes to lure skilled harpooners and crew members away from other *umialiq*s. Hence, the composition of a particular whaling crew could change on a seasonal basis.

Spencer (1972) explains that the political structures associated with whaling are embodied in three features; the presence of a hunt chief (*umialiq*), the formation of volunteer associations developed in the whaling crew, and the presence of a communal men's house (*karigi*). Historically, *umialiq*s are known as high status individuals who assumed the dual role of hunt chief and religious leader (Spencer 1972:115). Community feasts held at the *karigi* (communal structures owned by the *umialiq*) served to redistribute surpluses to members of the community. The size of the food shares were determined by an individual's contribution to the hunt and by his/her affiliation with the whaling crew (Gubser 1965:174-5). *Karigi*s were also centers for religious observances, the seasonal renewal/repair of whaling gear, dances, and other technical and ritual preparations associated with whale hunting (Sheehan 1985:128). Through its association with the *karigi*, the whaling crew assumed an economic importance throughout the year (Minc and Smith 1989:18). Thus, the religious ceremonies and economic endeavors led by the *umialiq* provided the social mechanisms necessary for integrating large numbers of people into the community. This, in turn, ensured the success of the whale hunt, upon which the survival of the community depended (Sheehan 1985:128).

Unlike Spencer (1959, 1972) who viewed the whaling crew as the ultimate instrument of economic, political, and social integration, Burch (1980) suggests that among

Northwest Alaskan groups, there was little integration at the societal level at all. Instead, local family segments were politically self-sufficient entities, who banded together only under threat of external conflict, or conditions of famine. According to Burch (1980:262-263), the smaller "domestic" family units which comprised these extended "local" families existed as a single conjugal group, which included a husband and wife, as well as grandparents and offspring. Domestic families occupied their own dwellings, which were built in clusters that were separated spatially from the dwellings of other local families (Burch 1980:262-263). These "family compounds" usually consisted of semi-subterranean houses, *karigi*'s, caches, and other storage structures. Burch (1980) explains that social barriers were erected around family compounds and that non-family members who entered them assumed the same risk of murder that threatened individuals traveling through other tribal territories. In fact, Burch (1980) claims that many of the "villages" reported by 18th and 19th century Euro-American explorers and traders may have represented single segmented, extended families. When different families did engage in cooperative endeavors, it was an *ataniq*[4] (foreman) rather than an *umialiq* who supervised the activity (Burch 1980:263). Thus, a complex network of affinal and consanguineal ties served to link local families within a community together. Hence, rather than cross-cutting different kinship groups, Burch (1980) states that whaling crews were kin-based groups drawn from within a *single local family*.

In constructing models of Thule Eskimo political, social, and ideological organization, it is my opinion that archaeologists have been more sympathetic to Spencer's (1959,1972)

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[4] Burch (1980:266) defines the *ataniq* as a leading expert on a particular type of activity.

position than Burch's (1980). However, Cassell (1988:107) suggests that the key to reconciling the views of Burch (1980) and Spencer (1959,1972) lies in the distinction between *real* (biologically-reckoned) and *ancillary* (fictive) kinship. To Cassell (1988:107), the volunteer associations which characterized whaling crew membership constituted a sort of *fictive* kinship which allowed *real* non-kin members to form alliances with other members of the community.

Regardless, Freeman (1979) has criticized Neoeskimo archaeologists for their uncritical use of Alaskan ethnographic and ethnohistoric data as interpretive analogues for Canadian Thule society. For example, although the whale cult was an important cultural institution in historic Alaskan whaling societies, little archaeological evidence exists to support its presence among Canadian Thule groups (Freeman 1979:283). McCartney (1980:528-529) acknowledges this fact, but states that the absence of archaeological evidence for whaling rituals may simply reflect the fact that many of the behaviors associated with such ritual practices leave few archaeological traces.

Freeman (1979) has also cited ethnographic evidence which suggests that many Thule communities would have been too small to muster the labor necessary to engage in consistently successful whaling endeavors. Freeman (1979) bases this statement on the comparison of McGhee's (1976:116) estimate of Thule site sizes (4 to 5 winter dwellings housing 20 to 50 people) to similar population estimates for 18th century Labrador Inuit calculated by Taylor (1974). Freeman (1979) attributes the low whaling success rate among Labrador Inuit to their small settlement sizes, implying that this was also a pertinent consideration among earlier Thule groups. However, a more detailed examination of the ethnographic record reveals that Labrador Inuit were sometimes able to take a whale using a single *umiaq*, although their chances of success greatly increased with the assistance of other *kayaks* and *umiaq*s (Taylor, 1974).

The ethnographic record also reveals a great deal of variability among estimations of the requisite community size necessary for whaling activities. Ellanna (1988:82) argues that successful bowhead whaling among various Alaskan communities requires a minimum of 5-8 *umiaq*s each crewed by 7-8 hunters, resulting in a total of 50-62 hunters. Using the historic ratio of two dependants for every hunter, Ellanna (1988) estimates a total community size of 150-162. This stands in marked contrast to estimates of minimum population levels required for bowhead whaling by Labrador Inuit. Utilizing 18th century Moravian missionary data, Taylor (1974) states that a community size of 48 individuals appears to have been sufficient for active whaling along the coasts of Labrador. While population sizes for Labrador Inuit whaling settlements more commonly ranged from 51-104, with an average of 75 individuals (Taylor 1974:64), these estimates are still considerably lower than those quoted by Ellanna (1988). Furthermore, ethnographic evidence from other circumpolar regions provides examples of groups whaling with as little as a single *umiaq* (Krupnik 1993:4), or groups of single hunters in *kayaks* (Parry 1824; Boas 1974:449).

It is foreseeable that small Thule communities could have pooled their labor, and cooperatively engaged in whaling activities from a single location (McGhee 1984b:82). The formation of whaling crews of mixed gender may also have facilitated the success of whaling activities under conditions of labor shortage. While many ethnographies suggest that women were barred from whaling because of ritual prohibitions (Taylor, 1985; Lantis, 1938; Boas, 1974[1888]) or its perceived danger (Guemple 1986:13), Edege's (1745) illustration of an *umiaq* propelled by women suggests that this may not always have been the case. Similarly, McClure (1969[1856]:93) observed Nuvorugmiut women paddling *umiaq*s that were engaged in the pursuit of bowheads off of Cape Bathurst. The selective culling of yearlings (Savelle and McCartney, 1991,1994) from a baleen whale species already noted for its docility and lethargic nature suggests that successful whaling endeavours could have been realized by small crews of mixed gender. These examples appear to support Taylor's minimum population estimates for whaling, thereby making it probable that at least some Thule groups had populations large enough to hunt whales.

The Thule-Inuit Transformation

Climatic Change

It has been hypothesized that with the advent of the "Little Ice Age" between AD. 1400 and 1600, a general cooling of annual temperatures regimes generated ice conditions that selected against open water whale hunting in many areas of the eastern and central Arctic (McGhee, 1984; McCartney 1977; Schledermann 1976a,b,1979; Taylor, 1965). In addition to constraining the seasonal movements of bowhead whales, the increasing size of drift-ice fields would have made hunting from *umiaq*s and *kayaks* difficult or even dangerous. Alternatively, the onset of cooler temperatures served to increase the stability and longevity of fast-ice forming along the shorelines of many eastern and central Arctic localities. This created more favourable habitats for ringed seals, which assumed a new economic importance among Thule groups that had previously depended on whaling (Maxwell, 1985; McGhee, 1983; Schledermann, 1976). In many areas, the large coastal villages of the Classic phase were abandoned in favour of snow house villages situated out on the sea ice. Semi-subterranean winter dwellings continued to serve as a primary winter house form in a few regions; for example, the Bache Peninsula and northern Hudson Bay. However, these houses were now constructed primarily from sod and stone, rather than whale bone.

Maxwell (1985) has remarked that the estimates of Thule winter village sizes during the Classic phase (4-6 houses) derived by McGhee (1976) and McCartney (1979) stand in vivid contrast to the large Netsilingmiut and Iglulingmiut snow house villages that were documented ethnohistorically. Situated on the sea ice, such villages are reported to have been occupied by as many as 50 to 200 hundred people (Damas 1969a:51). Consequently, Maxwell (1985) feels that there may have been a major change in the social system between the Classic and Post-Classic phases of Thule Culture. Larger aggregations of people at winter sites would have meant an increase in the sphere of social interaction. This may explain the emergence of more rigid social arrangements like seal meat sharing partnerships, as the potential for interpersonal conflict and the threat of feud would have been augmented.

Across the North American Arctic, Thule groups began to adapt to specific regional ecological conditions, and this eventually lead to the ethno-genesis of such groups as the

Copper Inuit[5], Netsilingmiut, Aivilingmiut, Sadlermiut, Iglulingmiut, and Nugumiut (McGhee, 1984).

Exposure to European Disease

Rasmussen (1929), Mathiassen (1928), Jenness (1924) and others have commented on the fact that many facets of Central Inuit Culture appear impoverished when compared to those of the Alaskan and Greenlandic Eskimo, and the earlier Thule Culture. Rasmussen (1929:251), for example, remarked on the incoherence of central Arctic Inuit folklore, and is said to have been "appalled" by the shortness of memory, and the lack of interest in mythology and tradition displayed among the central Inuit groups he encountered during his stay in the Canadian Arctic (cited in McGhee 1994:567). Mathiassen (1928:103) also alluded to the technical and artistic inferiority of Iglulingmiut material culture, as compared with that of the antecedent Thule Culture. According to Mathiassen (1928:103), many articles displayed "very poor craftsmanship", were "badly and carelessly finished", and held a disregard for "beauty and form of decoration".

McGhee (1994:567) has recently stated that the absence of a mechanism to tie environmental change to such degenerative changes in mythology and craftsmanship suggests that other factors may instead bear on the emergence of central Inuit Culture from ancestral Thule groups. McGhee (1994) also questions the impact of the Little Ice

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The Copper Inuit are unique in that they are characterized by ephemeral leadership, nuclear family household organization, agamous marriage practices, and neolocal residence patterns (Stevenson 1997:19).

Age on the abandonment of whaling by central Inuit groups; a subsistence practice he equates with a greater economic security than winter breathing hole sealing. Reports by 18th and 19th century European whaling ships, for example, suggest that during the height of the Little Ice Age, areas once supporting Thule villages still contained large numbers of whales (McGhee 1994:567). As an alternative, McGhee (1994) suggests that the emergence of central Arctic Inuit Culture from Thule is largely a product of centuries of exposure to European disease. Incipient contacts with Europeans as early as the 16th century, coupled with an increased susceptibility to alien diseases because of low population densities, and a high genetic uniformity, resulted in a prolonged period of culture stress among late Thule groups. McGhee (1994) feels that this is a much more satisfactory explanation for the development of Inuit Culture because it moves beyond simple environmental determinism, and acknowledges the fallacy of the notion that Inuit groups were pristine isolates in the 19th and early 20th centuries.

While McGhee's (1994) argument is intriguing, it also somewhat problematic. For example, the existence of complex dyadic sharing rules, and the construction of large composite snow house villages housing as many as 200 individuals suggests a greater level of social complexity among central Arctic Inuit than McGhee (1994) seems willing to acknowledge.

The Extended Family (Ilagiit) as a Socioeconomic Unit

The increasing importance of winter breathing hole sealing ostensibly required a renegotiation and transformation of the economic and social relations defined previously by whaling (Maxwell, 1985). The writings of Damas (1963, 1971, 1975a, 1975b) and more recently Wenzel (1981, 1991) have explored the ways in which traditional Inuit kinship formations structure the organization of subsistence activities, and the distribution of foodstuffs. Damas (1971), Wenzel (1981) and others have identified the extended family, or *ilagiit*, as the essential socioeconomic unit within historic and contemporary Inuit societies (see also Balikci 1964; Briggs 1970; Damas 1969b,c). Damas (1971:65-6) states that even during periods of the year in which the extended family temporarily separated into nuclear families, which then dispersed across the landscape to engage in caribou hunting and fishing, subsistence activities continued to be regulated within the organizational framework of the *ilagiit*.

Wenzel (1981:86) states that the internal cohesion of the extended family (*ilagiit)* is strengthened by two principal features of Inuit kinship; the *nalartuk* axis and the *ungayuk* axis. While these two features appear to contradict one another in terms of how they operate, Wenzel (1981:86) explains that they actually strengthen the solidarity of the extended family by patterning ecological activities in productive ways. The *nalartuk* axis is associated with leadership and decision-making, and constitutes a respect-obedience dyad between father-son and father's brother-brother's son (Wenzel 1981:86). Within the *ilagiit*, this respect-obedience subsystem is essentially focussed on a single individual - the *isumataq*. The *isumataq* is the eldest and most experienced male hunter within the extended family, and his duties included: 1) keeping people out of danger; 2) showing people how to do things; 3) decision-making; 4) settling or preventing internal disputes;

and 5) taking care of food (Wenzel 1981:91-92). Accordingly, the knowledge and wisdom of the *isumataq*, combined with the respect and obedience he is afforded, served to guide individuals engaged in subsistence activities. Given that flexibility is necessarily adaptive in Inuit socioeconomic arrangements, Wenzel (1981:87) states that the rigidity of the *nalartuk* subsystem should not be overemphasized. Such rigidity is modified through the *ungayuk* subsystem in which affectional solidarity is displayed within the context of same-generation relations - namely cooperative labour and voluntary associations. Thus, *nalartuk* and *ungayuk* subsystems worked together within the *ilagiit*, thereby allowing it to function simultaneously as a socioeconomic entity, and as a kinship formation (Wenzel 1981:86).

The seal meat sharing partnerships documented among such central Arctic Inuit groups as the Netsilik and Copper Inuit (Rasumussen, 1931; Balikci, 1970; Damas 1972) embody aspects of both the *nalartuk* and *ungayuk* subsystems. To illustrate, while the complex dyadic relationships which comprised Netsilik seal meat sharing partnerships were usually structured formally by kinship factors, Copper Inuit seal meat sharing partnerships, while highly structured, appear to have operated without consideration of kinship factors (Damas 1972:47). Among the Netsilik, seal meat sharing partners were commonly members of similar age-cohorts, and were referred to as *niqaiturvigiit* (Damas 1972:46). Seals were generally cut into 14 portions, with each piece bearing a particular sharing name. Individuals had an equal number of partners, all of whom were named after a specific portion of the seal (Balikci 1984:424).

The relationships held between seal meat sharing partners bore a social importance in daily life, and Balikci (1970) states that sharing partners frequently referred to each other by their sharing name. The man who obtained *aksatkolik* (shoulder part), for example, was referred to as *aksatkolik*, by his dyadic sharing partner (Balikci 1970:135). The fact that seal meat sharing associations were multi-generational illustrates the economic and social rigidity of the relationships they generated. Balikci (1970) reports that if a partner died, a brother or individual with the same sharing name as the deceased would replace him. Furthermore, hunters who became sharing partners would often make their sons sharing partners (Balikci 1970:136). Thus, while seal meat sharing partnerships functioned to smooth out nutritional imbalances produced by variation in hunting success, the alliances that were formed also served to integrate families within the band, by diffusing suspicion, jealousy, and hostility. Social tension was alleviated because individuals could now predict with certainty how others would relate and respond to them.

Summary

Canadian Thule Culture emerged from two antecedent Alaskan cultures; Birnirk and Punuk, at about AD 900. Population pressure and/or ameliorating climatic conditions resulted in the progressive eastward migration of Thule groups into the eastern Canadian Arctic at about AD.1000. Thule groups appear to have moved rapidly through this area, reaching Greenland by approximately AD.1200. The "Classic" phase of Thule is characterized by large, coastally situated villages organized around the pursuit of large baleen whales. At about AD. 1500, a major shift in the subsistence-settlement systems of Thule groups occurred. Whaling appears to have been abandoned in many regions of the Canadian Arctic, in favor of an increasing economic focus on ringed seals. The large coastally situated villages of Classic Thule times are replaced by snow house villages located out on the sea ice. The semi-subterranean house is retained among Thule groups in areas such as the Bache Peninsula, and Northeastern Hudson Bay, but these dwellings are now constructed using sod and stone rather than whale bone. The abandonment of whaling and the adoption of winter breathing hole sealing by Post-Classic Thule groups ostensibly changed socioeconomic relations in Thule society. The flexible, community-based social relations of the whaling crew were replaced by a more rigid and complex dyadic relation based on inter-generational sub-ordinance (*nalartuk)* and solidarity within kindred (*ungayuk)*. This would seem to suggest that the essential socioeconomic unit in Thule-Inuit society moved from the community-based relations of the whaling crew to the household-based relations of the extended family (*ilagiit)*. These changes are likely associated with the emergence of ethnographically known Inuit Culture, and have been variously described as an adaptive response to deteriorating climatic conditions, and centuries of exposure to European disease.

CHAPTER FIVE: THE SEMI-SUBTERRANEAN WHALE BONE HOUSE - ARCHITECTURAL VARIABILITY AT TWO THULE SITES

Introduction

Chapter 5 (Case Study#1) begins with a brief overview of the architectural attributes of the semi-subterranean whale bone house; the *qarmat* (autumn house), and the snow house. This is followed by a description of the location, environmental setting, and history of investigation of the two Classic Thule sites drawn upon for this study; the Deblicquy site (QiLe-1) and the Black Point site (QkLe-1). The methodology employed for recording and analyzing whale bone house architecture at each site is next outlined. An analysis and interpretation of architectural variability among houses within each site is then provided, using digitized plan drawings of these dwellings, and the multivariate statistical analysis of selected architectural attributes. This is followed by the analysis and interpretation of architectural variability between houses at the Deblicquy site and the Black Point site.

A Dynamic Consideration of Thule Whale Bone Houses

Traditionally, Thule semi-subterranean winter houses have been treated as static constructions; passive repositories of artefacts which could be used to establish new regional chronologies, or further refine existing ones. In 1979, however, Allen P. McCartney suggested that the detailed study of the various processes involved in the "life histories" of whale bone houses would be a profitable avenue of research for arctic archaeologists. Taking his lead from Schiffer (1976), McCartney (1979:304) argued that such features existed within a dynamic and systemic framework of human behaviours and activities. McCartney (1979:305) went on to define six time-ordered stages of human activity associated with Thule semi-subterranean whale bone houses, with each stage comprising a "whale bone house system". These stages include: 1) procurement of building materials, 2) construction, 3) use, 4) possible reuse, 5) abandonment/destruction, and 6) post-occupational erosion (McCartney 1979:305).

When combined with McGuire and Schiffer's (1983) theory of architectural design[6], McCartney's (1979) dynamic conceptualization of Thule winter houses gains further significance for interpreting variability in Thule architecture (Figure 2). To recapitulate, *production, use* and *maintenance* constitute three interdependent activity sets which relate to the built environment (McGuire and Schiffer 1983:278). Within the context of each activity set, individuals attempt to maximize certain goals. However, because it is impossible to maximize all goals simultaneously, the maximization of one goal is usually achieved at the expense of the others (McGuire and Schiffer 1983:278). Limitations placed on the procurement of specific types of building materials (stage 1), for example, may require that the design and construction of the dwelling (stage 2) be modified in order to accommodate such shortages. These compromises may subsequently impact on the symbolic and utilitarian functions of the structure (stage 3) through potential reductions in floor area, spatial partitioning, thermal efficiency, or architectural

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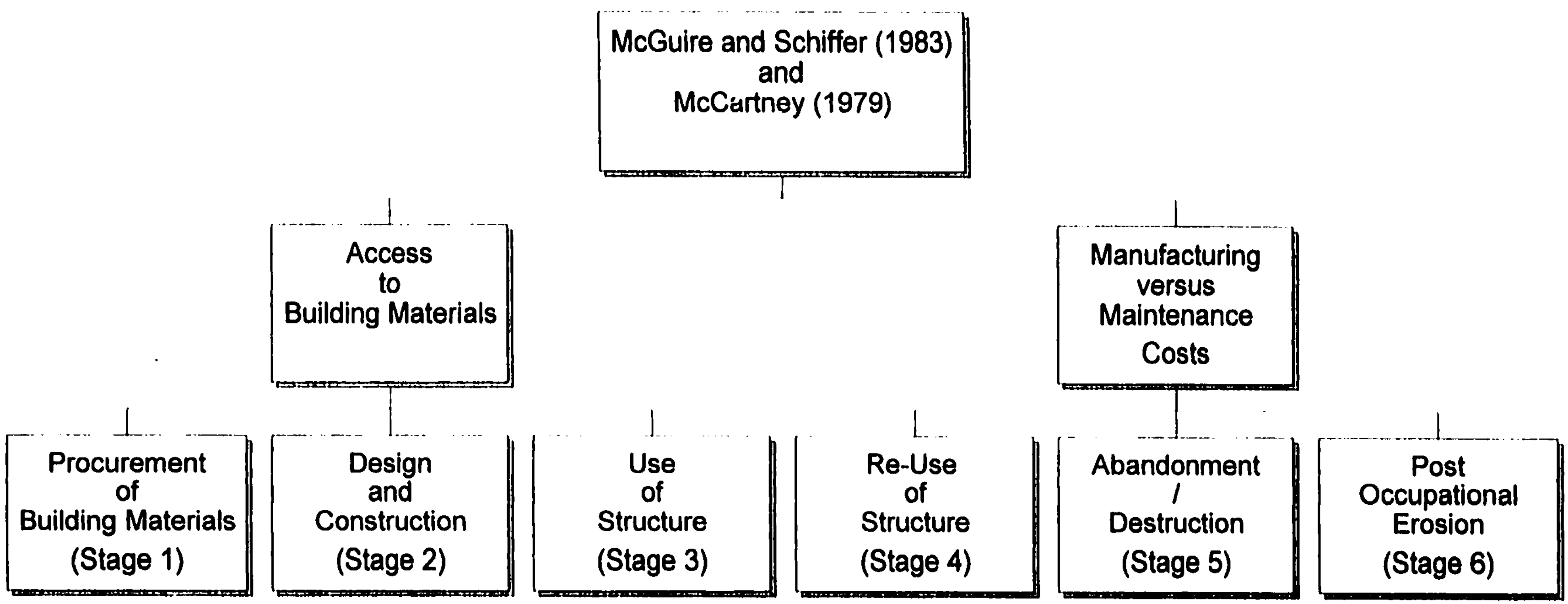
[6] Refer to Chapter 2 for complete overview

FIGURE 2. Proposed Model for Examining Architectural Variability in Thule Whale bone Houses



investments in symbolism (decoration, use of exotic construction materials, etc). Furthermore, the decision to reuse (stage 4) or abandon/destroy (stage 5) a dwelling is mediated, at least partially, by manufacturing and maintenance costs. According to McGuire and Schiffer (1983:282), the primary goal of production is to *minimize* the cost of the manufacture process; measured in construction time and value of building materials, whereas the main objective of maintenance is to *minimize* the cost of keeping the building functional. Since the reduction of maintenance costs requires that the builder increase his/her investment in the manufacturing process, these two goals are somewhat contradictory (McGuire and Schiffer (1983:282). Consequently, structures are sometimes abandoned when costs accrued in their maintenance supercede those associated with manufacturing a new one.

To summarize, limitations imposed by construction techniques and the availability of building materials, coupled with the inverse relationship between manufacture and maintenance, influence decisions relating to the procurement, construction, use , reuse, and abandonment stages of a whale bone house. This would seem to have three important implications for understanding variability in Thule architecture.

First, whale bone; a construction material of critical importance to Thule builders, was likely procured through either active whale hunting; the scavenging of naturally stranded whales, or the mining of abandoned semi-subterranean houses. However, sea ice severity, an important determinant in the biogeographical distribution of bowhead whales (see Dyke *et al.* 1996) may have placed limitations on the availability of whale bone in different regions of the Canadian Arctic, at different time periods. Furthermore, Thule peoples moving into regions unoccupied previously would have been unable to make use of building materials from abandoned houses. Under such circumstances, Thule builders may have had to alter certain aspects of the design of their semi-subterranean winter houses in order to accommodate shortages in the availability of elements important in construction (i.e mandibles, maxillae and skull bases). These modifications, in turn, may have influenced how such houses were used, when they were used, and how long they were used.

Second, because groups may have been less likely to abandon houses which reflected large investments in labour and construction materials, Thule dwellings with high manufacturing/low maintenance costs may have had longer anticipated use-lives than dwellings with low manufacturing/high maintenance costs.

Third, the decision to abandon a Thule winter dwelling may have been at least partially mediated by accelerating maintenance costs, with abandonment occurring when those costs became too high.

Thule Winter House Forms

The Semi-Subterranean Whale Bone House

Of the three winter dwelling types recognized by Neoeskimo archaeologists, the semi-subterranean house is perhaps the most thoroughly investigated. Constructed from sod, stone, and whale bone, these robust structures were used primarily as winter dwellings during the Classic Thule period. Mathiassen (1928:132-133) originally viewed the geographical spread of the semi-subterranean winter house as extending across the North American Arctic to Greenland, and attributed variability in the forms taken by these dwellings to constraints imposed by locally available building materials. For example, Mathiassen (1928:153) felt that the rectilinear driftwood houses of Pt. Barrow, Alaska, and the Mackenzie Delta region, and the ovate dwellings of the central and eastern Arctic were simply "coordinate forms of dwellings born of different materials", mainly because "walls built from whale bone can never be straight; the whale skull, jaw bones, and ribs will naturally compel the form of the house to be round". Comparisons of semi-subterranean house architecture from such progenitors of Canadian Thule culture as Okvik/Old Bering Sea (Rainey 1941:469), Birnirk (Ford 1959:67-68) and Western Thule (Dumond 1977:133) demonstrate that Mathiassen's (1928) observation is largely correct. To illustrate, while the winter house forms constructed by these antecedent cultural groups vary in shape (rectilinear to cruciform), they nevertheless share certain architectural attributes with Canadian Thule winter houses. These include semi-subterranean living spaces; sunken entrance tunnels (which served as cold traps, and as storage areas); paved floors; discrete 'kitchen' areas; and sleeping areas (either elevated platforms or on the floor) situated at the rear of the structure, or along its side walls. Hence, the architectural attributes of Thule semi-subterranean dwellings have been used by many researchers to infer cultural and historical relationships with earlier groups (Mathiassen, 1928; McCullough, 1989; McGhee, 1984; Steensby 1917), as well as interpret Neoeskimo subsistence-settlement systems and social organization (Greir and Savelle, 1994; Savelle, 1987; Savelle and McCartney, 1988).

Construction Techniques

While it has been over 70 years since Therkel Mathiassen and Peter Freuchen conducted the first extensive analyses of Thule semi-subterranean winter houses, Arctic archaeologists today still know comparatively little about how these enigmatic dwellings were roofed and constructed. This is due largely to the fact that whale bone is an extremely durable and long lived resource in arctic regions which can be reworked into a variety of objects such as sled shoes and, in recent years, carvings. It is not surprising then, that many Thule semi-subterranean dwellings were extensively mined for whale bone during the centuries which followed their abandonment (McCartney 1979: 303,307). This has severely reduced the number of 'intact' dwellings which have been encountered by archaeologists. Of the forty three houses excavated during the Fifth Thule Expedition, for example, only a single house on Southampton Island had any of its original roof supports remaining (Park 1988:164). Semi-subterranean houses which have been reported in relatively undisturbed contexts include Taylor's (1960) description of several Sadlermiut houses on Southampton Island, and an undisturbed whale bone house at Izembek Lagoon in Alaska, reported by McCartney (1979). These examples, coupled with attempts at experimental reconstruction (McGhee, 1984), and the micro-stratigraphic excavation of selected Thule houses (Habu and Savelle 1994) have provided Neoeskimo archaeologists with some insights into Thule construction practices. McGhee (1978:92,95) provides a summary of the generally accepted method of construction:

> The roof of the house is dome-shaped, held up by rafters of whale jaws and ribs set into the stones of the outer wall and tied together at the top. This frame was covered with skins, then with a thick layer of turf and moss, and finally probably thickly banked with snow. Such a house must have been almost perfectly insulated and probably required a ventilation hole in the roof.

Habu and Savelle (1994:11) describe the interior of the house as consisting of a flagstone floor overlying a bed of gravel, with a tunnel excavated into the structure to provide entrance and exit. A layer of grease with baleen and skin fragments may also have occasionally been laid down overtop of the flagstone floor. Next, the mandibles and maxillae used to form the superstructure of the dwelling would have been countersunk into the edge of the house mound, cantilevered inward, and braced using rocks and vertebrae (Habu and Savelle (1994:11). Once the distal ends of the jaw bones had been lashed together at the apex of the structure, ribs would have been fastened as cross pieces to the main support beams. At this point, Habu and Savelle (1994:11) explain that the stone and whale bone bench supports and stone bench seats were probably added. While skull bases were commonly used as wall supports, their occasional placement over entrance passages suggests that they may have also served a symbolic function in Thule architecture (McCartney 1979; Habu and Savelle, 1994). While the use of side benches in place of a rear sleeping platform likely distinguishes *karigi*, or communal men's houses, from habitation dwellings (Habu and Savelle 1994:11), it seems logical to assume that similar construction techniques would have been used to roof both types of dwellings.

McCartney (1979:305) estimates that the superstructures of Thule dwellings likely incorporated a minimum of 20 mandibles, reflecting roughly 15-20 whales-worth of construction material per house. Experimental reconstructions attempted by McGhee (1984:21), however, suggest that Thule houses could have been roofed with far fewer mandibles and maxillae. By altering the hemispherical shape of the superstructure to that of a fairly flat roof, McGhee (1984:21) found that as few as six mandibles could be used. McGhee's (1984) design, suggested by the positions of the roof beams of a semi-subterranean house at Brooman Point, Bathurst Island, utilized a single long mandible to span the front half of the house. With both ends of this central beam supported on piles of rock, the other five mandibles were propped up along its length, with their lower ends resting along the top of the house wall. McGhee's (1984) roofing hypothesis was further substantiated by Park (1988:166), who states that the positions of mandibles and maxillae among Thule houses at Porden Point, Devon Island imply the use of a similar type of roof architecture. Park (1988:166) points out that this type of roofing design has two important consequences for the interpretation of Thule architecture. First, in order to increase the roominess of the interiors of dwellings constructed in this fashion, raised rock and dirt walls would have had to have been constructed. Park (1988) states that the second point follows the first, in that the thick layers of fill found within collapsed Thule houses may be attributable to the toppling of such walls, rather than from the earthen roofs proposed for domed structures. Citing 16th century ethnohistoric accounts of semi-subterranean dwellings, Park (1988:167) also questions whether, in fact, many Thule houses ever possessed much more than skin roofs. However, as Habu and Savelle (1994:11) point out, it seems unlikely that Thule peoples would have built such massive and robust superstructures to support such light roofing materials.

The Functional Aspects of Thule Whale Bone House Design

Semi-subterranean structures generally lose far less heat than buildings constructed above ground (Underground Space Centre, University of Minnesota, 1979; Farwell, 1981; Gillman, 1987). This thermal efficiency is due largely to the fact that at some distance below ground, soil remains at a consistent temperature throughout the entire year. Thus, semi-subterranean houses are able to maintain stable interior temperatures fairly easily; a characteristic which is further aided by the reduction of air travelling through cracks and holes in walls (Gillman 1987:542). Semi-subterranean houses also take advantage of the fact that soils surrounding the excavation act as a "heat sink" (Gillman 1987:542). When air temperatures drop during winter months, the soils in which temperature is not held constant can take as long as three months to reach their annual low. During this time period, this 'stored heat' is radiated back into the interior of the semi-subterranean dwelling (Gillman 1987:542). The ovate floor plans and 'hemispherical' shapes of many Thule semi-subterranean houses have additional advantages, in that they possess a greater ratio of volume to surface area than dwellings of other shapes. Consequently they require far less building material for their construction (McGuire and Schiffer 1983:284; Strub

1996:99-100). Figure 3 provides an illustration of this important concept. Of the five sample floor plans shown, the circular plan with a perimeter to area ratio of 1.8 encloses the given floor area with the least length of wall (after Strub 1996:100). This is in contrast to the plan with the irregular 'stepped' side, which requires a 40 percent longer wall to enclose the same area. As the volume of a dwelling decreases, the influence of the surface increases, resulting in greater heat loss (Strub 1996:101). Consequently, the large volume to surface areas of many Thule semi-subterranean houses serves to further reduce heat loss. In addition, because they lack edges, corners, and large flat surfaces, dome-shaped dwellings are also extremely resistant to wind and snow loading (McGuire and Schiffer 1983:284).

Hemispherical structures do, however, have a number of disadvantages. McGuire and Schiffer (1983:285), for example, state that domed buildings have higher maintenance costs than other types of dwellings because they are often constructed from perishable materials. While this may be true for other regions of the world, the strength and durability of whale bone suggests that this would not have been the case for many types of Thule semi-subterranean dwellings. In addition, the ratio of volume to surface area in domed structures severely reduces the amount of usable interior space because of the reduction in headroom towards the edges of the structure (McGuire and Schiffer, 1983:284). Domes are also extremely difficult to subdivide internally, making storage, privacy regulation, and the spatial segregation of incompatible activities, much more difficult than in rectangular structures (Hunter-Anderson, 1977; McGuire and Schiffer, 1977). Archaeological investigations of bi-lobed and tri-lobed Thule semi-subterranean

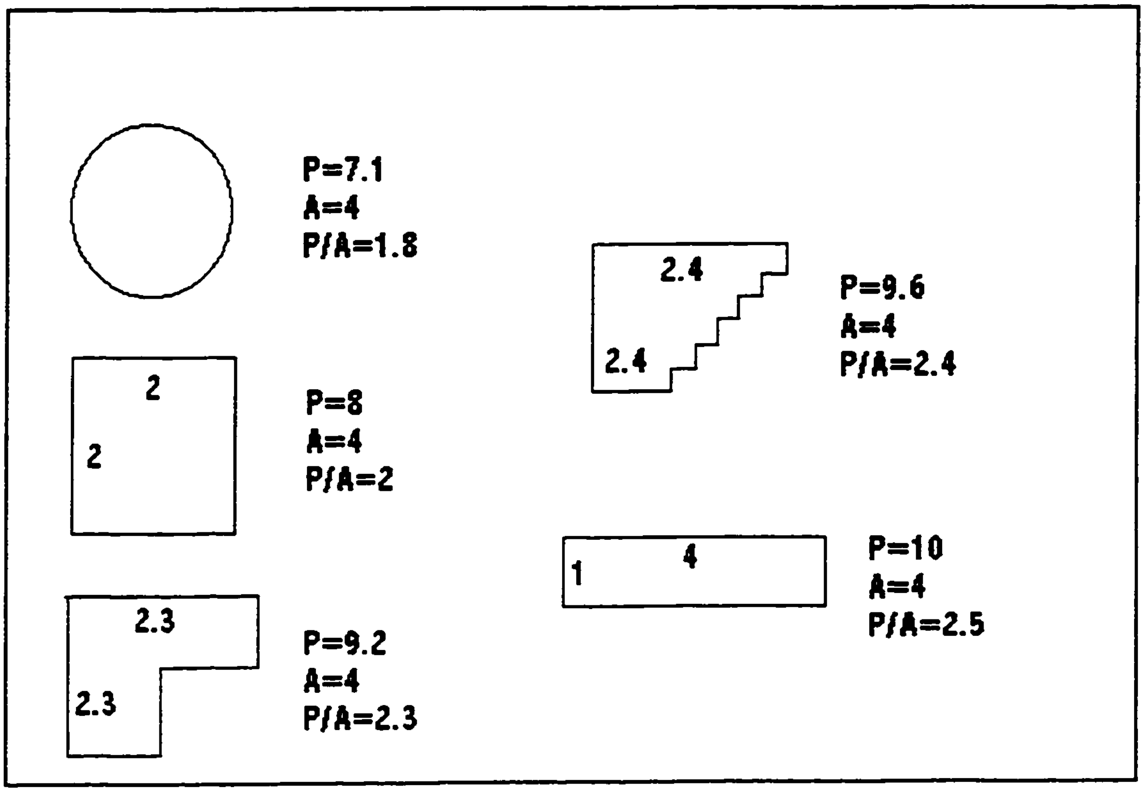


FIGURE 3. The relationship between floor plan and perimeter to area (P/A) ratios. Each of the five floor plans has the <u>same</u> floor area (4 units) but <u>different</u> P/A ratios. Higher construction costs are associated with longer perimeter walls (after Strub 1996:100)

houses, and ethnographic descriptions of multi-domed snow house complexes in the central Canadian Arctic, however, suggests that some of these problems were at least partially overcome through the practice of agglomerating various domes together.

The Qarmat (autumn house)

A second habitation structure, the *qarmat*, may have been associated with transitional seasonal periods in which it was too warm to continue living in semi-subterranean houses, yet too cool to move into skin tents (Mathiassen 1927:133). The dual use of the snow house and *qarmat* among some historic Inuit prompted Mathiassen (1927:133-134) to suggest that *qarmat* were intrinsically linked to the "snow house culture" of the central Arctic region, and that it represented a "relic" of Thule culture which had been absorbed by historic Inuit groups. *Qarmat* are perhaps the most enigmatic type of habitation used during the Classic Thule period (Park 1988:165). Mathiassen (1927:133) suggested that *qarmat* could be distinguished from "true" semi-subterranean winter houses on the basis of the depth of the house depression. Mathiassen (1927) reasoned that because *qarmat* were roofed with skins, their house pits "would not be so flattened out as winter houses, as the fallen-in roof has not filled the interior of the house". In addition, Mathiassen (1927) explained that because *qarmat* were used only temporarily, they tended to be more "roughly built" than true winter houses. Schledermann (1976a: 43-44) has since suggested that the *qarmat* was a late development among Thule groups, and that it gradually replaced the semi-subterranean house as the primary form of winter dwelling. This seems to be supported by ethnographic observations of late 19th century Inuit on Baffin Island, in which the primary form of winter dwelling seems to have been either the *qarmat* or the snow house (Mathiassen 1927:136-138; Park 1988:165).

Construction Techniques

Historically, *qarmat* have been described as constructed from snow, or blocks of ice, and enclosed with a roof of caribou hide (Schledermann 1976a). *Qarmat* were sometimes built into the house pits of abandoned semi-subterranean winter dwellings, and erected using materials mined from these preexisting structures (Mathiassen 1927:133; Savelle 1987:58; Schledermann 1976a: 43). House pits for *qarmat* constructed in this manner were thus of comparable depth to semi-subterranean winter houses. Park (1988:165), however, states that *qarmat* were not always semi-subterranean, and were occasionally erected on the surface. Maxwell (1985:287) provides an illustration of a reconstructed *qarmat* from the Ruggles Outlet site on northeastern Ellesmere Island, in which the roof was supported by three upright poles; the centre pole being the tallest. Alternatively, Boas (1964 [1888]:142) presents sketches of *qarmat* in which whale ribs were utilized to form the superstructure of the dwelling. Once the roof support had been assembled, a double layer of skins was next stretched over the house frame, and the spaces in between the two skins filled with moss and heather for insulation (Boas 1964 [1888]:141). Although it is unclear as to whether *qarmat* possessed true cold trap entrance tunnels, descriptions of these structures by Boas (1964 [1888]: 142) seem to suggest that rudimentary entrance tunnels constructed from snow were sometimes used. The internal spatial organization of the *qarmat* appears to have been identical to that of the semi-subterranean winter house; with a raised sleeping platform at the rear of the dwelling, and a cooking area towards the front and to one side of the entrance (Maxwell 1985:286; Park 1988:165). As mentioned previously, degree of permanence and the use of a skin roof have been cited as attributes which distinguish *qarmat* from other semi-subterranean winter house forms (Mathiassen 1927; Schledermann 1976a). A 16th century account by George Best, however, implies that in some regions of the Canadian Arctic, *qarmat* were sometimes occupied throughout the winter months (Park 1988:167). Consequently, Park (1988) has suggested that archaeologists forgo attempts to distinguish between these two dwelling forms, and instead consider them as belonging to a single semi-subterranean house complex.

The Functional Aspects of Qarmat Design

As *qarmat* were frequently built into the house pits of abandoned semi-subterranean winter houses, they likely shared at least a few of the thermal advantages outlined previously for such dwellings. However, the absence of sod in the construction of walls and roofs would, no doubt, have compromised the thermal efficiency of *qarmat*. Perhaps the real advantages of *qarmat* over "true" semi-subterranean winter houses were that they required less raw material and labour to built, thereby reducing their overall construction costs. Such reductions in architectural investment may reflect an increasing need for mobility (*sensu* Schledermann, 1976a), perhaps due to an inability to cache provisions adequate enough to see a family through the difficult winter months, had they remained living in a more permanent semi-subterranean structure.

The Snow House Complex

The large semi-subterranean whale bone houses built during the Classic phase of Thule culture suggest that the snow house was used primarily as a form of temporary shelter when travelling. Since the locations of snow dwellings (commonly sea ice) and the material they are constructed from make them archaeologically unrecoverable, indirect evidence of their use has been cited primarily from the retrieval of snow knives in Classic Thule sites (Savelle 1987). McGhee (1980) has suggested that these "snow knives" may, in fact, have functioned as flensing knives, thereby questioning the use of the snow house prior to the historic period. Maxwell (1985), however, has stated that the knives in question would have been too dull to have been effective in sea mammal flensing, and has pointed to the existence of stylistic similarities between these implements and snow knives documented ethnographically. In addition to their use as impermanent travelling shelters, snow houses may also have been constructed adjacent to semi-subterranean houses at Thule winter sites to accommodate visiting families (Park 1988:171). This practice, if true, has important implications for estimating population levels at Thule winter sites, and challenges arguments made by Freeman (1979), and McGhee (1984), that Thule communities were too small to allow for consistently successful bowhead whaling (Park 1988:171). Savelle (1984) has suggested that terrestrially situated snow houses are archaeologically recognizable, and that they should consist of gravel deposits associated with sleeping platforms, internal patterning of primary and secondary refuse, and bone concentrations corresponding to three dimensional disposal systems (Savelle, 1984). The methodology developed by Savelle (1984), however, has yet to be applied to sites dating to the Classic Thule period.

Construction Techniques.

Inuit snow houses, and the ingenious techniques employed to construct them, have captivated many 19th and 20th century explorers, missionaries, whalers, and ethnographers. Not surprisingly, numerous descriptions of how these structures were built exist in the literature (eg. Boas 1888; Gabus 1938-39; Hall 1980,1984; Handy 1973; Jumikis 1966; Rowley 1938). Boas 1964 [1888]:131-139) provides one of the most detailed accounts of this procedure, and he states that even though the style of house varied between Inuit groups, the basic principles of construction remained the same. After selecting a level area for the dwelling, a snow drift suitable for the cutting of snow blocks was sought out. Boas (1888 [1964]:131) explains that because blocks composed of separate layers often break apart when cut, it was necessary to locate drifts which would provide cut-blocks of a fine grain and uniform consistency. While drifts produced by a single storm event frequently satisfied such criteria (Boas 1888 [1964]:131), efforts to locate suitable snow drifts may have been considerable when winter conditions were less than optimal (Kershaw, Scott and Welch 1996:334). Consequently, situations in which access to suitable *iglu* building materials was limited likely placed a considerable stress on Inuit groups (Kershaw, Scott and Welch 1996:334). Snow blocks of three to four feet in length, two feet in height, and six to eight inches in thickness were cut from the drift using a *sulung* or snow knife (Kershaw *et al.* 1996:334). Boas (1964 [1888]:132) describes the construction process as requiring two individuals; one to cut the blocks, and the other to place them. In positioning snow blocks to form the first row, the first block is cut down to the ground, and the top of the row is inclined so as to form the first thread of a spiral (Boas 1964 [1888]:132). The subsequent rows were placed in a similar fashion; inclined slightly inward and supported on two sides (Boas 1964 [1888]:132). Boas (1964 [1888]:132) states that by building snow houses in this way, the snow blocks take on the shapes of almost perfect trapezoids. When the "vault" or dome was completed, the joints separating each cut-block were filled with snow. The last block to be fitted, the key block, was acquired by cutting a small door of an appropriate size and shape into the side of the dwelling (Boas 1964 [1888]:132). An entrance tunnel comprising two or three smaller vaults for storage was then fitted to this door way. Finally, a small window was cut over the entrance, and covered with either a translucent patch of sewn seal intestine, or a piece of fresh water ice (Boas 1964 [1888]:132). Inside the structure, an elevated platform was constructed at the rear of the dwelling, and lamp (*kudlik)* stands erected along the side walls adjacent to the opening of the entrance tunnel. Minnie Allakariallak, an Inuit Elder from Resolute Bay, also states that small sticks were often inserted into the wall of the dwelling to provide places to hang pots, items of clothing, etc (Dawson, 1997). Boas (1964 [1888]:135) reports that several Inuit groups hung skins from the inside of the snow house, and that this served to further raise the temperature of the interior by as much as 10 -20^{0} C.

Functional Aspects of Snow House Design

While Inuit snow houses are frequently described as hemispheres or domes, this is largely inaccurate because such shapes require that the walls spread outward, making a dwelling constructed of snow somewhat structurally unstable (Kershaw *et al.* 1996:328). In actuality, the snow house or *iglu* is best described as an inverted parabola or catenoid, in which compressive force is distributed towards the base of the structure, thereby ensuring structural integrity (Kershaw *et al.* 1996:328). Dead air spaces within snow blocks serve to insulate effectively the interior of the dwelling from cold outside air, and Kershaw *et al.* (1996:337) state that heat flux through new *iglu* walls is equal to that of a well insulated 2 x 4 house wall. Nevertheless, the insulation value of the snow blocks used to construct an *iglu* decreases with degree-hours of use, thereby limiting the length of occupation of the structure (Kershaw *et al.* 1996:336).

Energy used to heat the interiors of snow houses is derived from three principal sources; 1) the combustion of sea mammal oil in lamps called *kudliks*, 2) body heat generated by the occupants of the dwelling (including dogs), and 3) geothermal heat emitted from the soil below the dwelling[7] (Kershaw *et al.* 1996:334). Exterior temperatures and wind effects act contra to these energy sources, and place limits on the

[7] This would apply only to snow houses constructed on land.

temperatures which can be achieved within the snow house. Recent experimental constructions of traditional snow houses has resulted in the acquisition of detailed data relating to the thermal resistance of these structures (Kershaw *et al.* 1996). Estimates suggest that two adults occupying an *iglu* 4.1 metres in diameter require approximately 3.9 kg of fat per day, in order to maintain a consistent interior temperature of 5^0 C, with an outside temperature of -30^0 C (Kershaw *et al.* 1996:337). Kershaw *et al's* (1996) results demonstrate that snow houses with smaller surface area to volume ratios tend to be the most energy efficient, and that the energy efficiency of any *iglu* can be increased substantially through the installation of an interior skin lining. While the distribution of soot along the windward interior walls of Kershaw *et al.*'s (1996) experimental *iglu* illustrates that these structures are not completely impermeable to the effects of wind, the use of skin linings was also found to restrict air exchanges between the interior chamber and the snow blocks. This allows moisture generated by cooking, respiration and combustion to sublimate in the walls of the dwelling, and seal off pores in the surface of the snow blocks, effectively reducing air flow.

One of the more interesting aspects of Kershaw et al's (1996) study is the implied relationship between dog team size and dwelling size. The authors explain that without dogs, fuel for the lamp is balanced by the need for food, which roughly works out to a seal every 3.7 to 6.3 days for a single nuclear family. However, the extra meat required to feed a dog team would increase the availability of fat for lighting and heating, thereby permitting the construction of larger snow houses (Kershaw *et al.* 1996:337). By "larger", Kershaw *et al.* (1996) seem to be referring specifically to the diameter of the structure.

However, the size of a snow house can also be increased through the agglomeration and connection of "domes" of smaller diameter. The practice of connecting the *iglu's* of several nuclear families is well documented ethnographically (eg. Mathiassen, 1928; Jenness, 1922), and suggests that if each family provided enough fat to heat its own *iglu*, then the entire dwelling could have been kept comfortably warm.

Part A: The Deblicquy Site (QiLe-1): Location and History of Investigation

The Deblicquy site is a large Classic phase Thule winter village, located approximately 13 km north-northeast of the tip of the Brooman Peninsula (75^0 29' N, $97^0$29' W) on Bathurst Island, High Arctic Canada (Figure 4). The main part of the site rests approximately 346 metres inland from the western shore of the Gregory Peninsula, between 27 and 28 metres above sea level (Figure 5). A second site located 326 metres northwest of Deblicquy consists of a series of boulder caches, tent rings, *qarmat*, and kayak/umiak stands distributed along a 545 metre slope which rises in elevation from the shoreline to 14 metres above sea level (Figure 6). The types of features present at this site, coupled with the absence of winter houses, suggest that it functioned primarily as a warm season processing camp. A third smaller site consisting of three tent rings, a single boulder cache, and a grave - all grouped together in an isolated cluster, are situated 326 metres to the south of the processing site, at an elevation of approximately 10 metres above sea level.

FIGURE 4. Location of the Deblicquy site (QiLe-1) & the Black Point Site (QkLe-1)

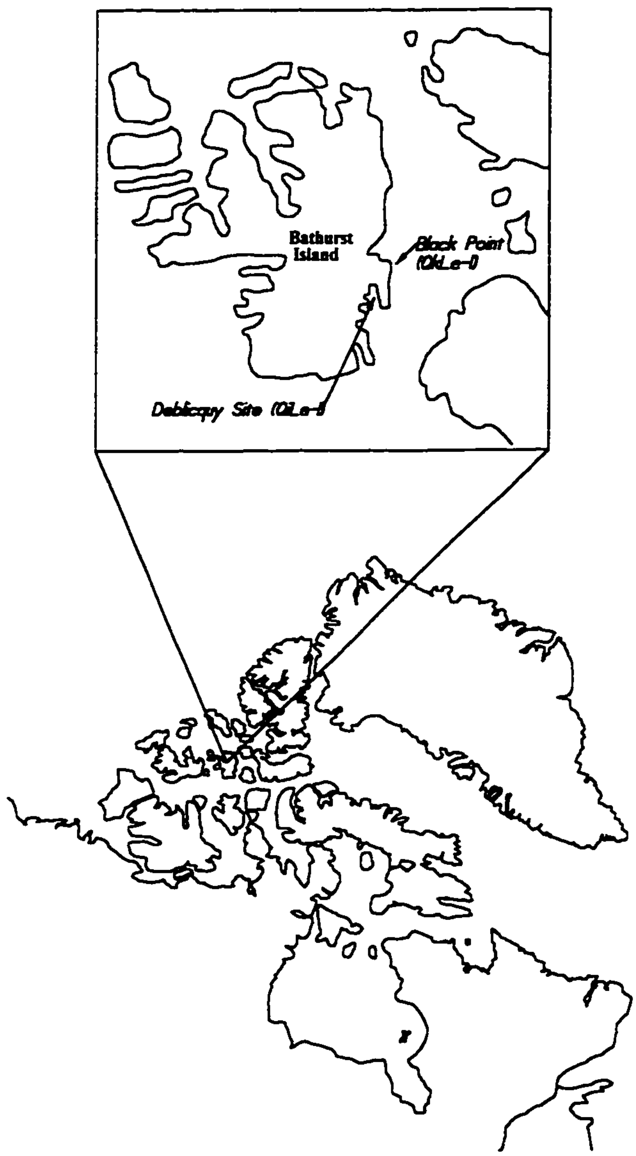


FIGURE 5. DEBLICQUY (QiLe-1) - MAIN SITE

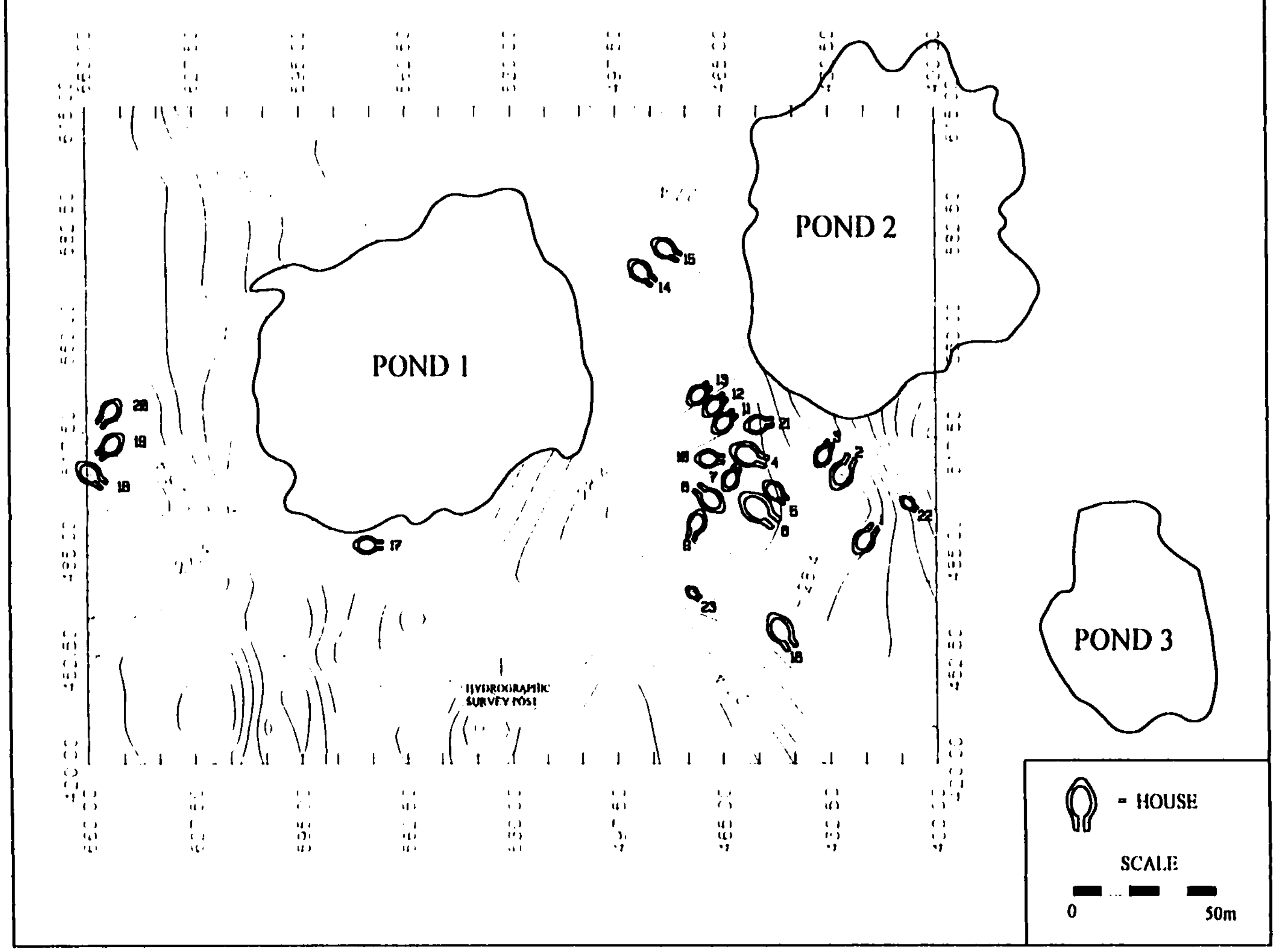
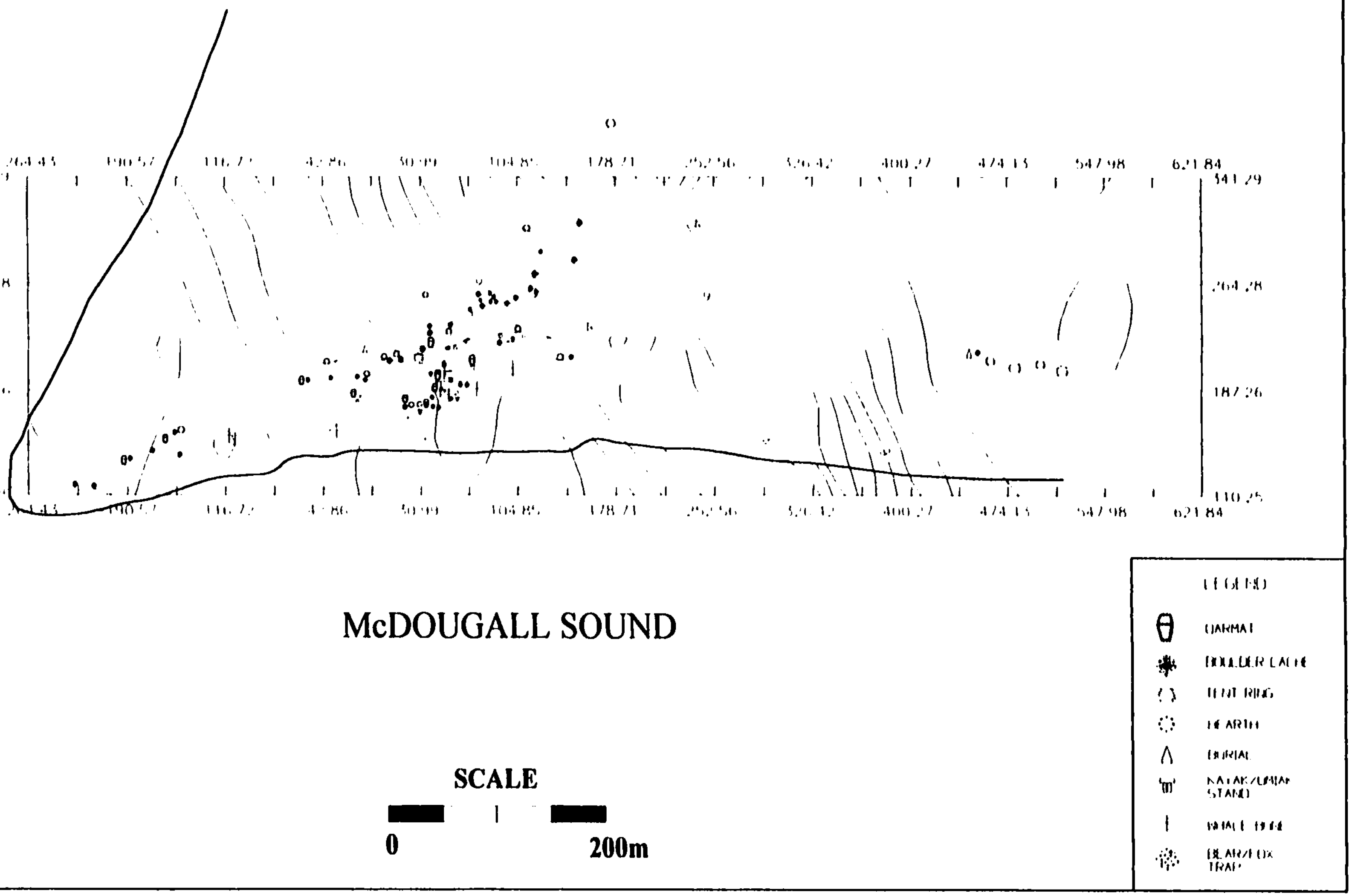


FIGURE 6. PROCESSING SITE WEST OF DEBLICQUY (QiLe-1)



The Deblicquy site was first investigated by Dr. William E. Taylor Jr. of the National Museum of Canada, in 1961. Over the course of a week, Taylor and his assistant George R. Carruthers excavated three house mounds (Taylor and McGhee 1981:1). Initially, the houses selected by Taylor (Houses 9, 15, and 16 on Figure 5) were thought to represent the oldest occupations of the site. However, the artifact collections retrieved from these structures were later interpreted by Taylor as indicative of a more "developed" form of Thule culture, with "very few surprises" (Taylor and McGhee 1981:11). The attributes of the assemblage are best summarized in the following passage:

> .....whale bone was used much more commonly than antler or ivory for making artifacts; wood is quite common in the collection; sinew, pieces of braided line fragments, knots and objects of baleen occurred in considerable abundance; stone material was largely of coarse slate occurring mostly as percussion-chipped flakes and fragments (Taylor and McGhee 1981:11).

Other notable aspects of the assemblages recovered included the presence of a stemmed, rubbed slate end blade (usually rare at Thule sites), a paucity of soapstone vessel and lamp fragments, a small piece of copper, and several small carvings; including a naturalized depiction of a seal (Taylor and McGhee 1981:11). Taylor's chronological estimates for the site were based primarily on the stylistic attributes of eight harpoon heads, which showed them to be similar to specimens recovered from the Thule District in northeastern Greenland. The use of drilled, rather than gouged lashing holes, an absence of ornamentation and vestigial side blades, the simplicity of the basal spur, and the generally straight to lateral convex margins of the harpoon heads recovered, led

Taylor to conclude that the site had been occupied between the 14th and 16th centuries AD (Taylor and McGhee 1981:11-12). Such estimates imply that the Deblicquy site had been inhabited more recently than other Classic Thule sites such as Naujan, Resolute (M1), and Crystal II. Although an unusually short field season and a small field crew prevented Taylor from conducting a detailed analysis of the faunal remains recovered, his impression of the assemblage was that it represented a "generalized Thule way of life", in which sea and land mammals such as bowhead whales, seal, walrus, and caribou were primarily hunted (Taylor and McGhee 1981:32). While Taylor felt it likely that the semi-subterranean houses present at the site would have been occupied throughout the winter months, he added that the absence of tent rings in the vicinity of Deblicquy suggested that the warm season months were occupied elsewhere (Taylor and McGhee 1981:51). Significant number of both *qarmat* and tent rings are, however, present at the processing site; a mere 326 metres northwest of Deblicquy (Figure 6), and numerous tent ring sites are also scattered along the eastern coast of the Gregory Peninsula; from Brooman Point to Polar Bear Pass. This would seem to suggest that at least a few of these sites would have been occupied by Deblicquy residents during warm season months.

House Forms Present at the Deblicquy Site (QiLe-1)

Taylor describes the semi-subterranean winter houses at the Deblicquy site as "lavish" and "redolent with whale bones", and his observations of sleeping platforms in several structures; of whale bone roof supports broken, yet still in their original upright positions;

and of the roofs of several entrance tunnels still partially in place, attest to their excellent state of preservation. With this in mind, I felt that the Deblicquy site would be an ideal location for a detailed study of Thule architecture. With the aid of three field assistants, the semi-subterranean whale bone houses present at the Deblicquy site[8] were recorded over a six week period during the summer of 1994. The large processing site to the northwest of Deblicquy was also mapped in detail, as were several small tent ring sites located along the eastern coast of the Gregory Peninsula.

Procedure for Recording Architecture.

The 1994 field season at the Deblicquy site consisted of three components. The first component involved mapping the frequencies and distributions of bowhead whale bone across the entire site. A north-south and an east-west baseline was first established; essentially bisecting the site into four discrete quadrants. From a series of nine survey stations, the location and elevation of the following targets were recorded using a Topcon TL-60SE theodolite (scale reading = 1 minute): 1) edges of house mounds, 2) edges of the interior house depressions, 3) all whale bone elements evident on the surface of the site, 4) rocks and flagging stones used in an architectural capacity, and 5) all artifacts evident on the surface of the site. Two shots (proximal and distal) were taken on bowhead whale elements such as mandibles, maxillae, ribs, and skull bases. Single shots were

8 All work was competed under the requirements stipulated by Northwest Territories Archaeologists Permit 94-787.

taken on smaller bowhead elements such as vertebrae, phalanges, radii, and humeri, and on elements which were partially buried, yet still visible. Single shots were also taken on rocks and any artifacts observed on the surface of the site. All shots were ultimately tied to a hydrographic survey post placed near the site by the Hydrological Survey of Canada, and to a series of survey stations which we extended down to the eastern shore of the Gregory Peninsula. This allowed us to establish precise elevations for each shot. Upon returning to the University of Calgary, the polar coordinate survey data was translated into X, Y, and Z coordinates, and plotted using Visual CADD v. 2.0 - a computer-aided drafting software package; and Surfer v. 3.0 - a cartographic software package used to generate contour maps. Bowhead elements were then grouped together by type (mandibles, maxillae etc), and each element type was plotted as a separate layer within Visual CADD. Thus, by choosing to "hide" certain element layers and "display" others, a clearer picture of the comparative distributions of bowhead whale bone across the site could be obtained.

The second component of the research design involved the construction of detailed plan views of Thule whale bone houses. In order to accomplish this, 3 x 3 metre grid units were placed over each house mound. The four outside corners of the units covering each house mound were then shot in using the theodolite, thereby tying the grid units into the north-south and east-west baselines. The architectural features contained within each unit (whale bone, stone, pit depression, lamp stands, sleeping platforms, etc) were next point provenienced and plotted on scaled metric graph paper. Upon returning to Calgary, each unit drawing was digitized using a 12' x 12' Calcomp digitizing tablet and Visual CADD

V.2.0. During the digitization process, specific skeletal elements were given distinctive colours, and then assigned to different layers. The ability to selectively "display" or "hide" elements and other digitized architectural features allowed for the examination of how these houses were constructed, how they collapsed, and the degree to which they had been dismantled and mined by later groups for raw material. The digitization of Thule whale bone houses also allows one to view the different architectural features of a house simultaneously, thus providing the researcher with a powerful visualization tool for examining variability in prehistoric architecture.

For the third component of the research design, 12 architectural attributes were systematically recorded for each house at the Deblicquy site[9]: 1) # of bowhead mandibles; 2) # of bowhead maxillae; 3) # of bowhead crania; 4) # of bowhead ribs; 5) # of bowhead scapulae; 6) # of bowhead vertebrae; 7) # of rocks; 8) # of lobes; 9) internal area; 10) length of tunnel; 11) diameter of widest lobe; and 12) height of house mound. The first seven attributes include all the construction materials observable on the surface of the site which play a significant role in Thule architecture (see Habu and Savelle, 1994; Mathiassen, 1928; McGhee, 1984; Park, 1988). The frequencies of each attribute were tabulated for all Deblicquy houses. The remaining five attributes consist of a series of measurements which define the floor plans of each of the houses recorded. Lobes are defined as discrete spaces set apart by a constriction in the floor plan of the dwelling, and ostensibly relate to socially mediated patterns of activity segregation within the house.

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The three houses excavated by Taylor (1981) (Houses 9, 15, and 16) were excluded from the study, as were the three amorphous house depressions (Houses 21, 22, 23), because they were completely devoid of whale bone.

Lobe frequencies were simply tabulated for each structure. Internal area (metres^2) likely relates to either the size of the resident household, or the availability of building materials, and was calculated directly from the digitized plan of each dwelling using the 'Measure Area' command in Visual CADD. The different lengths of jaw bones and ribs suggest that the diameter of the largest lobe in a dwelling might determine the type of elements chosen to enclose it. Thus, the diameter of the largest lobe per dwelling was selected as a variable, and measured from the digitized plan of each house using the 'Measure Distance' function in Visual CADD. Likewise, the 'Measure Distance' command was used in tandem with the digitized floor plans to calculate the entrance tunnel lengths for each house. Long entrance tunnels likely reflect either a need for storage space outside of the living area of the house, or were required for sheltering occupants from prevailing winds when houses were oriented in northerly directions. Finally, the height of each house mound was estimated by calculating the mean elevation of a series of theodolite shots taken from around the base and top of the house mound proper. Given that roof frame elements were countersunk into the edges of the house pit, house mound height presumably relates to the degree of house disturbance, as mining activities would have diminished the elevation of the house mound considerably.

The data collected for all twelve architectural attributes are summarized in Table 1, and detailed descriptions of the houses recorded at the Deblicquy site, accompanied by their digitized plans, are presented in Appendix 1.

Table 1. Architectural Attributes for Houses Recorded at the Deblicquy site (QiLe-1)

HOUSE	MANDIBLE	MAXILLAE	CRANIA	RIBS	SCAPULAE	VERTEBRA	ROCKS	LOBES	AREA (m^2)	TUNNEL (m)	MOUND (cm)	DIAMETER (m)
H.1	21	9	5	27	2	18	27	1	11.26	1.53	23.20	3.87
H.2	4	0	0	5	1	1	39	1	13.10	2.88	20.30	3.75
H.3	8	10	1	18	1	4	20	1	5.43	1.25	12.30	2.18
H.4	28	12	4	16	2	15	71	2	10.35	2.89	53.50	3.81
H.5	10	16	5	37	0	15	36	2	12.35	2.04	44.90	3.79
H.6	3	2	4	9	0	4	6	2	17.60	2.75	0.00	4/34
H.7	18	8	4	41	3	12	64	3	14.60	1.81	39.60	4.01
H.8	15	20	3	37	3	9	90	2	14.20	2.14	17.60	4.39
H.10	3	9	4	34	4	18	52	1	7.82	1.01	17.40	2.27
H.11	16	19	0	20	1	5	58	1	12.30	1.23	71.20	3.26
H.12	4	8	3	29	4	11	72	2	12.50	1.69	65.60	3.12
H.13	7	14	3	48	1	11	60	2	11.94	1.98	18.50	3.32
H.14	0	0	0	3	0	8	20	2	18.04	2.54	28.60	5.34
H.17	1	3	2	8	1	2	32	1	11.81	2.35	20.30	3.32
H.18	4	0	0	2	0	2	29	2	21.10	2.09	28.70	4.12
H.19	6	1	0	2	0	7	38	2	17.49	1.81	22.40	3.36
H.20	0	4	0	3	0	0	26	1	11.83	3.18	28.70	2.67

Procedure for Recording the Processing Site

After mapping and recording the Deblicquy site proper, the east-west baseline was extended down to the eastern shore of the Gregory Peninsula. Working from this baseline, a series of 15 survey stations were then established, and the various cultural features of the processing site, as well as any bowhead whale bone present on the surface, were mapped in. Each cultural feature was assigned a number, and described on a separate form.

Analysis of Architectural Variability at the Deblicquy Site (QiLe-1)

Were all semi-subterranean Thule winter houses designed and built in similar ways, or were some dwellings designed and built differently, so as to accommodate different architectural 'goals'? In order to address these questions, Factor Analysis was utilized to examine the architectural data collected at the Deblicquy site. Factor Analysis (F.A) is a multivariate statistical technique similar to Principle Components Analysis (P.C.A), and is used to establish which variables in a data set form coherent, relatively independent subsets (Tabachnick and Fidell 1989:597). These subsets, or *factors,* are comprised of variables which are correlated with one another, and are thought to reflect the underlying processes which are structuring the data (Rummel 1970; Tabachnick and Fidell 1989:597). P.C.A and F.A are similar to one another in that both techniques 'collapse' large numbers of variables into potentially more interpretable components. However, while P.C.A extracts components from all of the variance in the data set (*common variance*), F.A assumes that the variance in a data set can be divided into two segments; one segment which emphasizes commonality among variables (*common variance*), and another segment which emphasizes the unique aspects of variables which are not shared with others (*unique variance*) (Sheenan 1988:271). Consequently, the argument behind using F.A is that if one is concerned with defining underlying patterns of variation common to several variables, then one should operate using common variance and exclude unique variance from the analysis (Sheenan 1988:271).

A number of archaeologists have utilized P.C.A and F.A as analytical tools for interpreting highly complex data sets (eg. Bettinger, 1979; Greaves, 1981; Helmer *et al.*, 1993; Sheenan and Wilcock, 1975). Bettinger (1979), for example, employed F.A to examine the underlying relationships between various artifact types found at different archaeological sites in the Owens Valley, in eastern California (Bettinger 1979:458). The factors which were extracted from Bettinger's data set were comprised of artifact types whose occurrences were highly correlated with one another. Consequently, Bettinger (1979:468) interpreted these factors as representing the 'basic assemblages' associated with the different types of sites which made up the subsistence-settlement system of Owens Valley inhabitants; for example, base camps, temporary camps, and pinon nut roasting camps (Bettinger 1979:468). Other examples include Greaves's (1981) use of Factor Analysis to explore the idea that ethnic affiliation among Late Plains Indian groups is expressed via metric variation in projectile points, and Helmer *et al.*'s (1993) Factor Analysis of the spatial distributions of Paleoeskimo artefacts within and between archaeological features at a Late Dorset site on Little Cornwallis Island, in the Canadian High Arctic.

Within the context of this study, I felt that if certain architectural variables were highly correlated with one another, then the factors extracted from an F.A solution might be interpretable as design 'goals'; that is, building strategies aimed at accommodating the needs of resident households, or solving various architectural problems (*sensu* McGuire and Schiffer, 1983). Such factors might also reflect processes relating to the selective removal of building materials from abandoned houses for use in new dwellings (*sensu* McCartney, 1979).

The steps for performing an F.A are as follows. First, a series of variables are defined and measured. In cases where variables have been measured metrically using different scales, it is conventional practice to standardize the data prior to conducting an F.A/P.C.A (Christenson and Read, 1977). This is usually accomplished by transforming the raw metric data into z-scores. A correlation matrix is next calculated in order to test for correlations between variables (Christenson and Read, 1970; Hodson, 1969). The correlation matrix is used to establish the *factorability* of the data set, and Tabachnick and Fidell (1989:604) state that the use of F.A is questionable in the absence of any correlations exceeding .30. Two other methods also exist for mathematically assessing the *factorability* of a data set; the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, and Bartlett's test of sphericity (Norusis 1992:50; Tabachnick and Fidell 1989:604). A set of factors is then extracted from the correlation matrix and rotated, either orthogonally or obliquely, in order to increase their interpretability[10] (Davis, 1971). A scree test is commonly employed to aid in selecting factors that are "meaningful". Eigenvalues are plotted against factors, and factors with eigenvalues of less than 1 are considered unimportant in explaining variability in the data set (Tabachnick and Fidell 1989:634-35). The final test of the success of a F.A, however, is the interpretability of the factors. As Tabachnick and Fidell (1989:598) state, "a good F.A "makes sense"; a bad one does not". At this point, it is worth mentioning that there is no criterion beyond the interpretability of the factors extracted against which to test the solution (Tabachinick and Fidell 1989:598). Vivian and Carlson (1981:277-278), for example, have demonstrated that P.C.A and F.A can produce patterned results with a completely random data set. In this situation, however, the random nature of the data is ultimately revealed by the predominance of unusually low coefficient values in the correlation matrix (Vivian and Carlson 1981:277-278). Consequently, F.A and P.C.A are used more commonly as data exploration tools than as techniques for confirming hypotheses (Tabachnick and Fidell 1989:598). It is for precisely this reason that F.A was chosen for the analysis of the architectural data presented here - the aim of which is to explore the variability inherent in the data sets assembled from Bathurst Island, and derive behavioral implications from a subjective assessment of the results.

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I refer the reader to Tabachnick and Fidell (1989:628-31) for a more in-depth discussion of orthogonal and oblique rotation

Results of the Factor Analysis for the Deblicquy Site

Data collected for the 12 architectural variables outlined in Table 1 were first standardized as z-scores (Table 2) and then subjected to a Factor Analysis, using S.P.S.S, Version 5.0.1, a statistical software package for Windows. Because the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, and Bartlett's test of sphericity are extremely sensitive to sample size, they were unsuitable for testing the *factorability* of the Bathurst island data set (see Norusis 1992:50; Tabachnick and Fidell 1989:604). However, a significant number of correlations greater than .30 among the variables selected for analysis indicated that a Factor Analysis was warranted. The F.A resulted in the extraction of three factors from the data set. The three factor solution was then rotated orthogonally (Varimax rotation) to maximize the variance of the loadings within the factors extracted, thereby facilitating their interpretation. It is important to keep in mind that because factors can be rotated in an infinite number of ways while still accounting for the same amount of variance in the original data set, the selection of a different type of rotation (i.e orthogonal rotation; oblique rotation) will define each factor slightly differently (Tabachnick and Fidell 1989:598). This, in turn, can have an effect on how each factor is subsequently interpreted. If a data set is good, then different methods of rotation should yield similar results (Tabachnick and Fidell 1989:628). A varimax rotation was selected for use here because it is the most commonly used of all of the rotations available in statistical packages (Tabachnick and Fidell 1989:628). A scree plot of the eigenvalues for each factor indicated that a three factor solution was the most

Table 2. Architectural Attributes Standardized as Z-Scores and Factor Scores for Deblicquy Houses (Table 1)

HOUSE	ZMAN	ZMAX	ZCRANIA	ZRIBS	ZSCAP	ZVERT	ZROCKS	ZLOBES	ZAREA	ZTUNNEL	ZDIAMETER	ZMOUND	FACTOR 1	FACTOR 2	FACTOR 3
H.1	1.51221	0.15952	1.41526	0.45417	0.45838	1.63374	-0.72819	-1.06716	-0.49560	-0.84936	0.36792	-0.36624	1.39129	-0.33318	-0.69152
H.2	-0.57884	-1.19638	-1.14425	-0.96133	-0.25003	-1.24523	-0.19954	-1.06716	-0.01565	1.28297	0.21721	-0.51873	-1.18252	-0.12682	-0.36085
H.3	-0.08683	0.31017	-0.63235	-0.12490	-0.25003	-0.73718	-1.03656	-1.06716	-2.01629	-1.28912	-1.75466	-0.93941	-0.21283	-2.00777	-0.69994
H.4	2.37322	0.61148	0.90335	-0.25358	0.45838	1.12569	1.21019	0.58209	-0.73296	1.29879	0.29257	1.22708	0.45281	0.57003	1.36656
H.5	0.15918	1.21410	1.41526	1.09758	-0.95844	1.12569	-0.33170	0.58209	-0.21128	-0.04578	0.26745	0.77485	0.97755	0.35194	0.01867
H.6	-0.70184	-0.89507	0.90335	-0.70397	-0.95844	-0.73718	-1.65332	0.58209	1.15813	1.07733	0.95823	-1.58620	0.24803	1.15853	-1.90295
H.7	1.14320	0.00886	0.90335	1.35495	1.16679	0.61763	0.90181	2.23133	0.37561	-0.40961	0.54376	0.49615	1.15765	1.10070	0.71095
H.8	0.77419	1.81672	0.39145	1.09758	1.16679	0.10958	2.04721	0.58209	0.27127	0.11240	1.02103	-0.66071	0.82569	0.60024	0.94928
H.10	-0.70184	0.15952	0.90335	0.90456	1.87520	1.63374	0.37316	-1.06716	-1.39288	-1.67509	-1.64162	-0.67123	1.36981	-1.77738	-0.67746
H.11	0.89719	1.66607	-1.14425	0.00378	-0.25003	-0.56783	0.63749	-1.06716	-0.22432	-1.33183	-0.39822	2.15782	-1.14354	-0.90768	2.16593
H.12	-0.57884	0.00886	0.39145	0.58285	1.87520	0.44828	1.25424	0.58209	-0.17215	-0.59943	-0.57405	1.86335	0.15307	-0.25411	1.31972
H.13	-0.20983	0.91279	0.39145	1.80534	-0.25003	0.44828	0.72559	0.58209	-0.31822	-0.14069	-0.32286	-0.61338	0.88653	-0.06223	-0.08121
H.14	-1.07084	-1.19638	-1.14425	-1.09001	-0.95844	-0.05977	-1.03656	0.58209	1.27290	0.74514	2.21419	-0.08228	-0.76913	1.50842	-0.59065
H.17	-0.94784	-0.74441	-0.12045	-0.76831	-0.25003	-1.07588	-0.50792	-1.06716	-0.35213	0.44301	-0.32286	-0.51873	-0.63532	-0.57428	-0.73093
H.18	-0.57884	-1.19638	-1.14425	-1.15436	-0.95844	-1.07588	-0.64008	0.58209	2.07107	0.03331	0.68192	-0.07702	-1.16961	1.08381	-0.19112
H.19	-0.33283	-1.04572	-1.14425	-1.15436	-0.95844	-0.22912	-0.24359	0.58209	1.12944	-0.40328	-0.34798	-0.40830	-0.81421	0.37950	-0.25089
H.20	-1.07084	-0.59376	-1.14425	-1.09001	-0.95844	-1.41458	-0.77224	-1.06716	-0.34692	1.75120	-1.20203	-0.07702	-1.53527	-0.70974	-0.35360

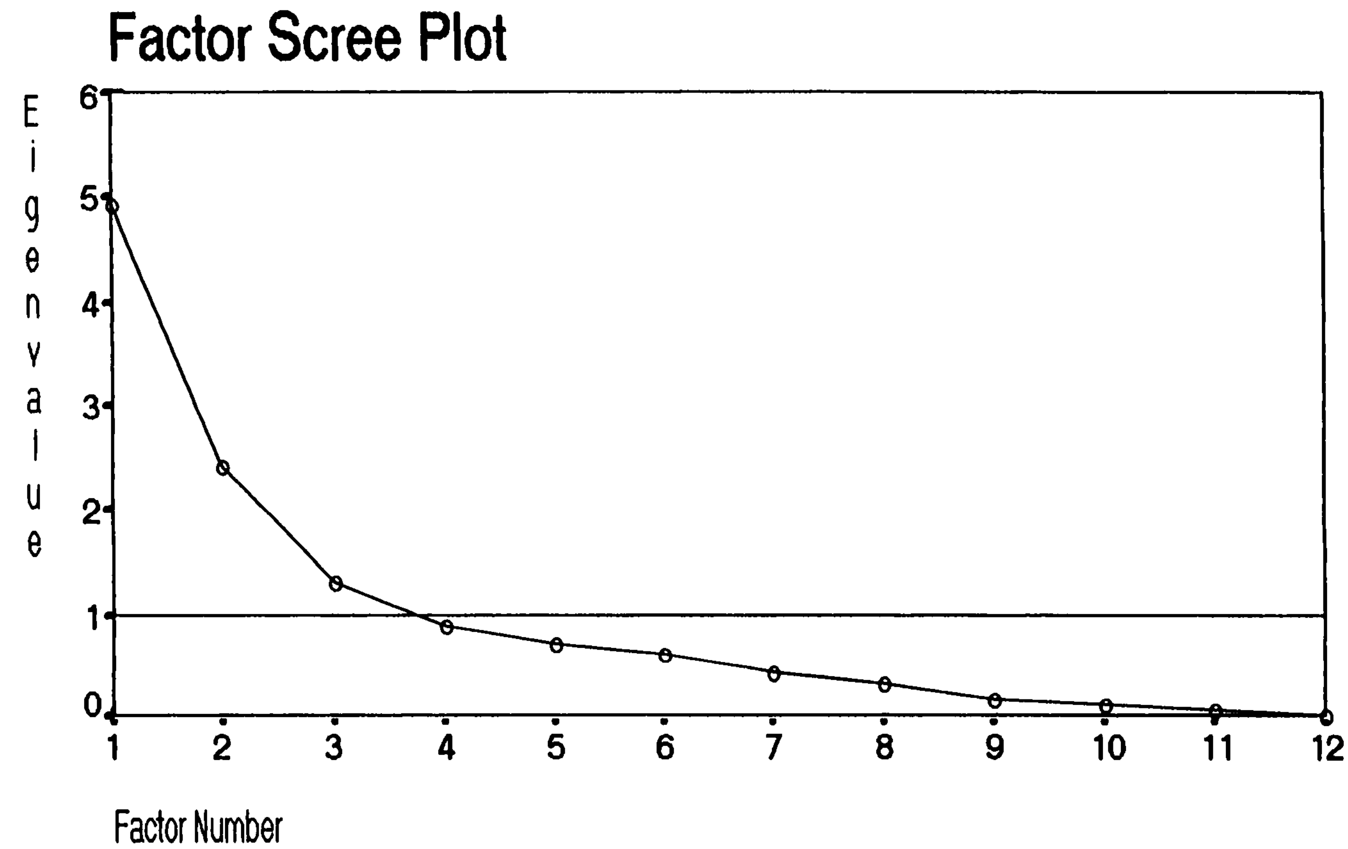


FIGURE 7. Scree plot of factors plotted against their eigenvalues for the 12 architectural variables measured at the Deblicquy Site ((QiLe-1). Eigenvalues of less than 1 are considered unimportant in explaining variability in the data set (Tabachnick and Fidell 1989:634-35).

parsimonious (Figure 7). The resulting three factors explain a total of 72.2 percent of the total variation inherent within the data set. The factors are defined as follows:

Factor 1

Factor 1 is comprised of crania, vertebrae, ribs, and scapulae, and accounts for 41.1 percent of the total variation present in the data set. Houses which scored highly on factor 1 possess high frequencies of these elements. From the descriptions of the digitized plans constructed for the Deblicquy houses (Appendix 1), it appears that crania were sometimes utilized in roof construction; supporting either a mandible 'bridge', or extending the length of maxillae/pre maxillae roof beams. The placement of crania over door ways suggests that they were also symbolically resonant. Vertebrae were used to consolidate the walls of the interior house depression, brace mandible and maxillae roof beams, and may have occasionally functioned as lamp (*kulliq)* stands. Ribs appear to have been used as cross-braces in mandible/maxillae roof frames, and as roofing material for the enclosure of small lobes with narrow internal diameters, and entrance tunnels. Finally, the close proximity of many scapulae to the entrances of dwellings suggests their use as wind breaks.

With the possible exception of ribs, factor 1 elements appear to have played a relatively minor utilitarian role in Thule architecture, and were likely used to supplement more critical building materials such as mandibles and maxillae. This impression is supported by the fact that other building materials were easily substituted for factor 1 elements in some Thule houses; perhaps during times when factor 1 elements would have been in short supply. Rocks, for example, were sometimes used as surrogates for vertebrae in the construction of house walls, and rock piles and the broken ends of upright mandibles/maxillae were often used in place of crania for supporting mandible 'bridges' (i.e McGhee, 1984). In addition, snow blocks, or large, flat rocks, could have easily been used in place of scapulae at door entrances for wind breaks. Conversely, because ribs are among the most abundant elements in a bowhead skeleton, they may have occasionally been substituted as roofing material when mandibles and maxillae were in short supply.

From a strictly utilitarian perspective then, factor 1 elements such as crania, scapulae, vertebrae, and ribs, represent low cost building materials which could have been easily substituted for in times of shortage; or in the case of ribs, used in place of more costly and potentially more scarce building materials. Factor 1 elements used in a supplementary capacity likely had little effect on the production, use, and maintenance of Thule dwellings (*sensu* McGuire and Schiffer, 1983). This may not have been the case, however, if Thule builders were forced to use factor 1 elements as principal building materials. To illustrate, while houses roofed exclusively using ribs would have likely cost less to manufacture than houses roofed with mandibles and maxillae, they would have been much more costly to maintain. The lower stress and weight bearing properties of ribs, for example, suggests that roof frameworks constructed from these elements would have required much more frequent repair. This, in turn, may have reduced the length of time such dwellings were occupied, as maintenance costs would soon begin to supercede the cost of manufacturing a new dwelling. In addition, because the use of rib frameworks would have required the construction of smaller dwellings, houses roofed in this manner may have been used differently than larger, more robust houses. For example, rib-roofed houses may have demanded smaller families, and different patterns of activity segregation within the household.

From a symbolic perspective, the use of intact bowhead crania ostensibly represents a structural investment in the symbolic function of the dwelling beyond its utilitarian requirements. McGuire and Schiffer (1983:281) consider such investments as a response to greater social differentiation within the community. Thus, the use of whale crania over door ways may represent a means by which various social groups communicated economic, social, and/or ideological status.

To summarize, factor 1 elements represent low cost utilitarian building materials which were used to either supplement higher cost materials in Thule architecture, or as substitutes for higher cost materials when they were in short supply. While crania represent low cost utilitarian building materials, they were likely high cost symbolic building materials. Thus, I have interpreted factor 1 as representing a **low cost/high maintenance building strategy** and/or **high cost symbolic building strategy.**

Factor 2

Factor 2 consists of floor area, diameter of widest lobe, number of lobes, and length of entrance tunnel, and explains 20 percent of the variability present in the data set. Houses which score high on factor 2 are large, bi-lobed dwellings with wide lobes, and long entrance tunnels. As a single nuclear family would logically require a smaller living area than several co-resident nuclear families, floor area is most likely associated with the size of the residential unit. As mentioned previously, the diameter of the widest lobe presumably indicates the type of roofing material used to enclose the dwelling; with wide lobes reflecting the use of mandibles and maxillae, and narrow lobes reflecting the use of ribs. The number of lobes should reasonably relate to socially mediated patterns of activity segregation within the household. Hence, the need for spatially discrete cooking areas, equipment storage areas, meat lockers, or multiple sleeping platforms, would necessitate the construction of bounded spaces, or lobes. Finally, the length of the entrance tunnel conceivably relates to the orientation of the dwelling, with north-facing orientations favoring long entrance tunnels to keep out prevailing winds. Alternatively, the ethnographic record provides many accounts of entrance passages being used to store equipment and food, as well as house dogs during periods of inclement weather (Stefansson 1964:116; Petitot 1887:33). Consequently, long entrance tunnels may also reflect the need for extra storage space outside of the main living area of the dwelling.

To summarize, factor 2 relates to the size of the residential unit, the type of roofing material used to enclose the dwelling, patterns of activity segregation within the house, orientation of the dwelling, and the need for extra storage space outside of the main living area. Thus, I have interpreted factor 2 as representing the **Plan/Design** of the dwelling.

Factor 3

Factor 3 consists of mound height, frequency of rocks, mandibles, maxillae, and accounts for 11.1 percent of the total variation observed in the data set. Houses that score high on factor 3 possess high house mounds, and contain large numbers of mandibles, maxillae, and rocks. As mentioned previously, the digitized plans of several houses at Deblicquy indicate that the proximal ends of mandibles and maxillae were often countersunk into the house mound, cantilevered inwards, and braced with rocks, thereby forming a robust, self-supporting, hemispherical roof frame. Given that there are roughly 6.5 ribs for every jaw bone in a bowhead whale skeleton, mandibles and maxillae were ostensibly a much more costly type of building material. However, the use of such sturdy elements in Thule architecture would seem to imply that dwellings constructed using mandibles and maxillae would also have been associated with lower overall maintenance costs. According to McGuire and Schiffer (1983:283), the decay-resistant properties of building materials can impact on the use-life of buildings. Hence, dwellings constructed of sturdy, decay-resistant materials tend to have longer anticipated use-lives than those built from less substantial materials. This suggests that houses scoring high on factor 3 would have had longer anticipated use-lives than those scoring low on factor 3, and high on factor 1. Furthermore, given that the dismantling of a semi-subterranean house, either for airing, or for the acquisition of raw materials, likely resulted in excessive disturbance of the house mound, and the removal of mandibles, maxillae, and rocks, low factor 3 scores may also reflect the abandonment/destruction phases of whale bone house evolution.

To summarize, the elements which make up factor 3 represent high cost utilitarian building materials which were likely used to construct large houses with self-supporting domed roofs, and long anticipated use-lives. In addition, factor 3 may provide a measure of the degree of house disturbance. Consequently, I interpret factor 3 as representing a **high cost/low maintenance building strategy** and/or **degree of house disturbance.**

A Hierarchical Cluster Analysis of the Houses from Deblicquy.

In the next phase of analysis, I wanted to examine the degree of architectural diversity among houses at the Deblicquy site, based on how each dwelling scored on factors 1, 2, and 3. In order to accomplish this, a hierarchical cluster analysis was employed to group together houses which shared the same subsets of architectural attributes (factors), and split apart those that did not. A hierarchical cluster analysis combines 'cases' into clusters, hierarchically, using a memory-intensive algorithm that allows the researcher to establish empirically the number of clusters. Ward's method was used to cluster the houses together based on their mean factor scores; the squared Euclidean distance to the cluster means were first calculated for each house, summed, and finally plotted in the form of a dendrogram (Figure 8). Results indicate the presence of six discrete clusters of houses.

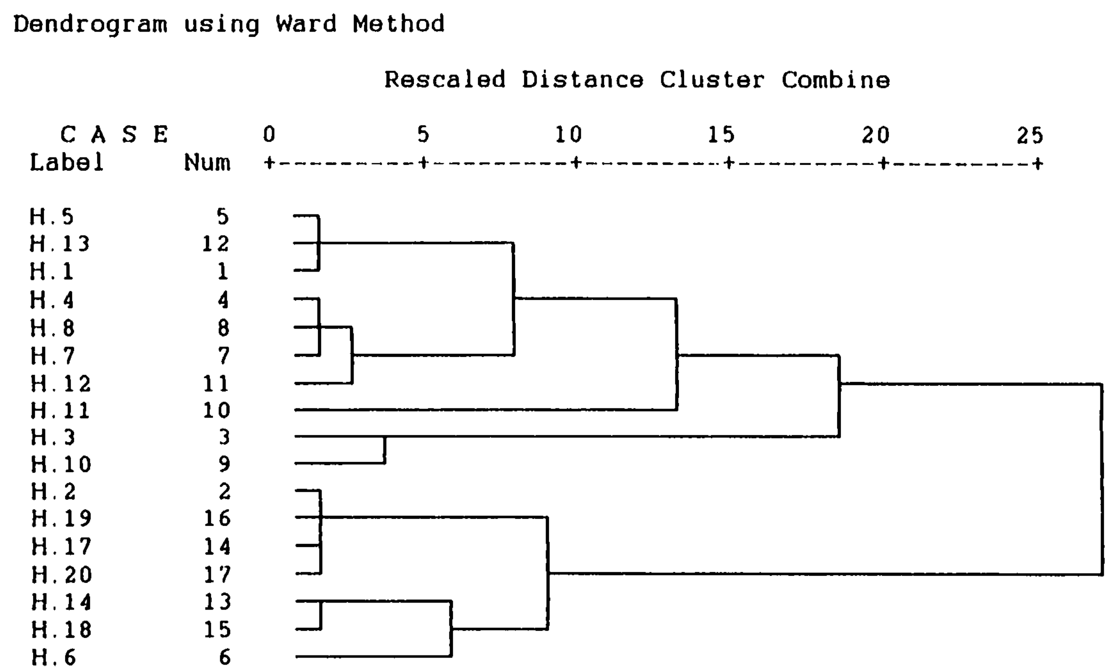


FIGURE 8. Results of the hierarchical cluster analysis of Deblicquy houses.

House Cluster 1.

House cluster 1 consists of three houses; H.5, H.13, and H.1 (Appendix 1) . All three houses scored high on factor 1, and low on factor 3. Commonalities shared among cluster 1 houses include the intensive use of bowhead crania in a utilitarian capacity. Houses 1, 5, and 13, for example, all make use of crania as supports for a mandible bridge, upon which the remaining mandibles and maxillae would have been affixed. The resulting roof framework would have been relatively flat and sloping. Given that this type of roof structure can be constructed with as few as 6 jaw bones (i.e Park 1988:166), cluster 1 houses would have had lower over-all manufacturing costs than dwellings constructed using a self-supporting hemispherical or domed mandible/maxillae framework. The remaining factor 1 elements would have been used in a supplementary capacity, with ribs functioning as cross braces on the roof lattice, vertebrae serving as flagging in wall construction, and scapulae performing as wind breaks in the entrance tunnel. Thus, cluster 1 houses likely reflect a low cost/high maintenance building strategy. The type of roof construction practiced in cluster 1 houses may reflect a more limited access to high cost building materials such as mandibles and maxillae. Alternatively, a shorter anticipated use-life for cluster 1 dwellings may explain why their builders elected to use lower cost building materials and techniques. Finally, low factor 3 scores suggest that at least some mandibles and maxillae were removed by later groups, following the abandonment of cluster 1 houses.

House Cluster 2.

House cluster 2 consists of four houses; H.4, H.8, H.7, H.12 (Appendix 1). All of these houses scored high on factor 3. Commonalities shared among cluster 2 houses include high house mounds and, with the exception of House 12, large numbers of mandibles, maxillae, and rocks. Given the relative scarcity of mandibles and maxillae in House 12 as compared with Houses 4, 7, and 8, a high score on factor 3 presumably reflects its higher than average house mound. This may be attributable to the fact that House 12 shares a mound with House 11. Consequently, the inclusion of House 12 in cluster 2 must be considered as tentative. Houses 4, 8, and 7 all appear to have been enclosed using a large, self-supporting, dome-shaped roof framework constructed primarily from mandibles and maxillae. Although it is difficult to establish, House 12 may have been roofed in a manner similar to that of cluster 1 houses. The high factor 3 scores attained by Houses 4, 8, and 7 testify to their excellent preservation, and suggest that they are relatively undisturbed. McCartney's (1979:305) estimates of a minimum of 20 mandibles for the construction of hemispherical roof frames would seem to suggest that cluster 2 houses reflect a high cost/low maintenance building strategy. According to McGuire and Schiffer (1983), such an investment in architecture would imply a longer anticipated use-life for cluster 2 dwellings.

House Cluster 3.

House cluster 3 consists of a single dwelling; H.11 (Appendix 1). Extremely low scores on factors 1 and 2, and a very high score on factor 3, distinguishes House 11 from all other houses at Deblicquy. The unusual rectilinear shape of this structure, making it much narrower in width than in length, suggests that it was roofed in a manner similar to that of cluster 1 houses. However, the large number of mandibles, maxillae, and rocks, coupled with extremely low frequencies of crania, vertebrae, ribs and scapulae, indicate that much more intensive use of high cost building materials was made. Again, this would suggest a longer anticipated use-life for house 11.

House Cluster 4.

House cluster 4 consists of two dwellings; H.3 and H.10 (Appendix 1). Extremely low scores on factor 2 distinguish these dwellings, indicating that they are among the smallest of all houses at the Deblicquy site. The small internal areas and narrow diameters of House 3 and 10 suggest that ribs would have formed an integral part of the roof framework for these dwellings. Consequently, cluster 4 houses likely reflect a low cost/high maintenance building strategy, and may have had a relatively short anticipated use-life. Decisions relating to the design of House 3 and House 10 may have been influenced by restricted access to higher cost elements such as mandibles and maxillae.

Alternatively, such limited architectural investment might reflect the use of these dwellings as temporary habitations.

House Cluster 5.

House cluster 5 consists of four dwellings; H.2, H.19, H.17, and H.14 (Appendix 1). Extremely low scores on factors 1 and 3 distinguish these dwellings from all others at the Deblicquy site. The relative paucity of bowhead elements among cluster 5 houses suggests their intentional removal by house occupants or post-occupational visitors, following abandonment. In addition, several of these houses appear to be somewhat disturbed by frost-cracks and animal burrowing. Consequently, the extremely low factor scores attained by cluster 5 houses suggests that they correspond with the abandonment/destruction and post-occupational erosion stages of McCartney's (1979) six sequential stages of whale bone house evolution. The poor condition of cluster 5 houses would seem to imply that they are among the earliest occupations of the Deblicquy site.

House Cluster 6.

House cluster 6 consists of three dwellings; H.14, H.18, and H.6 (Appendix 1). High scores on factor 2 and low scores on factors 1 and 3 distinguish these dwellings from all others at the Deblicquy site. Cluster 6 dwellings are among the largest dwellings at the site, reasonably suggesting that they would have been occupied by several co-resident families. The four upright bowhead crania in House 6, however, hint that this particular dwelling functioned in some capacity other than as a habitation structure; perhaps serving as a *karigi*, or communal men's house. Thus, the low scores on factors 1 and 3 attained by House 6 may reflect the architectural uniqueness of a special purpose structure, rather than the post-occupational destruction of a standard dwelling . The paucity of factor 1 and factor 3 building materials in House 14 and 18, however, suggests their intentional removal by house occupants or post-occupational visitors, following abandonment. Like the houses in cluster 5, House 14 and 18 also appear to have been disturbed by frost cracks and burrowing animals. The extremely low factor scores attained by House 14 and 18 correspond with the abandonment/destruction and post-occupational erosion stages of McCartney's (1979) six sequential stages of whale bone house evolution. Additionally, the poor condition of House 14 and 18 would seem to imply that they are also among the earliest occupations of the Deblicquy site.

Summary of Architectural Variability at the Deblicquy Site.

In summary, significant architectural variability was observed among Thule whale bone houses at the Deblicquy site. The results of the Factor Analysis suggest that this variability can be explained in terms of :

1) the implementation of a **low cost/high maintenance** building strategy, involving the construction of flat roofed dwellings using minimal numbers of mandibles and maxillae

(clusters 1 and 3), or small, narrow dwellings roofed primarily with ribs (cluster 4). This type of building strategy might reflect either limited access to high cost building materials such as mandibles and maxillae, or reduced architectural investment due to a shorter anticipated use-life for the dwelling.

2) the implementation of a **high cost/low maintenance** building strategy, involving the construction of large, bi-lobed dwellings with self-supporting, hemispherical roof frames assembled primarily from mandibles and maxillae (cluster 2). This type of building strategy might reflect a greater access to high cost building materials, either from higher whaling success rates, a surfeit of abandoned houses from which to acquire raw material, easy access to whale bone from natural whale strandings, or the ability of high status individuals to control the circulation of whale bone within and between communities. This increased investment in architecture suggests a longer anticipated use-life for the dwelling.

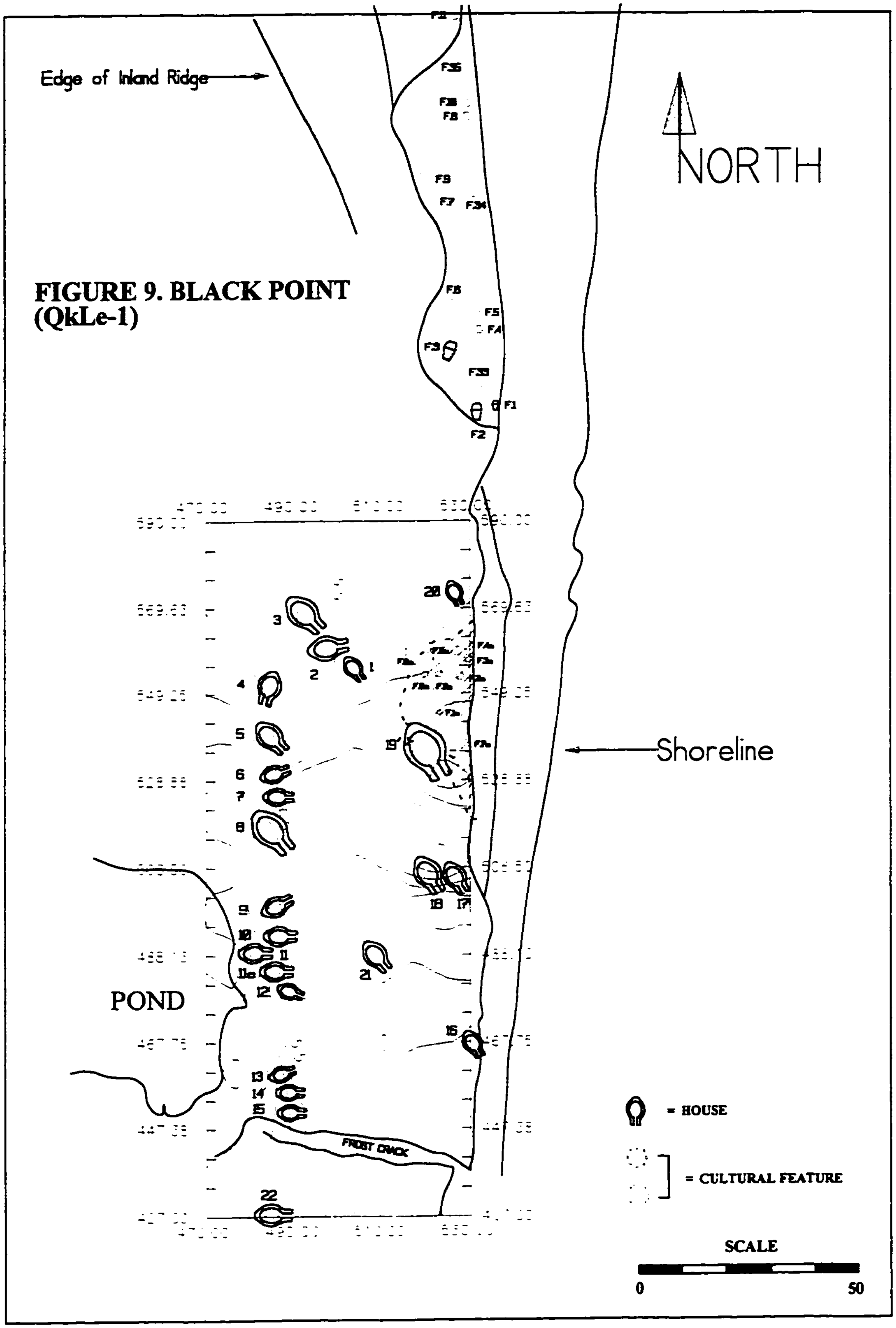
3) The removal of whale bone by later site occupants or visitors, and the post-occupational erosion of houses due to frost cracks and animal disturbances; McCartney's (1979) **abandonment/destruction** and **post-occupational erosion** stages of whale bone house evolution (clusters 5 and 6).

Part B: The Black Point Site (QkLe-1): Location and History of Investigation.

The Black Point site is located immediately south of the eastern tip of Black Point (75^0 42' N, 97^0 23' W) on the Gregory Peninsula, just south of Polar Bear Pass (Figure 4). Although Taylor observed the site from the air in 1961, the absence of a suitable landing area prevented a closer examination of the site at that time. The Black Point site has since been visited by Schledermann (1978) and Savelle (1988). Taylor remarked that the houses present at the site "seemed a little worn down" in comparison to those at Deblicquy and Brooman Point, and that the site appeared to be threatened by erosion (Taylor and McGhee 1981:5). At the time of writing, the Black Point site remains un-excavated, and therefore, no chronological information exists which would help to establish when this site would have been occupied relative to other Thule sites in the region.

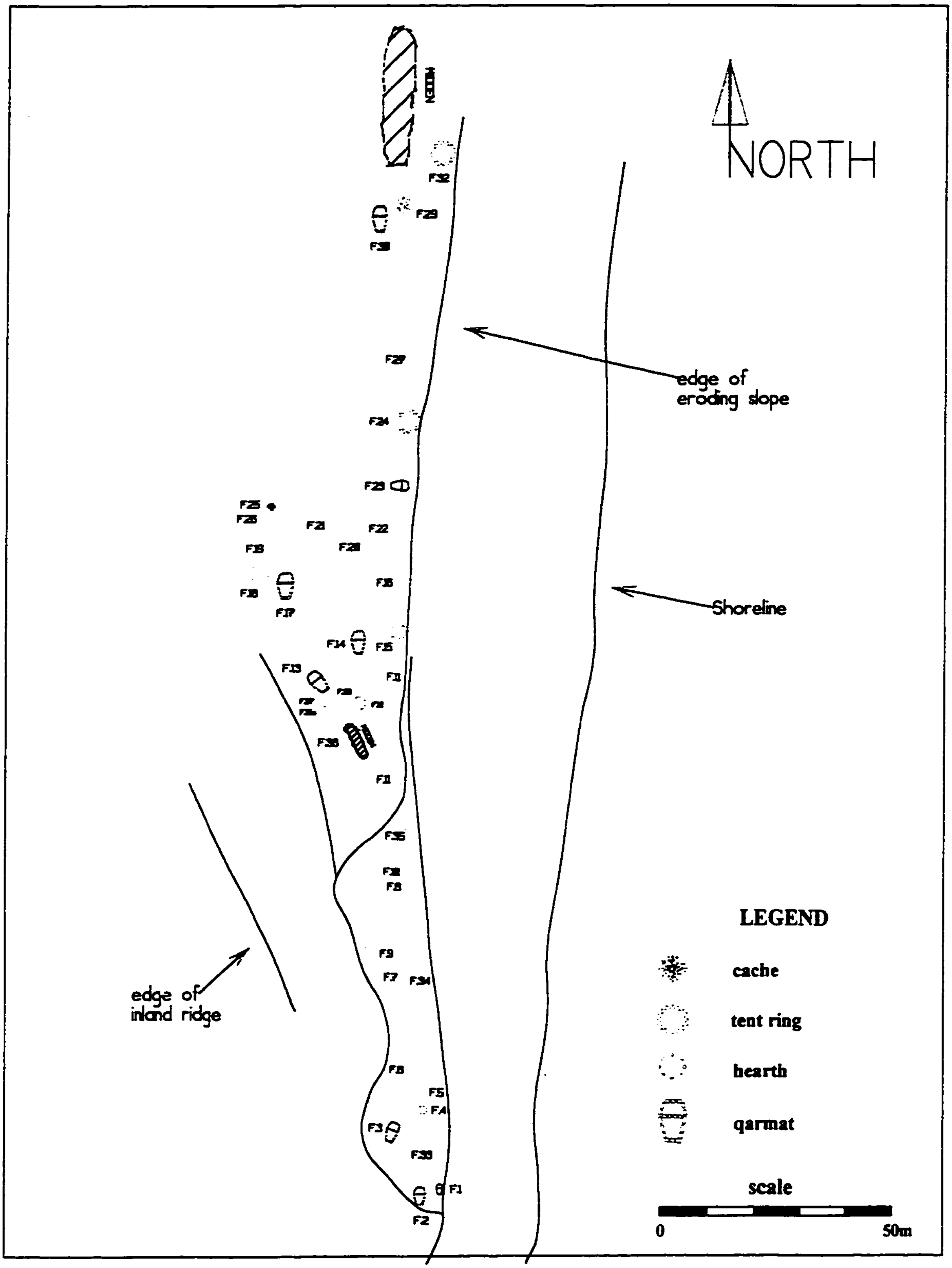
House Forms Present at the Black Point Site (QkLe-1).

The Black Point Site consists of 22 semi-subterranean whale bone houses roughly arranged into two house rows (Figure 9). Several of the dwellings situated along the easternmost house row presently rest close to the edge of an eroding slope. A smaller site, located 37 metres to the north of the habitation site, consists of a series of *qarmat*, tent rings, middens, caches, and several possible Paleoeskimo features; all of which are scattered along a 270 metre stretch of beach ridge (Figure 10).



Edge of Inland Ridge
NORTH
FIGURE 9. BLACK POINT (QkLe-1)
Shoreline
POND
FROST CRACK
= HOUSE
= CULTURAL FEATURE
SCALE
0
50

FIGURE 10. SITE ADJACENT TO BLACK POINT(QkLe-1)



Procedure for Recording Architecture.

With the aid of three field assistants, all of the houses present at the site were mapped and recorded using the same methodology outlined above for the Deblicquy site. In addition, the frequencies and distributions of whale bone across the site were recorded by theodolite. All of this was accomplished over a 5 week field season during the summer of 1995. Upon returning from the field, digitized plans of each house were compiled and assembled following the same procedure used to analyse the Deblicquy houses.

Procedure for Recording Adjacent Site.

The various cultural features associated with the smaller adjacent site were also mapped, recorded, and processed using the same procedure employed the previous summer at the processing site adjacent to the Deblicquy site.

Analysis of Architectural Variability at the Black Point Site (QkLe-1)

A Factor Analysis of the Black Point houses was next performed using the 12 architectural variables defined for the Deblicquy site. Houses 7, 9, 10, 11, 15, 20, 21, and 22 were excluded from the analysis because their extremely poor state of preservation prevented the consistent measurement of the architectural variables selected for analysis.

The data collected for each house on the 12 architectural attributes is presented in Table 3, and their standardized z-scores and factor scores are provided in Table 4.

A correlation matrix of the architectural variables selected revealed a significant number of correlations greater than .30, indicating that the Black Point data set was factorable. Initially, the F.A carried out on the remaining 14 houses resulted in the extraction of 4 factors (Figure 11). Although the factors derived explained 80.6 percent of the total variability inherent within the data set, the factors themselves were somewhat difficult to interpret. Consequently, a decision was made to re-run the test using an option in SPSS which allows the researcher to select the number of factors to be extracted. A three factor solution was chosen and rotated orthogonally (Varimax rotation) to maximize the variance of the loadings within the factors extracted. While the total variability explained by these three factors was somewhat reduced (71.0 percent), each of the three factors individually explained a greater amount of variability in the data set. Furthermore, the variables correlated and grouped together within the factors in ways which made them much easier to interpret. The factors extracted are defined as follows:

Factor 1

Factor 1 is comprised of mandibles, maxillae, and rocks, and accounts for 34 percent of the total variability observed in the data set. Houses which score highly on factor 1 possess high frequencies of these materials. Except for the exclusion of mound height, the variables correlated in factor 1 are identical to those in factor 3 for the Deblicquy site

Table 3. Architectural Attributes For Houses Recorded at the Black Point Site (QkLe-1)

HOUSE	MANDIBLE	MAXILLAE	CRANIA	RIBS	SCAPULAE	VERTEBRA	ROCKS	LOBES	AREA(m^2)	TUNNEL(m)	MOUND(cm)	DIAMETER (m)
H.1a	3	3	0	7	0	1	38	2	24.65	3.80	33.00	3.22
H.2a	7	10	1	34	3	5	80	2	10.96	1.21	14.00	2.10
H.3a	1	0	0	2	1	1	62	2	8.03	1.50	23.00	2.45
H.4a	2	1	0	0	1	0	19	2	16.35	2.07	30.00	3.71
H.5a	13	6	0	10	0	1	94	2	8.53	2.16	40.00	2.65
H.6a	0	0	0	0	0	2	10	1	9.30	0.64	4.00	2.96
H.8a	0	0	0	1	1	1	34	3	12.62	1.90	14.00	1.86
H.12a	0	1	0	0	0	0	7	1	6.20	0.00	2.00	2.07
H.13a	1	1	0	0	0	1	33	2	10.24	0.99	5.00	2.32
H.14a	0	1	0	5	0	0	34	2	6.30	1.06	3.00	2.81
H.16a	4	4	0	7	0	0	95	1	7.97	0.00	7.00	3.11
H.17a	0	0	0	1	0	3	66	1	15.02	2.02	39.00	2.60
H.18a	0	0	1	2	0	3	41	2	14.17	1.93	57.00	2.81
H.19a	0	0	0	13	0	4	48	2	12.45	2.94	30.00	2.17

Table 4. Architectural Attributes Standardized as Z-Scores and Factor Scores for Black Point Houses (Table 3)

HOUSE	ZMAN	ZMAX	ZCRANIA	ZRIBS	ZSCAP	ZVERT	ZROCKS	ZLOBES	ZAREA	ZTUNNEL	ZMHEIGHT	ZDIAMETER	FACTOR1	FACTOR2	FACTOR3
H.1a	0.24044	0.40958	-0.39340	0.12552	-0.50324	-0.35635	-0.32280	0.37014	2.65381	2.10320	0.67162	1.14295	0.22972	-0.67210	1.96262
H.2a	1.22222	2.73909	2.36039	3.09092	3.01942	2.13809	1.14858	0.37014	-0.13635	-0.35639	-0.43801	-1.03198	1.69153	2.69973	-0.50392
H.3a	-0.32058	-0.66557	-0.39340	-0.42363	0.67098	-0.35635	0.51799	0.37014	-0.73319	-0.08141	0.08760	-0.35232	-0.25453	0.07972	-0.27206
H.4a	-0.04007	-0.30719	-0.39340	-0.64329	0.67098	-0.97996	-0.98843	0.37014	0.96182	0.45771	0.49641	2.09448	-0.10602	-0.85746	0.88489
H.5a	2.90528	1.30555	-0.39340	0.45501	-0.50324	-0.35635	1.63904	0.37014	-0.63097	0.54177	1.08043	0.03606	2.10212	-0.82787	0.35066
H.6a	-0.60109	-0.66557	-0.39340	-0.64329	-0.50324	0.26726	-1.30372	-1.35717	-0.47472	-0.89817	-1.02203	0.63805	-0.69456	-0.46196	-0.79961
H.8a	-0.60109	-0.66557	-0.39340	-0.53346	0.67098	-0.35635	-0.46293	2.09745	0.20256	0.29443	-0.43801	-1.49804	-1.13917	0.86281	0.04503
H.12a	-0.60109	-0.30719	-0.39340	-0.64329	-0.50324	-0.97996	-1.40882	-1.35717	-1.10579	-1.50616	-1.13883	-1.09024	-0.80713	-0.26895	-1.62046
H.13a	-0.32058	-0.30719	-0.39340	-0.64329	-0.50324	-0.35635	-0.49797	0.37014	-0.28256	-0.57001	-0.96362	-0.60476	-0.60907	-0.06925	-0.61503
H.14a	-0.60109	-0.30719	-0.39340	-0.09414	-0.50324	-0.97996	-0.46293	0.37014	-1.08512	-0.50209	-1.08043	0.34677	-0.38629	-0.38760	-0.80910
H.16a	0.52095	0.76797	-0.39340	0.12552	-0.50324	-0.97996	1.67407	-1.35717	-0.74640	-1.50616	-0.84682	0.92934	1.37197	-1.23134	-1.13489
H.17a	-0.60109	-0.66557	-0.39340	-0.53346	-0.50324	0.89087	0.65812	-1.35717	0.69120	0.41022	1.02203	-0.06103	-0.20262	-0.30188	0.60350
H.18a	-0.60109	-0.66557	2.36039	-0.42363	-0.50324	0.89087	-0.21770	0.37014	0.51814	0.32530	2.07325	0.34677	-0.57854	0.65109	1.21959
H.19a	-0.60109	-0.66557	-0.39340	0.78450	-0.50324	1.51448	0.02753	0.37014	0.16757	1.28777	0.49641	-0.89605	-0.61740	0.78505	0.68877

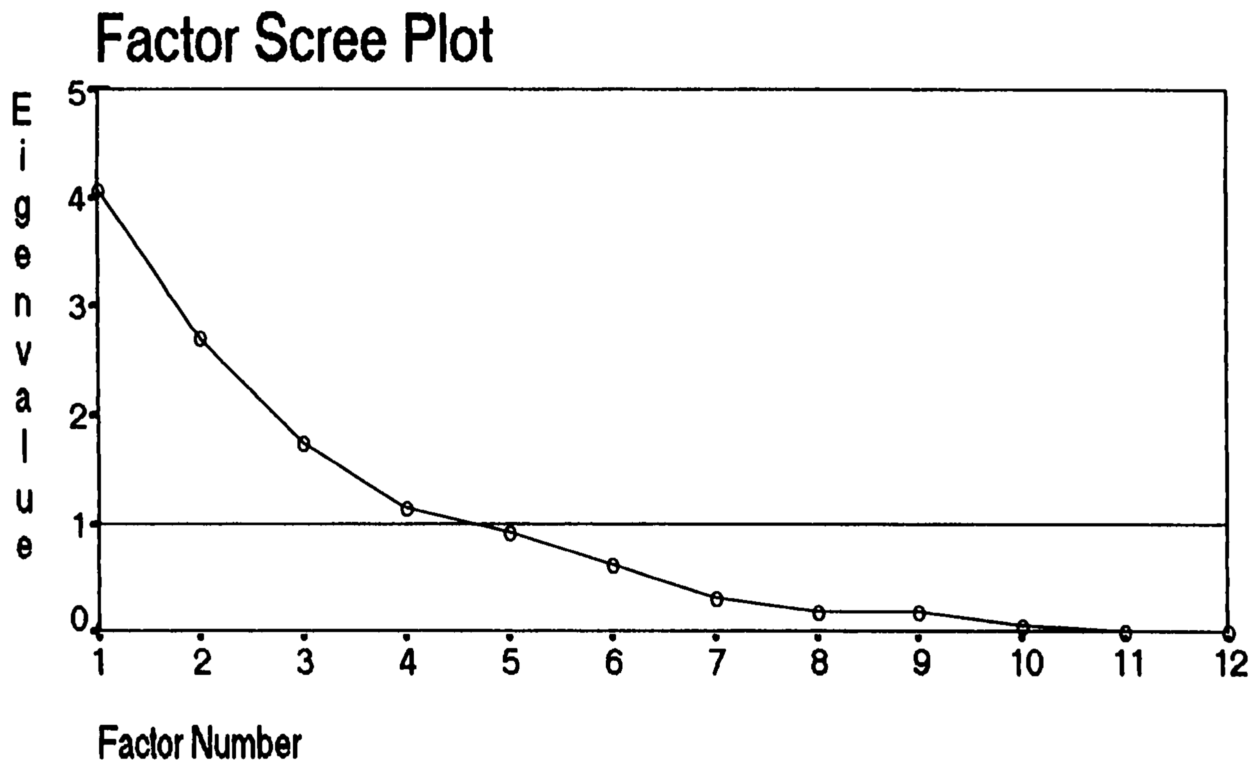


FIGURE 11. Scree Plot of factors plotted against their eigenvalues for the 12 architectural variables measured at the Black Point Site (QkLe-1). Eigenvalues of less than 1 are considered unimportant in explaining variability in the data set (Tabachnick and Fidell 1989:634-35).

data. The absence of a significant correlation between mound height and other factor 1 elements at Black Point may reflect the use of a different roofing style. Rather than countersink the proximal ends of mandibles and maxillae into the edges of the house mound, the mandible/maxillae roof framework may have simply sat on top of the ground surface. The base of the superstructure might then have been braced for support using rocks which are extremely plentiful in many Black Point houses. At Deblicquy, mandibles and maxillae were interpreted as high cost building materials which were frequently used to roof large dwellings. Consequently, I have interpreted factor 1 at Black Point as representing a **high cost/low maintenance building strategy.**

Factor 2

Factor 2 is comprised of vertebrae, scapulae, crania, ribs, diameter of widest lobe, and number of lobes, and accounts for 22.4 percent of all variability present in the data set. Houses which scored highly on factor 2 are narrow[11], bi-lobed or tri-lobed houses with high frequencies of vertebrae, scapulae, crania, and ribs. Like factor 1 from Deblicquy, the bowhead elements which make up this factor likely reflect low cost utilitarian building materials which could have been used in place of more costly, and potentially scarcer elements. As mentioned previously, the use of roof frameworks constructed from ribs would have ostensibly required narrower lobes. Consequently, the construction of multiple lobed dwellings may have allowed Thule builders at Black Point to increase the

[11] The variable of "diameter of widest lobe" was negatively correlated with the other variables in factor 2.

floor areas of their dwellings without having to increase the maximum diameter of the house. This supposition is supported by the fact that among many multi-lobed houses at Black Point, lobes are of an equal diameter and area. Thus, I have interpreted factor 2 as representing a **low cost/high maintenance building strategy.**

Factor 3.

Factor 3 is comprised of tunnel length, internal area, and mound height, and accounts for 14.6 percent of the variability observed in the data set. Houses which score high on factor 3 have long entrance tunnels, large internal areas, and high house mounds. The variables 'tunnel length' and 'internal area' were similarly correlated in factor 2 from the Deblicquy site. The correlation of 'mound height' with other variables in factor 3 may reflect the fact that dwellings with longer tunnel lengths and larger internal areas would have generated greater amounts of back dirt during the excavation of the house pit, thereby resulting in the formation of higher house mounds. As mentioned previously, the decision to construct long tunnels may relate to the orientation of the house relative to prevailing winds, and/or the need for greater storage space outside of the main living area. Likewise, the construction of houses with large internal areas may reflect the need to accommodate larger numbers of individuals. Consequently, I have interpreted factor 3 as representing the **Plan/Design** aspects of dwelling construction.

A Hierarchical Cluster Analysis of the Houses from Black Point

A hierarchical cluster analysis was next used to examine the degree of architectural diversity among houses at the Black Point site. The resulting dendrogram groups together houses which share similar subsets of correlated architectural attributes (based on factor scores), and splits apart those which do not (Figure 12). Five separate house clusters were defined as follows:

House Cluster 1.

House cluster 1 is comprised of five houses; H.6, H.14, H.13, H.3, and H.12 (Appendix 2). Extremely low scores on factor 3 indicate that short tunnels and small interior floor areas distinguish cluster 1 houses from other dwellings at Black Point. This would seem to suggest that cluster 1 houses were occupied by single (nuclear) families, perhaps during the warmer months of spring and autumn. This interpretation implies a shorter anticipated use-life for cluster 1 dwellings, and suggests that they may have functioned as *qarmat*. Low scores on factors 1 and 2 also indicate that all five dwellings possess little in the way of bowhead whale elements. This possibly reflects the removal of such materials by post-occupational visitors. Thus, cluster 1 houses may correspond with McCartney's (1979) abandonment/destruction and post-occupational erosion stages of whale bone house evolution.

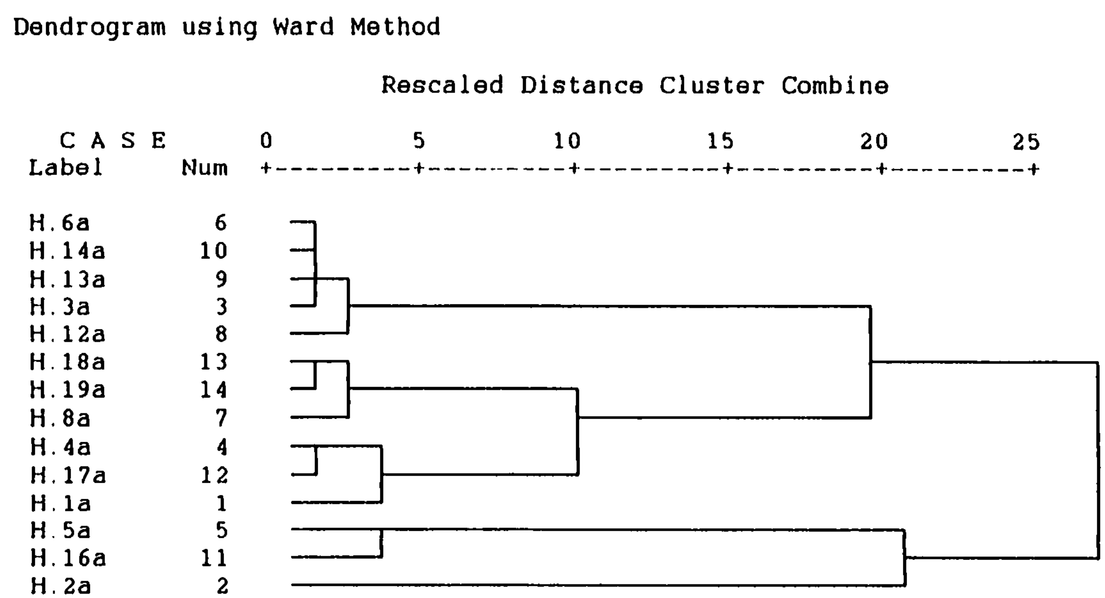


FIGURE 12. Results of hierarchical cluster analysis for Black Point houses.

House Cluster 2.

House cluster 2 is comprised of three houses; H. 18, H.19, and H.8 (Appendix 2). High scores on factor 2 indicate that cluster 2 houses are narrow, multi-lobed dwellings, which contain high frequencies of low cost bowhead elements such as vertebrae, scapulae, crania, and ribs, relative to other dwellings at Black Point. Houses 18 and 19 also scored highly on factor 3, indicating that they possess long entrance tunnels and large internal areas. Consequently, these two houses may have been designed to accommodate several co-resident families over the winter months. The narrow diameters and equal sizes of the lobes which make up cluster 2 houses likely reflect the primary use of bowhead ribs as roofing material. These factors scores suggest that cluster 2 houses are representative of a low cost/high maintenance building strategy. The use of such a strategy may reflect a limited access to higher cost building materials such as mandibles and maxillae, or a shorter anticipated use-life.

House Cluster 3.

House cluster 3 is comprised of three houses; H.4, H.17, and H.1 (Appendix 2). High scores on factor 3 indicate that cluster 3 houses possess long tunnels, large interior areas, and high house mounds. Low scores on factors 1 and 2, however, testify to the relative scarcity of bowhead elements within these structures. This would seem to suggest that cluster 3 houses were occupied by larger families during the winter months, and were likely mined for building materials by post-occupational visitors, following their abandonment. Low scores on factors 1 and 2 imply that cluster 3 houses correspond with McCartney's (1979) abandonment/destruction and post-occupational erosion stages of whale bone house evolution.

House Cluster 4.

House cluster 4 is comprised of two houses; H.5 and H.16 (Appendix 2). High scores on factor 1 indicate that cluster 4 houses contain large numbers of mandibles, maxillae, and rocks relative to other houses at Black Point. This suggests the use of mandibles and maxillae as primary roofing material. The lack of evidence for mandible bridge supports such as upright bowhead crania or rock piles would seem to imply the use of a self-supporting dome-shaped roof framework. This framework would have likely been braced at the edge of the house depression using rocks. Thus, cluster 4 houses represent a high cost/low maintenance building strategy, relative to other houses at Black Point. This would seem to suggest a longer anticipated use-life for such dwellings.

House Cluster 5.

House cluster 5 is comprised of a single house; H.2 (Appendix 2). Extremely high scores on factors 1 and 2 distinguish this dwelling from all others at the Black Point site. The narrow diameter and comparable internal areas of the two lobes in House 2 indicate that this dwelling was likely roofed using a framework constructed from ribs; perhaps supported in some fashion by several broken, upright mandibles. Consequently, House 2 reflects a high cost/low maintenance building strategy relative to many of the other houses at Black Point. This increase in architectural investment may reflect a longer anticipated use-life for House 2.

Summary of Architectural Variability at the Black Point Site (QkLe-1).

While houses at the Black Point site are in a generally much poorer state of preservation than those at Deblicquy, significant architectural variability was nevertheless identified via the Factor Analysis. Results suggest that this variability can be interpreted as:

1) the implementation of a **low cost/high maintenance building strategy** (cluster 2), in which investment in utilitarian architecture is reduced because of a limited access to higher cost building materials such as mandibles and maxillae, or a shorter anticipated use-life for the dwelling.

2) the implementation of a **high cost/low maintenance building strategy** (cluster 4 & 5), in which investment in utilitarian architecture is increased because of a greater access to higher cost building materials, or a longer anticipated use-life for the dwelling. As mentioned previously, greater access to high cost building materials could result from

either higher whaling success rates, a surfeit of abandoned houses from which to acquire raw material, easy access to whale bone from natural whale strandings, or the ability of high status individuals to control the circulation of whale bone within and between communities.

3) the removal of building materials by later groups, and/or post-occupational erosion due to frost cracks and burrowing animals (cluster 1 and 3). These processes correspond with McCartney's (1979) **abandonment/destruction and post-occupational erosion** stages of whale bone house evolution.

Part C: An Analysis of Architectural Variability Between the Deblicquy Site and the Black Point Site.

When the digitized plans for each house are used in coordination with the factors extracted from the Factor Analysis, an understanding of the feedback which exists between the properties of different whale bone elements (size, strength, abundance) and the plan/design of a dwelling (floor area, lobe diameter, tunnel length) can be achieved. Such an understanding makes it possible to distinguish between houses which have been 'designed' to accommodate a limited access to specific types of building materials, and houses in which such materials were originally present, but have since been removed by post-occupational visitors. At Deblicquy and Black Point, for example, certain dwellings appear to have been 'designed' to accommodate different complements of whale bone building materials, while others reflect the post-occupational removal of building materials by later groups, and/or disturbance through frost cracks and burrowing animals. Among the former types of houses, I have outlined two specific types of building techniques; a high cost/low maintenance strategy, and a low cost/high maintenance strategy. While evidence for both types of building strategies was found at each site, comparison of digitized plans of houses from Deblicquy and Black Point reveals architectural variability which differs more in degree than in kind. To illustrate, even though some houses at Black Point reflect high cost/low maintenance building strategies relative to other dwellings at the site, these houses generally contain far less whale bone than high cost/low maintenance dwellings recorded at the Deblicquy site. Furthermore, while multiple-lobed houses occur at both sites, lobes among Deblicquy houses frequently vary in size and diameter (i.e one large lobe and one small lobe), while those among Black Point houses are roughly of equal size and diameter.

In order to search for architectural variability in a more precise fashion, a Discriminant Function Analysis (D.F.A) was run on the 12 architectural variables collected from both sites. Discriminant Function Analysis is a multivariate statistical technique which allows the researcher to distinguish how different the members of two or more groups are, using a set of predictors (Harris, 1975; Tabachnick and Fidell 1989:504). In my example, I am asking if it is possible to distinguish between whale bone houses from Deblicquy, and whale bone houses from Black Point, based on twelve architectural variables. Thus, the *groups* are houses from the two sites, and the *predictors* are the architectural variables. If a significant difference between groups exists, then the combination of variables (predictors) contributing the most to those differences can be used to predict group membership (Tabachnick and Fidell 1989:504). Correlations between the discriminant function and the predictors, referred to as *loadings*, are used to assess which predictors contribute the most to the differences observed between groups. While consensus is lacking as to how high correlations (loadings) have to be in order to be interpreted, Tabachnick and Fidell (1989:539) state that correlations in excess of .30 (9% of the variance) are usually considered eligible. In summary, the discriminant function is best visualized as a continuum upon which the members (houses) of each group (Deblicquy; Black Point) are placed according to their loadings on each of the discriminating variables. If houses gravitate to opposite ends of the continuum, then predicted group membership is high and significant architectural differences exist between each site.

Interpretation of the Discriminant Function Analysis.

A resulting Chi-square value of 27.986 ($p = .0056$) indicates that a statistically significant difference does exist between whale bone houses from Deblicquy and Black Point. These differences are illustrated graphically, in the territorial map for the canonical discriminant function, which shows little overlap between the two groups (Figure 13). Examination of the loadings of predictors within the structure matrix indicates that vertebrae are contributing most to the architectural variability observed in the data set, followed in importance by crania, house diameter, maxillae, ribs, and mandibles (Figure 14). The total percentage of groups correctly classified by the discriminant function was

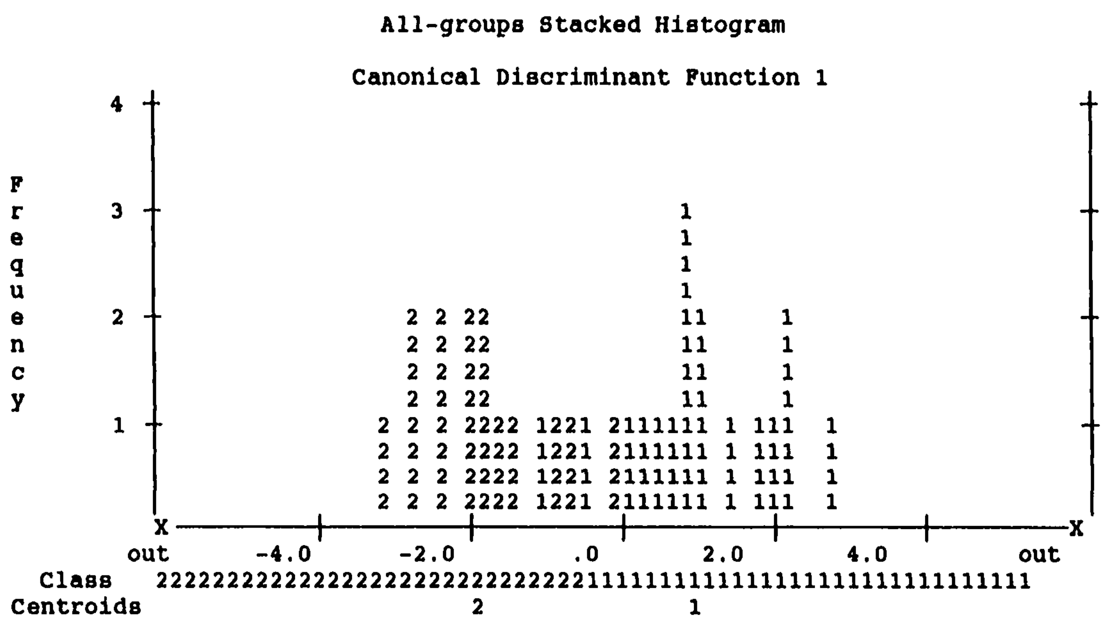


FIGURE 13. Territorial map illustrating the degree of overlap and divergence of Deblicquy (1) and Black Point (2) houses, based on 12 architectural variables.

Structure matrix:

Pooled within-groups correlations between discriminating variables
and canonical discriminant functions
(Variables ordered by size of correlation within function)

	Func 1
VERT	.50127
CRANIA	.47470
DIAMETER	.46107
MAX	.38516
RIBS	.36008
MAN	.33736
SCAP	.25851
TUNNEL	.19043
MHEIGHT	.15897
AREA	.11765
LOBES	-.07789
ROCKS	-.04826

FIGURE 14. Factor loadings for the 12 architectural variables measured and recorded at the Deblicquy Site and the Black Point site. Correlations in excess of .30 (9% of variance) are usually considered as significant in the identification of variables (predictors) which are important for distinguishing between groups.

90.32%, with 88.2% of the Deblicquy houses predicted as belonging to the Deblicquy group, and 92.9% of the Black Point houses predicted as belonging to the Black Point group. The results of the D.F.A indicate that narrow house diameters, and a general paucity of bowhead whale elements serve to distinguish Black Point houses from those at Deblicquy. Interestingly, the variable 'diameter of widest lobe' was the only plan/design variable which loaded significantly within the discriminant function, and a simple t-test further substantiates this conclusion (t-value = 3.27, 2-Tail Sig = .003). As illustrated previously at the Deblicquy site, the decision to design houses with narrow lobes likely reflects the use of ribs, rather than mandibles and maxillae, as primary roofing material. Consequently, while the low frequencies of bowhead elements such as crania, vertebrae, and ribs may reflect their purposeful removal from the site by post-occupational visitors, the plan/design of Black Point houses suggests that mandibles and maxillae were never very frequent at this site to begin with. Thus, I suggest that the low frequencies of these high cost elements observed at Black Point is not solely attributable to their intentional removal by later groups. Rather, I would argue that it reflects either 1) an adaptation of Thule architecture to whale bone scarcity, or 2) shorter anticipated use-lives for Black Point dwellings, perhaps due to higher mobility, or a different seasonal use of the site.

If houses at Black Point represent a compromise in design, due to the limited availability of whale bone, then it is important to understand why this might have been so. In Chapter 3, the sensitivity of bowhead whales to sea-ice conditions was discussed in some detail. To summarize, bowheads generally avoid ice-choked regions in favor of ice leads and open water, and this has resulted in a distinctive pattern of seasonal migration, which is largely determined by the spring and autumn movements of the flow edge (Dyke *et al.* 1996:236). In Chapter 4, I outlined Savelle and McCartney's (1991) speculation that the small numbers of Thule peoples inhabiting the Crozier Strait, Barrow Strait, Lancaster Sound region, would have had limited whaling opportunities, due to labor shortages, and poor ice conditions. Using annual patterns of sea-ice distribution, historic data on the location and frequency of bowhead kills, and recent sightings, Savelle and McCartney (1991:207) delineated this region into *core* and *peripheral* summer ranges. According to Savelle and McCartney (1991), whale abundance would have been highest and most predictable in *core* areas because summer ice clears from the area earlier and more completely. Conversely, bowheads would have been less numerous in *peripheral* areas, because of frequently incomplete ice break-ups which occur later on in the season. As Bathurst Island clearly falls within the *peripheral* summer range, it is conceivable that whaling success rates might have been much lower during the time in which Black Point was occupied. In response, the inhabitants of this site may have had to supplement elements derived from infrequent whale kills with elements obtained from the remains of natural whale strandings, and engage in more conservative architectural practices. In contrast, the plethora of whale bone present at the Deblicquy site suggests much higher whaling success rates during the time of its occupation. McGhee (1984:93) has suggested that the Thule occupants of Brooman Point may have participated in cooperative whaling endeavors with the members of other nearby Thule communities such as Resolute Bay. If Deblicquy residents practiced similar types of inter-community whaling endeavors, then whaling prospects in this area may have increased considerably. In addition, the relatively recent date of occupation estimated by Taylor and McGhee (1981) for Deblicquy suggests that residents could also have obtained whale bone from the abandoned houses of other earlier Thule sites.

Alternatively, the reduced investment in architecture reflected in Black Point houses may indicate a shorter anticipated use-life for these dwellings. In Chapter 3, recent studies by Miller and Barry (1992) were outlined which demonstrate that male and female Peary caribou aggregate in coastal areas on Bathurst Island, during the short autumn rutting season. Unlike Deblicquy, which is situated 400 meters inland, Black Point is located directly on the coast and is, at present, frequented by large numbers of Peary caribou[12]. Consequently, it is possible that the residents of Black Point were occupying the site during the autumn season, to take advantage of the hunting opportunities provided by the caribou. A sinew twister, bodkin, and caribou hunting point recorded on the surface of the site provide evidence for the practice of archery, thereby supporting the notion that caribou hunting was carried out by the occupants of Black Point. Thus, if Black Point was inhabited mainly during the short autumn rutting season, then families may have been unwilling to invest substantial amounts of labor and building materials in the construction of dwellings.

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This assessment is based on conversations with Frank Miller in 1995, and personal observations made during the 1995 field season at Black Point.

Summary

In summary, the use of digitized plan drawings of whale bone houses in combination with multivariate statistical analysis resulted in the identification of significant architectural variability among Thule whale bone houses at the Deblicquy site and Black Point site. The architectural variability associated with each site has been interpreted as a product of:

- ❑ 1) the implementation of low cost/high maintenance building strategies.
- ❑ 2) the implementation of high cost/low maintenance building strategies.
- ❑ 3) the post-occupational removal of building materials, and/or disturbance through frost cracks and burrowing animals.

House designs which reflect low cost/high maintenance building strategies are typically small, narrow dwellings enclosed using either the flat-roofed design described by McGhee (1984) and Park (1988), or roof frameworks constructed primarily from ribs, as described by Maxwell (1985) (Figure 15). This type of building strategy was likely employed during periods of whale bone scarcity, or when the anticipated use-life for a dwelling was limited to a single season. In contrast, house designs which reflect high cost/low maintenance building strategies are typically larger dwellings, with wider

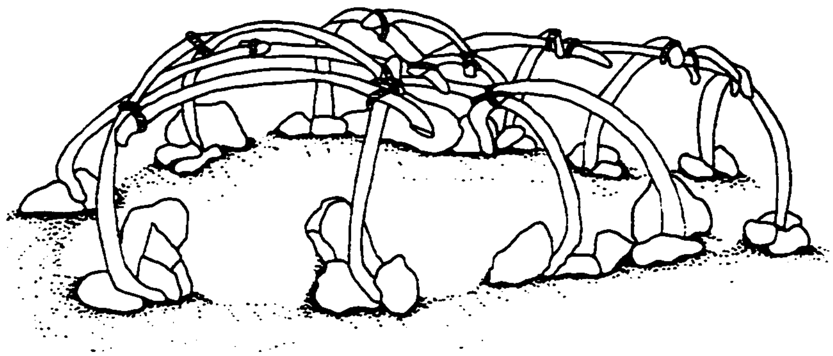


FIGURE 15. Example of a semisubterranean whalebone house constructed using a **low cost/high maintenance** building strategy.

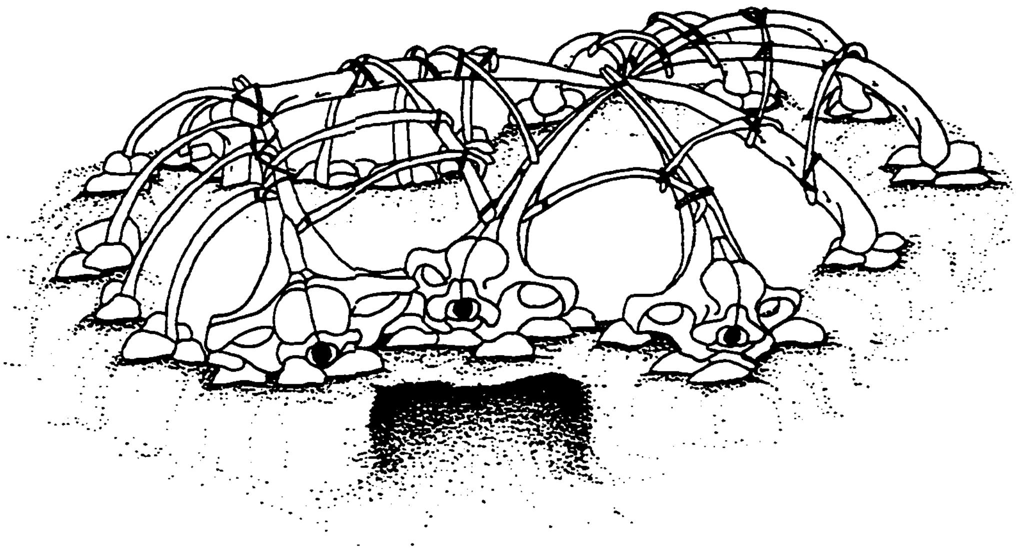


FIGURE 16. Exampe of a semisubterranean whalebone house constructed using a **high cost/low maintenance** building strategy

diameters, and self-supporting roof frameworks constructed primarily from mandibles and maxillae, as described by McCartney (1979) (Figure 16). This type of building strategy was likely employed during periods when whale bone was more abundant, or when the anticipated use-life of a dwelling was much longer.

While similar types of building strategies were identified at both sites, house designs at Black Point appear to reflect a greater reliance on low cost elements. Architectural evidence seems to suggest, for example, that rib-roofed dwellings were much more frequent than flat-roofed ones. I have suggested that the construction of smaller houses with narrow, equal sized lobes, and roof frameworks constructed from ribs, ostensibly represents either 1) an adaptation of Thule architecture to whale bone scarcity, or 2) a decreased investment in architecture due to a shorter anticipated use-life for Black Point dwellings. While the former suggests lower whaling success rates for Black Point occupants, the latter posits a different functional and seasonal use for this site; autumn caribou hunting.

CHAPTER SIX: THE COMPOSITE SNOW HOUSE - SPATIAL ORGANIZATION AND SOCIOECONOMIC CHANGE, AD. 1000-1940.

Introduction

This chapter provides a detailed analysis of variability in the spatial organization of two principal winter house forms used in the Canadian Arctic from AD. 1000 to the beginning of the Settlement Era; the semi-subterranean whale bone house of the Classic Thule phase (AD. 1000 to 1500), and the composite snow house of the historic period (AD. 1500 to 1950). Modern architectural theory contends that built environments are spatial systems which reflect, sustain, and order the social lives of their occupants. I use concepts acquired from studies of space syntax, outlined in Chapter 2, to analytically compare the spatial organization of each house type. I argue that the floor plans of semi-subterranean winter houses and snow houses are generated by different space syntaxes, each of which may plausibly reflect the differing socioeconomic relations that characterize Classic Thule and later Neoeskimo households.

Historical Explanations for Variability in Neoeskimo Architecture

Archaeologists and anthropologists have long recognized the existence of variability in the floor plans of Neoeskimo dwellings. Many researchers have attempted to explain variability in house size (single family versus communal) and shape (circular versus rectilinear) in terms of the constraints imposed by different types of building materials (driftwood versus whale bone) (Mathiassen, 1928), the diffusion of Asiatic, Athapaskan, European and Norse traits (Thalbitzer, 1914; Bird, 1945), and as responses to seasonal ritual intensification (Mauss, 1979 [1906]), and climatic deterioration (Schledermann, 1976a,b). Mathiassen (1927:153), for example, felt that the rectilinear driftwood houses of Pt. Barrow, Alaska, and the Mackenzie Delta region, and the ovate dwellings of central and eastern Arctic were simply "coordinate forms of dwellings born of different materials", mainly because "walls built from whale bone can never be straight; the whale skull, jaw bones, and ribs will naturally compel the form of the house to be round". Thalbitzer (1914), on the other hand, interpreted the adoption of larger, rectilinear house forms by later Thule groups as an influence of Norse architecture, while Bird (1945) suggested that they represented attempts by their builders to imitate the houses of early European whalers. In his classic monograph, Mauss (1979 [1906]) rejected functional explanations for the variations he observed in the size differences of historic Inuit winter and summer dwellings. Instead, he argued convincingly that the larger winter dwellings had been designed to accommodate the collective intensification of ritual activity which occurred mainly during the winter months. More recently, Schledermann (1976a,b) has suggested that the construction of large communal Thule houses in areas such as Labrador and Cumberland Sound reflected a need to conserve fuel, construction materials, and facilitate food-sharing practices, in light of deteriorating environmental conditions brought about by the 'Little Ice Age'.

Many of these traditional explanations for architectural variability focus almost exclusively on the external, physical reality of Thule houses. However, these structures also enclose and shape a volume of space into a specific pattern. As outlined in Chapter 2, it is within these patterns that Glassie (1975), Hillier and Hanson (1984), and others suggest social meaning resides. The grammatical approaches they support treat the spatial organization of buildings and settlements as a 'language'; complete with syntactic rules which generate and modulate how spaces, and the people within them, are connected together.

Spatial Organization and the Science of Complexity

The syntactic approaches of Glassie (1975) and Hillier and Hanson (1984) have much in common with the new science of complexity, in that they see the *global* spatial structure of a building arising from *local rules* governing interactions between individuals (Figure 17 [see Gleik, 1987; Kellert, 1993, Kauffman, 1993; Lewin, 1992]). Cellular automata models such as Conway's "Game of Life" provide an illustration of this important concept. Cellular automata are mathematical simulations; typically graphs composed of units (cells), in which the 'state' of any individual unit, as from black to white, may change, depending on the 'states' of neighboring units (Banning 1996:513). Such changes in 'state' are modulated at the local level by a series of rules defined by the initiator of the model. In the example presented here, an initial 7 cell pattern is acted on

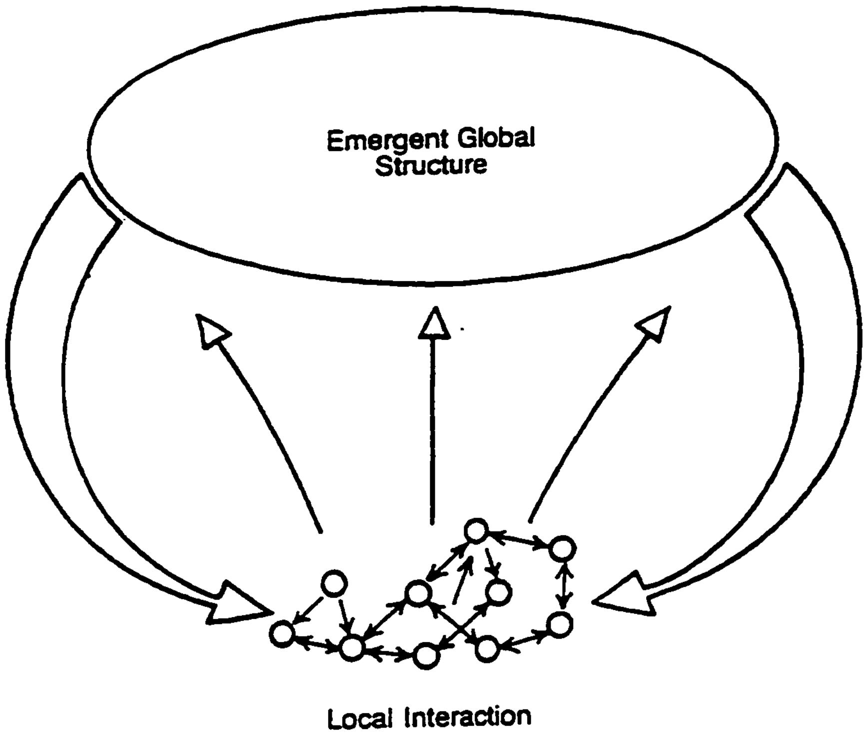


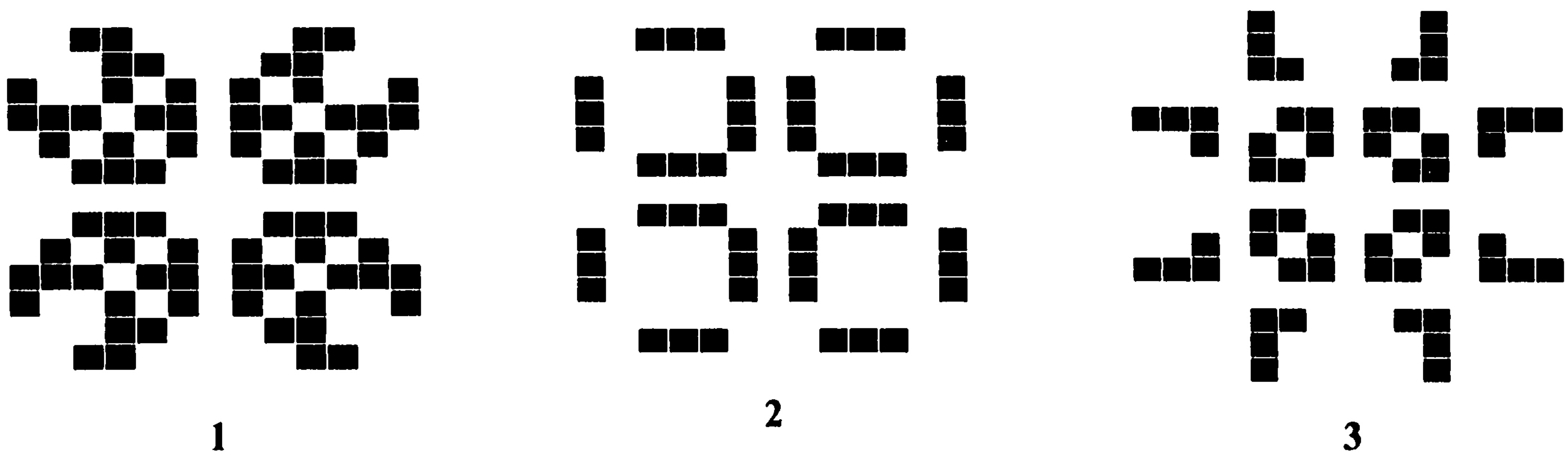
FIGURE 17. The relationship between local interaction and emergent global structures (after Lewin 1992:13).

by the following rule: an empty cell is filled if three of its neighbors are filled - otherwise it is left empty. A filled cell dies of loneliness if it has one or fewer neighbors, continues to live if it has 2 or 3 neighbors, and dies of overcrowding if it has more than 3 neighbors (Figure 18). Taken to 33 iterations, the process eventually stabilizes into three repeating patterns (Figure 19). These patterns are emergent properties of both the local rule, and the initial 7 cell pattern. More advanced computer simulations such as those developed by Chris Langton of the Santa Fe Institute demonstrate that by varying the local rules, a bewildering array of different global patterns of varying complexities can be produced (Langton, 1986). The spatial systems generated by cellular automata programs, in effect, become self-organizing, and evolutionary biologist Stuart Kauffman (1996) has referred to this phenomenon as "order for free". Christalleran settlement lattices provide an illustration of a similar type of spatial system arising within a human social and economic system. In Christalleran theory, global hexagonal settlement structures emerge out of local, economically informed decisions relating to the location of towns, villages, and cities (Christaller 1933; Haggertt 1965; Hodder and Orton 1976). Rather than being the end result of some 'master plan' implemented by a ruler, government, or other centralized authoritative body, the hexagonal settlement patterns which form across the landscape are simply an emergent property of sets of 'rules' designed to minimize transportation and travel costs.

FIGURE 18. Cellular Automata Generated Using Conway's "Life for Windows"

THE INITIAL 7 CELL PATTERN

FIGURE 19. Cellular Automata Generated Using Conway's "Life for Windows"



AFTER 33 GENERATIONS, THE INITIAL 7 CELL PATTERN STABILIZES INTO 3 REPEATING PATTERNS

Architectural Change in Canadian Arctic Prehistory

As discussed in Chapter 4, the emergence of historically known Inuit cultures from earlier Neoeskimo groups appears to have been accompanied by a major shift in subsistence, and in settlement location (Maxwell, 1985; McCartney, 1977; McGhee, 1994,1969/70; Schledermann, 1976a,b; Savelle, 1987). Between AD. 1400-1600, whaling was abandoned in many areas of the Canadian Arctic in favor of an increasing economic emphasis on the hunting of Ringed Seals, and other smaller marine mammals (Mathiassen, 1927; Maxwell, 1985; McCartney, 1977; Sabo and Jacobs, 1980; Schledermann, 1979). The terrestrially-situated, semi-permanent coastal villages of the Classic Thule period were replaced by more transient winter villages constructed out on the sea ice (Mathiassen, 1928; McGhee, 1968; Schledermann 1976a). Concomitant with this change was the adoption of the snow house as the principal winter house form in many areas of the central and eastern Canadian Arctic (Maxwell, 1985; McGhee, 1968; Savelle, 1987; Schledermann 1976a).

The transition from semi-subterranean winter dwellings (whale bone houses, *qarmat)* to snow houses also appears to have been accompanied by the adoption of more communal living arrangements (see Mathiassen, 1928). Estimates of Thule hunting band sizes (20-25 people [McCartney, 1979; McGhee, 1976]) stand in vivid contrast to ethnohistoric accounts of aggregations of over 100 persons living in traditional Netsilingmiut and Igloolingmiut snow house villages located out on the sea ice during *aglu* (breathing hole sealing)(Maxwell, 1985; Mathiassen, 1928). In 1830, British Naval explorer Sir John Ross observed 120 Netsilik Inuit families inhabiting 12 snow houses, and estimated an average household unit of 10 persons (Ross 1835:243). Likewise, during his search for Sir John Franklin, Leopold McClintock commented on 12 persons inhabiting two snow houses with conjoining entrance tunnels (McClintock 1868:225). During the course of his research among the Netsilik, Danish explorer Knud Rasmussen described "two communicating snow houses" occupied by a family and two married sons (Rasumssen, 1931). In summarizing such data, Damas (1971:60) states that while early commentaries on the composition of Inuit households are frequently brief, they nevertheless suggest that large multifamily dwellings or compounds of dwellings were relatively common in the eastern and central Canadian Arctic, and that the occupants of these "composite" dwellings were likely jointed through close kin ties. This would seem to imply that with the transition from semi-subterranean houses to snow houses, there may also have been a major change in the social system of Neoeskimo groups.

If the ways in which spaces are connected together within a dwelling is an emergent property of the local rules (space syntax) that govern interactions between individuals, then the socioeconomic changes which accompanied the abandonment of whaling in the Canadian Arctic might be reflected in the spatial organization of semi-subterranean whale bone houses, and the snow houses which replaced them. Semi-subterranean whale bone houses and snow houses were occupied during periods of the year in which inclement weather would have required that the majority of the daily activities be conducted indoors. Consequently, both house forms should provide a relatively enduring picture of spatial organization within traditional households.

Houses Sampled for Analysis

Detailed floor plans were constructed for 35 Thule whale bone houses from the Deblicquy site (QiLe-1) and the Black Point site (QkLe-1), Bathurst Island (Appendix 1 and 2). Houses from these two sites are collectively single lobed, bi-lobed, or tri-lobed dwellings, and are more or less typical of Thule winter houses found in other areas of the eastern and central Canadian Arctic. In contrast, the snow house is more variable in form, with some structures consisting of up to 15 interlinked domes, and accommodating as many as four families (Figure 20). While the snow house has been more or less ignored by arctic archaeologists because of its archaeological invisibility[13], the floor plans of these structures were occasionally sketched and mapped by explorers, missionaries, and ethnographers in the 19th and early 20th century. A search through the ethnographic and ethnohistoric literature resulted in a sample of 23 snow house floor plans, representing most of the central Inuit groups documented ethnohistorically (Jenness, 1922 (Copper Inuit); Gabus, 1938; (Padleirmiut); Hall, 1865,1879 (Netsilik Inuit); Parry, 1824 (Iglulik Inuit); Boas, 1888 (Baffinland Inuit); Richardson, 1820-22 (Caribou Inuit); Mathiassen, 1928 (Iglulik Inuit); Whitaker, 1937 (Copper Inuit).

One particular snow house plan, sketched by John Richardson, Surgeon-Naturalist with Franklin on his journey across the Barren Grounds in 1820-22 (Houston, 1984:29), appears to have been embellished by its Inuit builder to please Richardson. I therefore acknowledge that the accuracy of the ethnohistoric maps used in the analysis likely varied

[13] Savelle (1984) reports some success in locating and excavating land-based snow houses.

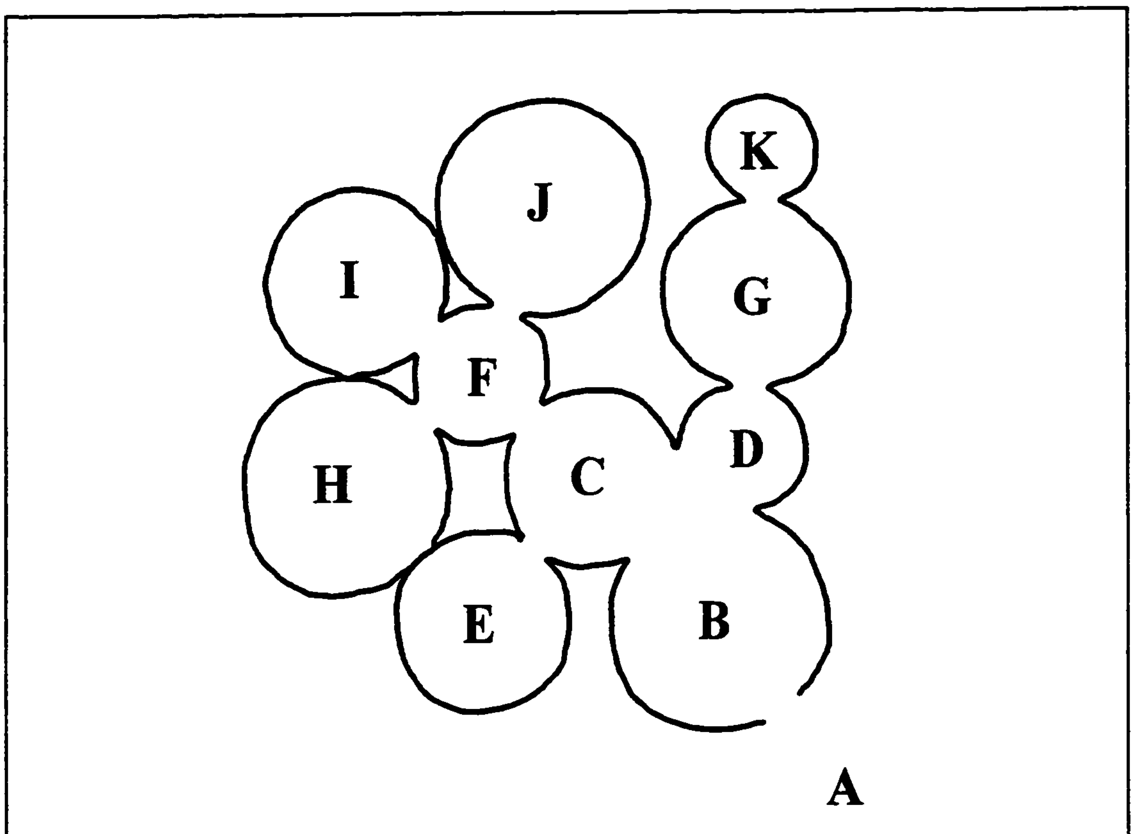


FIGURE 20. Example of a Iglulingmiut snow house complex (after Mathiassen 1928).

between reporters. Consequently, a subjective assessment of the accuracy of each snow house plan was made, based on the circumstances of its construction. Snow houses built at the request of an ethnographer/enquirer, for example, were excluded from the analysis in favor of those built exclusively for use as shelter. Regardless, the aim of this analysis is not to produce a statistically significant pattern, rather, it is to provide a general impression of the relative differences in spatial complexity manifest in these two house types.

Method of Analysis

In order to examine the premise that various forms of socioeconomic confederation are reflected in the spatial organization of Neoeskimo house forms, it is first necessary to identify the ways in which whale bone houses and snow houses differ from one another spatially. Hillier and Hanson's (1984) concepts of transpatial and spatial solidarity, reviewed in Chapter 2, provide a useful analytical framework for making such a distinction. To reiterate, transpatial solidarity is a solidarity of analogy and isolation; an arrangement of space based on exclusion and the systematic control of encounters with others (Hillier and Hanson 1984:145). In transpatial solidarity, the inhabitants of dwellings emphasize relations with each other and downplay relations with individuals residing within the community. This is manifest spatially in the maintenance of strong boundaries separating the interior of the dwelling from the community outside (Hillier and Hanson 1984:145). In contrast, spatial solidarity is a solidarity of contiguity and encounter. Inhabitants build relations with other community members by encouraging interactions with individuals within the larger community (Hillier and Hanson 1984:145). This is manifest spatially in the weakening of the control of movement between community and dwelling (Hillier and Hanson 1984:145).

As the concepts of transpatial and spatial solidarity imply the differential control of movement through space, a graph-based theory of nodes and links (network analysis) was used to quantify the relative accessibility of spaces within each dwelling type. Justified network diagrams were first drawn for each of the houses sampled. Network diagrams depict bounded spaces as open circles (nodes), and the paths connecting spaces together as lines (edges [Figure 21]). Two variables were then selected to measure the spatial organization of the houses chosen for comparison; *node frequency* and *number of access ranks*. *Node frequency* refers simply to the number of discrete, bounded spaces (lobes) within the dwelling. Lobes are defined as spaces set apart by a constriction in the floor plan of the dwelling, and ostensibly relate to socially mediated patterns of activity segregation within the house. Among the whale bone houses and snow houses sampled, any noticeable constriction in the floor plan was considered as demarcating a lobe. The *number of access ranks* is calculated using a pathway matrix (*sensu* Blanton 1994:34-36). The pathway matrix summarizes the shortest paths between conjoined spaces, and then ranks each space according to its relative accessibility. The procedure for calculating the matrix is a relatively simple one; the number of shortest 'trips' between nodes, counted by the number of 'edges' on the graph, is first tabulated. These 'trip lengths' are then summed for each node, and ranked from most accessible to least accessible by score. To

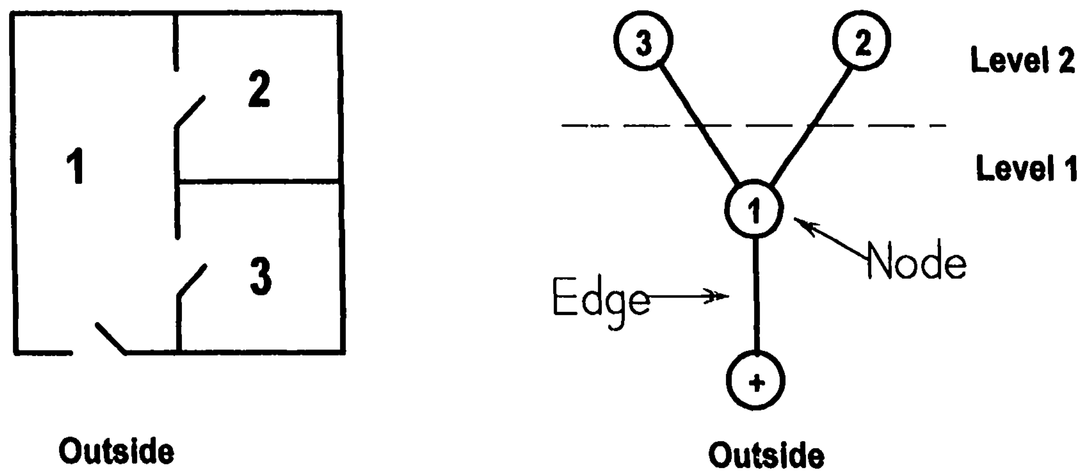


FIGURE 21. A floor plan and its hierarchical graph, illustrating nodes, edges, and two hierarchical levels of structural depth (after Blanton 1994:37)

illustrate, the pathway matrix in Table 5 ranks the accessibility of spaces **A** through **K** in Figure 20 from 1, indicating most accessible, to 8, indicating least accessible. The number of accessibility ranks is a measure of the number of nodes in the network graph which occupy structurally unique positions and, as such, it can be considered as a measure of spatial complexity. While more mathematically precise methods for calculating spatial accessibility exist, pathway matrices provide a simple and effective means of analyzing relatively small graphs. The *node frequencies*, and *number of access ranks* for each house were then tabulated and graphed as a scatter plot (Figure 22).

Results of Analysis

An R sq. value of .8600 indicates that among the houses sampled, a strong correlation exists between *node frequency* and *number of access ranks*. As the number of bounded spaces within a dwelling increases, greater differences in the relative accessibilities of spaces become apparent. Consequently, the higher a house plots along the trend line, the greater its spatial complexity is determined to be. With a few exceptions, the distribution of whale bone houses and snow houses along the trend line separate out nicely, indicating that the spatial organization of each house type is quite distinct. In addition, the snow house sample is much more dispersed along the trend line than the whale bone house sample, demonstrating that the former display a much greater range of spatial complexity. Most importantly, however, the distribution of data points along the trend line indicates

TABLE 5. Pathway Matrix Calculated for Iglulik Inuit Snowhouse Recorded by Mathiassen (1928)

SPACE	A	B	C	D	E	F	G	H	I	J	K	SUM	RANK	DEPTH
A	X	1	2	2	3	3	3	4	4	4	4	30	7	0
B	1	X	1	1	2	2	2	3	3	3	3	21	3	1
C	2	1	X	1	1	1	2	2	2	2	4	18	1	2
D	2	1	1	X	2	2	1	3	3	3	2	20	2	2
E	3	2	1	2	X	2	3	3	3	3	4	26	4	3
F	3	2	1	2	2	X	3	1	1	1	4	20	2	3
G	3	2	2	1	3	3	X	4	4	4	1	27	5	3
H	4	3	2	3	3	1	4	X	2	2	5	29	6	4
I	4	3	2	3	3	1	4	2	X	2	5	29	6	4
J	4	3	2	3	3	1	4	2	2	X	5	29	6	4
K	4	3	3	2	4	4	1	5	5	5	X	36	8	4

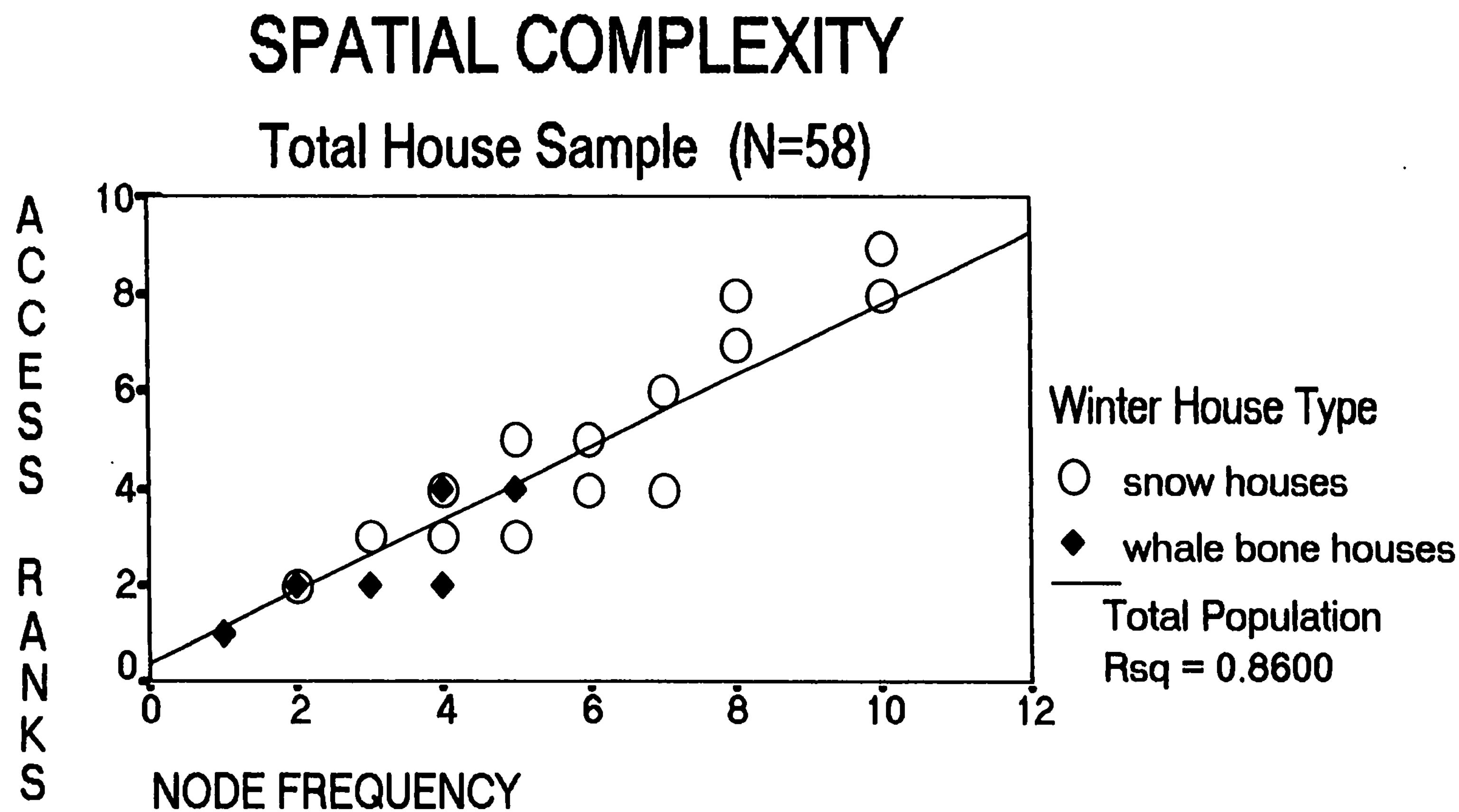


FIGURE 22. Scatter plot of # access ranks against node frequency for houses sampled.

* Some data points represents more than one house.

that among the dwellings sampled, snow houses exhibit a higher level of complexity in spatial organization.

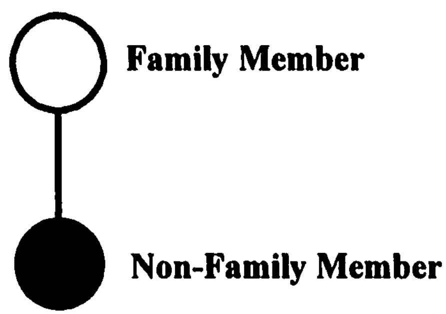
Interpretation of Results

Are these differences in the global patterning of space in whale bone houses and snow houses generated by different syntactic 'rules' governing the social interactions of their occupants, or are they simply products of the unique properties of the building materials used to construct them? At first, it would seem obvious that the characteristics of snow would make it a much more flexible and plentiful construction material than whale bone. However, the ethnographic record suggests that even though the conjoining of multiple snow houses by later Inuit groups was relatively common, it was occasionally prevented by the limited availability of suitable snow. Jenness (1922), for example, reports that among the Copper Inuit, limited access to snowdrifts of a depth appropriate for cutting snow blocks sometimes resulted in families constructing unlinked, single room snow houses (see Jenness, 1922:76-77). Alternatively, the archaeological record demonstrates that although Classic Thule families possessed the ability to link two or more houses together, they frequently chose not to. To cite an instance, examples of two semi-subterranean houses with linked entrance passages have been recorded at some Classic Thule sites, thereby demonstrating that the conjoining of multiple dwellings made from whale bone was possible (Mathiassen 1927:132). However, a survey of the literature reveals that this practice is more the exception than the rule. Thus, it would appear that the decision for two or more families to join their houses together was being mediated by something other than the unique properties of snow and whale bone.

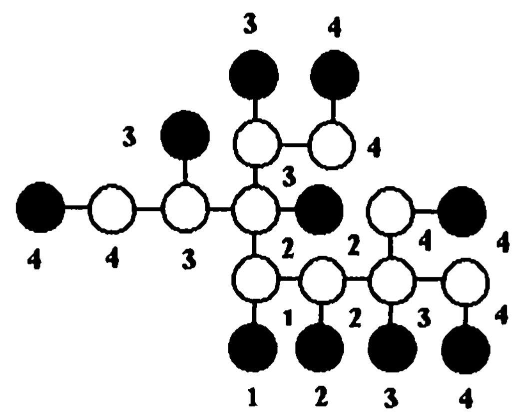
Spatial Variability in Neoeskimo Architecture: A Model

An elementary cellular automata model similar to Conway's "Game of Life" can be used to provide an alternative explanation for the spatial variability observed in the sample. Using the cellular automata model and a simple joining "rule" governing the interaction of cells, it is possible to simulate the spatial consequences of socioeconomic alliances which are household-based and community-based. Among alliances which are household-based, the relations of production operate at the level of the family and involve the cooperation of family members only. In the cellular automata model, we let open dots represent members of a family and black dots represent non-members (Figure 23). The basic unit of aggregation is the family member - non-family member dyad, with the line joining the dyad representing encounters within a community. Such encounters define any community and are thus treated as a constant. In order to simulate a situation in which economic production is achieved through the cooperation of family members only, a simple "rule" governing interaction between members of the same and different families is imposed. We then let the rule of aggregation be that open dots can be joined to other open dots, representing repeated encounters within the family, but that black dots cannot be joined to other black dots, representing limited encounters between families. We now label some initial dyad as generation 1, and then let the dyads generated immediately

FIGURE 23. The Aggregation of Community Dyads
(Taken to 4 Generations)



The composition of a community dyad.



adjacent to generation 1 be generation 2, and so on (Figure 23). If we carry the simulation through a number of generations, link dots of the same color by proximity, and then disentangle the components, an interesting morphological pattern emerges. The encounter networks generated within families are much "clumpier" and "denser" than those generated between families, which tend to be much "sparser" and "stringier" (Figure 24).

Among socioeconomic alliances which are community-based, the relations of production operate at the level of the camp/settlement, and involve the cooperation of different families. By imposing a new rule in which non-family members, or black dots, can only interact with each other, a simulation of alliance at the community level can be achieved. When the procedure is repeated using the new rule, the opposite morphological trend occurs. Encounter networks generated between families are now much "clumpier" and "denser" than the encounter networks generated within families (Figure 25). The spatial consequences of these two forms of socioeconomic alliance would seem clear. If "denser", "clumpier" encounter networks occur within families rather than between them, then dwellings should exhibit a more complex and structured ordering of space; defined by Hillier and Hanson (1984) as transpatial solidarity. Likewise, if "sparser", "stringier" encounter networks occur within families rather than between them, then dwellings should exhibit a less complex, less structured arrangement of space; defined by Hillier and Hanson (1984) as spatial solidarity.

As discussed in Chapter 4, many researchers describe North Alaskan whaling societies, the closest analogue for Classic Thule, as "mutually dependent sphere(s) of interaction" in which "the exigencies of the whale hunt demanded a level of integration and cooperation

FIGURE 24. Simulation of Household-Based Socioeconomic Alliances

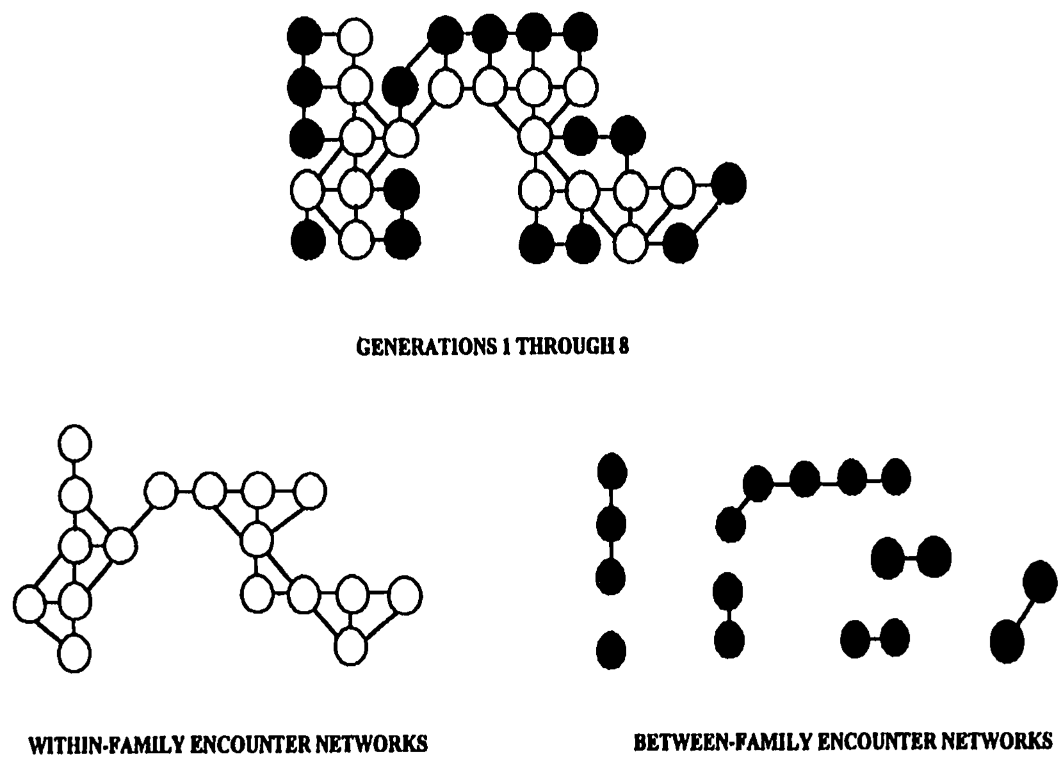
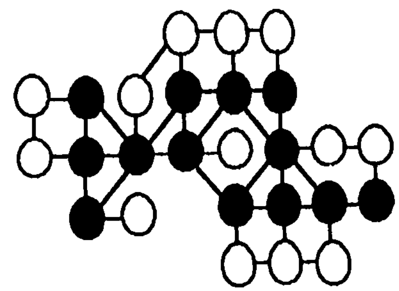
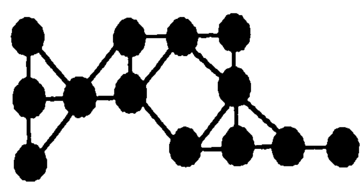


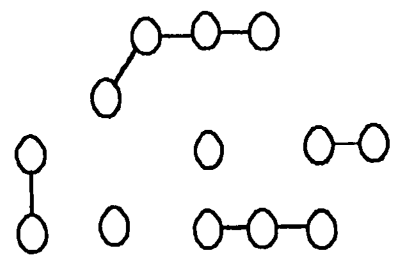
FIGURE 25. Simulation of Community-Based Socioeconomic Alliances



GENERATIONS 1 THROUGH 8



BETWEEN-FAMILY ENCOUNTER NETWORK



WITHIN-FAMILY ENCOUNTER NETWORK

beyond the familial" (Cassell 1988:90). By implication then, the greater the dependance on whaling, the stronger the 'mutually dependant sphere of interaction" overriding the kin-based local family structure is likely to be (Grier and Savelle 1994:96). This generally accepted model of Classic Thule society would seem to conform to the cellular automata simulation of community-based socioeconomic alliances, in which encounter networks are denser within the camp/settlement rather than within the household.

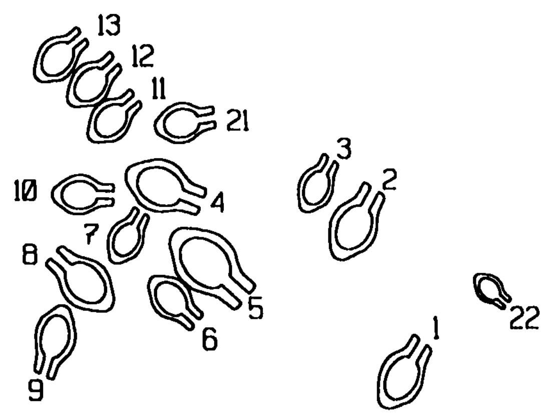
After AD.1500, whaling was abandoned in many areas of the Canadian Arctic in favor of an increasing economic focus on winter breathing hole sealing (McCartney 1977; Schledermann, 1976a,b; McGhee, 1969-70). As whaling decreased in importance, corporate groups tended to be based less on the membership of the entire community and more on individual family units (Grier and Savelle 1996:96). The volunteer associations of the whaling crew were replaced by socioeconomic alliances which facilitated the harvesting and redistribution of foodstuffs at the level of the extended family (*ilagiit*) rather than the community; for example, seal meat sharing partnerships (Damas, 1972; Balikci, 1970). Consequently, later Neoeskimo society conforms more to the simulation of household-based socioeconomic alliances, in which encounter networks are denser within the home rather than within the community. This interpretation would seem to corroborate Damas's (1971:77) view that within the traditional Inuit snow house, the residential unit and the economic unit were one in the same. To illustrate, Damas (1971:77) states:

> " it is important to note that, in contrast to the Copper Eskimo who also at times inhabited composite dwellings, the occupants of the Netsilik clusters or multi-family single domes formed a structured sort of entity, that is, a patrilocally oriented group of kin connected by primary ties. This pattern obtained mainly for the period of the snow house dwelling or about six or seven months of the year. Thus, for that period at least, one can safely conclude that the Netsilik comprised an extended family unit" (Damas 1971:61).

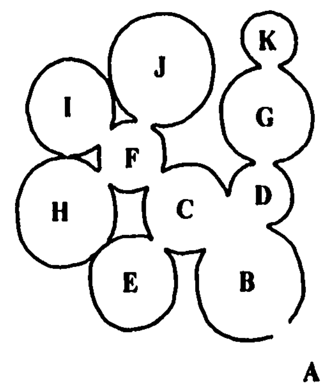
Defining the Space Syntax of Classic Thule and Later Neoeskimo House Forms

I suggest that two different space syntaxes have generated the differences observed in the ordering and arrangement of space in the whale bone houses and snow houses sampled; one based on transpatial solidarity and the other on spatial solidarity. To summarize, snow houses exhibit a greater range and degree of spatial complexity because the encounter networks necessary to sustain the socioeconomic relations unique to later Neoeskimo society are denser within the household than within the community (Figure 26). Consequently, the transpatial solidarity reflected in many snow house complexes; typically aggregations of linked spaces of varying accessibility, ensures that the inhabitants of the dwelling emphasize relations with each other, and down play relations with individuals residing within the community. In contrast, the encounter networks necessary to sustain communal activities such as whaling are denser within the community than the household, and this is reflected in the comparatively less stringent arrangement and ordering of spaces within Classic Thule houses. Consequently, the spatial solidarity reflected in many whale bone houses; typically unattached single lobed

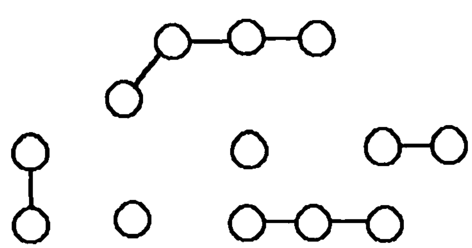
FIGURE 26. Comparison of the Spatial and Transpatial Properties of Neoeskimo House Forms



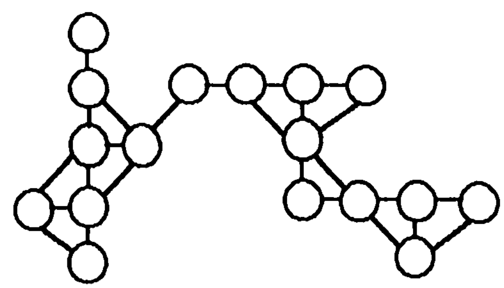
Example of the spatial solidarity reflected in Thule whale bone houses from the central house cluster of the Deblicquy site (QiLe-1). Houses are typically unattached single-lobed and bi-lobed dwellings.



Example of transpatial solidarity reflected in an Iglulik Inuit snow house documented by Mathiassen (1928). Spaces are aggregated and linked together in ways which create patterns of varying accessibility.



Within-family encounter network for cellular automata model of community-based socioeconomic alliance; "sparse" and "stringy".



Within-family encounter network for cellular automata model of household-based socioeconomic alliance; "clumpy" and "dense".

and bi-lobed structures, encourages individuals to built relations with members of the community (Figure 26).

The Relationship Between 'Household' and 'House Form' in Historic Inuit Society

The spatial analysis of two Iglulingmiut snow house complexes documented by Mathiassen (1928) illustrate how the transpatial syntax of the composite snow house reflects and sustains the *nalartuk* and *ungayuk* subsystems of the *ilagiit* (extended family), as discussed in Chapter 3. The first snow house was recorded at Itibdjeriang on the east coast of Melville Peninsula in 1922, and was occupied by two families (Figure 27a). According to Mathiassen (1928), the shaded spaces labeled (4) and (5) denote family living areas; each of which opened onto a front room (7). This front room, in turn, led to a small storage room for skin clothing (6), and a bigger storage room (2) for such items as dog harnesses, meat, etc. The larger storage room (2) opened onto a third storage room (3), and the dog room (1), from which access to the outside could be gained. The second snow house, built by the same Inuit group one month earlier, was recorded at Aua's River, near Itibdjeriang (Figure 27b). This structure was occupied by five families, and contained 10 separate rooms/spaces. The shaded spaces denote family living areas (3,5,6,7,9); all of which merged, either directly or indirectly, into a central room (2). While Mathiassen (1928) does not provide a description of the function of spaces (10) and (1), it is likely that they served functions similar to those of the first snow house. Thus, space (10) operated ostensibly as a storage area, and space (1) as a dog room.

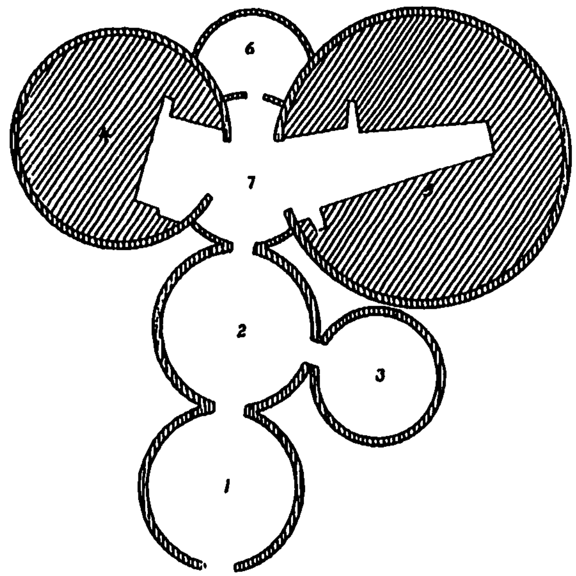


FIGURE. 27a

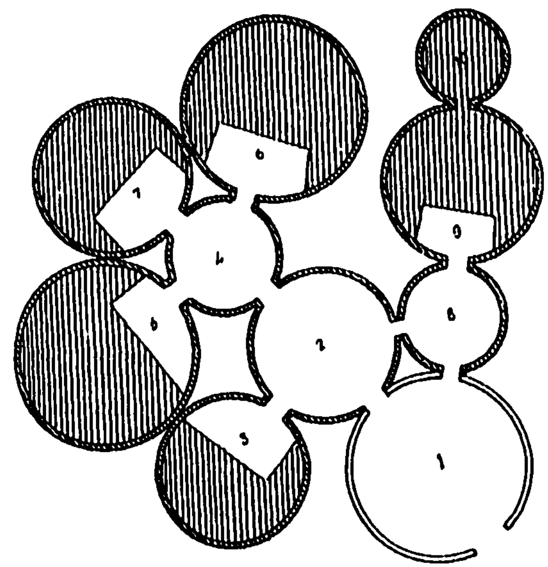


FIGURE. 27b

FIGURE 27a & 27b. Floor Plans of Two Iglulingmiut Snow Houses Documented by Mathiassen (1928)

Pathway matrices calculated for each snow house (Tables 6 & 7) reveal variation in the accessibility of different family living spaces between these two dwellings. In the Itibdjeriang snow house, the spaces occupied by each family share an accessibility rank of 1 - meaning that an individual has to make an *equal* number of 'trips' to move from the entrance of the dwelling to either of the two resident family's living areas. In the Aua's River snow house, however, the spaces occupied by each family possess different accessibility ranks. To illustrate, while space (9) has an accessibility rank of 3, and space (3) has an accessibility rank of 4, spaces (5), (6), and (7) all possess accessibility ranks of 2. This means that an individual must make an *unequal* number of 'trips' to move from the entrance of the dwelling to the living areas of different resident families.

Why would some families choose to situate themselves in more spatially inaccessible areas than others within a snow house ? In a detailed review of the relationship between family structure and residence patterning among central and eastern Arctic Inuit groups, Damas (1971:61) states that:

> "There appears to have been a definite accepted pattern of habitation of clusters or composite snow houses. The rearmost dome was inhabited by the father and his youngest unmarried son while the domes to the side were the dwellings of older married sons and an occasional son-in-law"

In the case of the Aua's river snow house, the rearmost domes (spaces 7, 8, and 9) are the most segregated space in the dwelling. As Damas (1965:105) states that father-son relations are central to the integration of nuclear families into extended families, the

TABLE 6. Pathway Matrix Calculated for the Floor Plan of Figure 27a.

X	CA	1	2	3	4	5	6	7	Sum	Rank
CA	X	1	2	3	4	4	4	3	21	0
1	1	X	1	2	3	3	3	2	15	2
2	2	1	X	1	2	2	2	1	11	3
3	3	2	1	X	3	3	3	2	17	1
4	4	3	2	3	X	2	2	1	17	1
5	4	3	2	3	2	X	2	1	17	1
6	4	3	2	3	2	2	X	1	17	1
7	3	2	1	2	1	1	1	X	11	3

TABLE 7. Pathway matrix calculated for the floor plan of Fig. 27b

X	CA	1	2	3	4	5	6	7	8	9	10	sum	rnk
CA	X	1	2	3	3	4	4	4	2	3	4	30	
1	1	X	1	2	2	3	3	3	1	2	3	21	5
2	2	1	X	1	1	2	2	2	1	2	3	17	7
3	3	2	1	X	2	3	3	3	2	3	4	26	4
4	3	2	1	2	X	1	1	1	2	3	4	20	6
5	4	3	2	3	1	X	2	2	3	4	5	29	2
6	4	3	2	3	1	2	X	2	3	4	5	29	2
7	4	3	2	3	1	2	2	X	3	4	5	29	2
8	2	1	1	2	2	3	3	3	X	1	2	20	6
9	3	2	2	3	3	4	4	4	1	X	1	27	3
10	4	3	3	4	4	5	5	5	2	1	X	36	1

hierarchical distribution of space in the Aua's River snow house may reflect the hierarchical pattern of the respect-obedience dyad embodied in the *nalartuk* axis. With the introduction of three additional families in the Aua's River snow house, socioeconomic relations between household members would have likely become more complex. Under such conditions, it would have become necessary to more formally organize the patterns of interaction between individuals within the dwelling. This may have been accomplished by spatially emphasizing the patrilineal slant of the snow house, which would have served to regulate conflicts, as well ensure the socioeconomic integration of all resident families.

In contrast, the aggregation of nuclear families in non-hierarchically distributed space, as reflected in the Itibdjeriang snow house, likely reflects the cooperative labor and voluntary associations embodied in the *ungayuk* axis. The smaller number of nuclear families within this structure suggests that they could have been integrated together without the need to express overtly the primacy of age and generation (*nalartuk* axis) through hierarchically distributed space.

Summary

In Chapter 2, several theories were outlined which suggest collectively that 1) local 'rules' *frame* human activities and interactions which, in turn, reproduce the social structure of a culture, and 2) this process is both facilitated by, and reflected in, the spatial organization of the built environment (Bourdieu, 1977; Foucault, 1982; Giddens, 1984; Goffman, 1959,1974; Hillier and Hanson, 1984; Markus, 1993; Sibley, 1996). One of the implications of this supposition is that because local 'rules' and the activities and encounters they *frame* require specific spatial contexts, the introduction of new rules and routines should also be accompanied by the introduction of new spatial orders within the built environment. With the abandonment of whaling between AD. 1400-1600, the daily routines and activities which served to 'socialize' individuals into Thule society necessarily changed. Consequently, because the local 'rules' which governed these new routines and activities had to be anchored to specific spatial and temporal contexts, a new space syntax emerged - one which was based on transpatial rather than spatial solidarity. These two space syntaxes reflect a shift *towards* the emphasis of socioeconomic relations at the level of the household (transpatial solidarity), and *away from* the emphasis of socioeconomic relations at the level of the community (spatial solidarity).

The results presented here have relevance for understanding the emergence of historic Inuit societies. As discussed in Chapter 4, Robert McGhee (1994) has recently suggested that historically known Inuit societies represent a less complex and culturally impoverished form of Classic Thule culture, due to centuries of exposure to European disease. McGhee (1994) cites archaeological evidence such as the abandonment of whaling in favor of winter sealing at breathing holes, the apparent technological simplification and decline in the craftsmanship of historic Inuit material culture, and a breakdown in the symbolic associations between artifacts and belief systems as evidence for the impoverishment and economic insecurity of later Neoeskimo culture. If social complexity can indeed be equated with spatial complexity, then the complex structure and ordering of space identified among many of the snow houses analyzed clearly do not support McGhee's (1994) interpretations. The hierarchical distribution of living space within snow houses, for example, seems to correlate with the respect-obedience (*nalartuk*) subsystem of the extended family, in which father-son relations become central to the bonding of nuclear families into extended families - the essential socioeconomic unit in traditional Inuit society. Thus, the spatial data presented here corroborate Oswalt's (1987) conclusions that among many Circumpolar groups, clothing and dwelling styles are better indicators of complexity than food-getting technology.

CHAPTER SEVEN: THE GOVERNMENT HOUSE: THE TRANSFORMATION OF THE TRADITIONAL INUIT HOUSEHOLD THROUGH EURO-CANADIAN ARCHITECTURE.

Introduction

In Chapter 7, I begin by examining the socioeconomic impact of 19th century European exploration, the Commercial Whaling Era, and the Fur Trade on Inuit groups inhabiting the eastern and central Canadian Arctic, and argue that the extended family remained the basic socioeconomic unit of production in Inuit society up until the Settlement Era of the 1950's. At this time, Government officials began attempts to assimilate Inuit families into a broader Canadian economic and social reality through the introduction of health care, education, and housing programs. I then review the history of Government housing programs and house designs, and demonstrate that they were organized around the notion of the nuclear family, which had emerged after the Second World War as a dominant socioeconomic form in southern Canada (Miron, 1988). Concepts acquired from studies of space syntax (Hillier and Hanson, 1984) and Frame Analysis (Goffman, 1974), outlined in Chapter 2, are then used to compare the spatial organization of traditional and Euro-Canadian house forms. Based on the results of the analysis, and ethnographic interviews conducted with Inuit tenants in Resolute Bay, N.W.T, I argue that the floor plans of traditional Inuit houses and Euro-Canadian Houses are generated by different space syntaxes; each of which reflect the differing socioeconomic relations that characterize Inuit and Euro-Canadian cultural praxis. As a consequence, Euro-Canadian house designs and housing programs effectively undermined the solidarity of the traditional Inuit extended family, and fostered the ascendancy of the nuclear family, a household form favored by the Canadian Government for administrative purposes.

Socioeconomic Relations in 19th Century Inuit Society.

While physical contacts between early European explorers and Inuit groups can be classified as incipient and largely ineffectual, the ships and caches they frequently left behind constituted a sustained European *material* presence in the Arctic (see Savelle 1985; Hickey 1984). The presence of European goods and materials modified many Inuit technological practices; with iron replacing ground slate in the manufacturing of knives and end blades, and wood replacing bone in the production of sled runners and harpoon shafts (Mitchell 1996:54). Consequently, when such materials were encountered by Inuit groups, they appear to have been eagerly and rapidly incorporated into local and regional indigenous economic systems (Hickey 1984; Savelle 1985). This seems to have resulted in the small-scale modification of inter-group trade networks, and traditional subsistence-settlement systems, as Inuit groups began to synchronize stops at abandoned European caches and shipwrecks into their seasonal rounds (Hickey 1984; Savelle 1985). By way of illustration, the discarding of the *H.M.S Victory's* steam engines at Felix Harbor (Boothia Peninsula) by 19th century British Naval explorer John Ross, and the abandonment of the ship herself at Victoria Harbor (Boothia Peninsula) a year later, appears to have dramatically altered the economy of the Netsilik Inuit. Savelle (1985) states that because the Netsilik had gained easy access to large quantities of wood, ship iron, and other exotic materials, trade relations with nearby Inuit groups such as the Ookjulik and Utkuhikjalik were altered greatly in their favour. Similarly, Hickey (1984) has suggested that social relations among the Copper Inuit were transformed as a consequence of the abandonment of the *HMS Investigator*, a vessel deployed by the British Admiralty in the search for Sir John Franklin in 1853. Copper Inuit living in the area had already made contact with the crew of the *Investigator* during the spring of 1851, and they easily located the wrecked ship and her caches some years later; removing such items as exotic wood, smelted copper, glass, tin and various textiles (Hickey 1984:18). Hickey (1984) suggests that the sudden injection of so many exotic and valuable goods into the economic system of the Copper Inuit- a group numbering only between 8-900 people, nearly undermined the egalitarian structure of their society.

With the dawn of the Whaling Era came the sustained presence of Euro-Americans in the central Arctic (Boas, 1964[1888]; Damas 1988, 1984 Eber 1989; Mitchell 1996; Ross 1984; Ross; 1975). Inuit were drawn into new social networks with societies organized differently from their own. Many traditional technologies were abandoned in favour of new items such as the whaleboat and rifle (Damas 1988:105; Mitchell 1996:71). As the rifle eliminated the need for cooperative hunting efforts, the whaleboat promoted them by encouraging coastal residence and increased family mobility, promoting cooperative hunting endeavours, creating new leadership roles, and facilitating trade and contact with European whalers (Ross 1975:95). Thus, while the rifle and whaleboat greatly enhanced traditional extractive practices, their combined effects appear to have balanced each other out, thereby ensuring that the organization of production in Inuit society remained essentially unchanged. Interactions with whalemen provided Inuit with opportunities for employment, and the whaling captains often administered relief to needy families (Ross 1975:85). These relations were also somewhat damaging to Inuit society, however, because of the transmission of various diseases, and social problems brought about by alcohol, and sexual relations between Inuit and whalers (see Eber 1989:77; Keenleyside 1990:9 for specific examples).

With the collapse of the whaling industry, the demand for arctic fox pelts rose, and Inuit were encouraged by various trading companies to run trap lines (Mitchell 1996:1). Participation in the fur trade, and secondarily in the seal skin trade, funnelled more and more non-traditional items into the Inuit economy (Damas 1988:130). This had an indirect effect on the seasonal rounds of various Inuit groups - reducing annual mobility in favour of longer periods spent at cache sites, from which trapping and hunting activities were pursued (Damas 1988:130). During this time period, Damas (1988) states that relations between Inuit and Euro-Canadians were stabilized and regularized; an era he refers to as the 'contact-traditional horizon'. This allowed Inuit to manage their own affairs, and organize various economic and social activities through such traditional channels as kinship and other forms of socioeconomic confederation (Damas 1988:130). Throughout the contact-traditional horizon, the virilocal extended family continued as the basic socioeconomic unit of production, and communities remained entirely native until the 1960's, providing Inuit groups with a certain amount of autonomy (Balikci 1964; Briggs 1970; Damas 1969b,c).

Damas (1988) states that among many central Arctic Inuit groups, the extended family began to fragment towards the end of the contact-traditional horizon. However, among the Copper Inuit, the occurrence of the nuclear family as the basic socioeconomic unit represented a continuation from the traditional aboriginal pattern (see Jenness 1922:74). The reason for the more fragmentary nature of socioeconomic ties among the Copper Inuit may be traceable to the cultural stresses placed on this group via their encounter with expedition materials from the *HMS Investigator,* discussed earlier in this chapter. As outlined in Chapter 4, leadership within the extended family was based on principles of patrifilial succession and seniority, with the *isumataaq* or 'thinker' assuming the role of leadership (Steenhoven 1962:52-57). *Isumiataaq's* were usually experienced senior male hunters/whaleboat captains, who were able to influence the affairs of the family, as well as offer advice and council (Damas 1988:116). By the 1960's, however, the *isumataaq* was completely absent from Netsilik society (Balikci 1964:62-70). This suggests that a breakdown in leadership and integration occurred within the extended family at this time[14].

With the decline of the fur trade during the great depression of the 1930's, the Hudson's Bay Company assumed an even greater role as provider of relief to destitute Inuit families. Mitchell (1996:90) states that many adult Inuit have memories of hunger

[14] Wenzel (1995) states that the *ilagiit* lost neither social meaning or coherence after resettlement. Rather, he states that the dispersal of households throughout communities served only to make the social and economic importance of the *ilagiit* less apparent.

and starvation during the depression, and numerous traders are remembered for having assisted hunters who were in need. By 1936, individuals who wished to apply for licenses to establish posts in new regions were required by the Department of the Interior to assume full responsibility for the welfare of the Inuit they traded with, as well as support natives who were impoverished (Mitchell 1996:91). Later, traders assumed the responsibilities of the distribution of family allowance and social security cheques until those functions were taken over by the RCMP (Mitchell 1996:91).

The Settlement Era in the Canadian Arctic

Changes to Inuit life proceeded at an extremely rapid pace between 1939 and 1963, and in many ways, this period represents the culmination of a long series of transformations which began with 19th century European exploration (Duffy, 1989; Marcus, 1995; Mitchell, 1996; Tester and Kulchyski, 1994;). Inuit were drawn even deeper into new networks of social relations, and by the mid 1960's, various economic and political forces were attempting to restructure Inuit society according to western concepts about work, family, community and social relations (Tester and Kulchyski 1994:4). Damas (1988:128) sees this period as marking the end of the contact-traditional horizon, as Inuit began to loose more and more of their autonomy from the state.

Throughout the Settlement Era, government officials had assumed that Inuit families, like their Euro-Canadian counterparts, were structured as independent nuclear families, which had emerged after the Second World War as a dominant socioeconomic form in southern Canada. Subsequently, because many government initiatives undertaken in the North were organized around this belief, they frequently threatened to undermine the solidarity of the extended family (*ilagiit*) - the essential socioeconomic unit in Inuit society at this time. The relocation of Inuit families from Northern Quebec to the Canadian High Arctic provides a particularly tragic example of how the structure of the extended family was threatened by such policies. Fearing that many Inuit groups in Northern Quebec were becoming increasingly 'welfare dependant' due to the depletion of local wildlife resources, the Canadian government attempted to create a number of economically self-sufficient communities in 'pristine' areas in the High Arctic (Royal Commission on Aboriginal Peoples, 1994; Marcus, 1995; Tester and Kulchyski, 1994). On July 28th, 1953, the *CD. Howe* picked up seven Inuit families from Port Harrison, destined for Resolute Bay, a desolate recess on the southern coast of Cornwallis Island (Tester and Kulchyski 1994:143). Inuit families from Pond Inlet were picked up *en route* to teach the Port Harrison Inuit how to hunt seals using nets placed below the sea ice, and other skills necessary to live in the High Arctic. Once aboard, however, the group was informed that they were to be broken up, with some Inuit disembarking at Craig Harbor, an RCMP detachment on Ellesmere Island, and others disembarking at Resolute Bay (Tester and Kulchyski 1994:144). John Amagoalik, speaking before the House of Commons Standing Committee on Aboriginal Affairs, described what happened next:

> We had been promised that our whole group would stay together, that we would not be separate. But when we got near Craig Harbour on Ellesmere Island, the RCMP said to us, half of you have to get off here. We just went into a panic because they had promised that they would not separate us. That was the first

> broken promise. And when we realized it, I remember we were all on the deck of the *CD. Howe*. All the women started to cry. And when women start to cry, the dogs join in. It was eerie. I was six years old then, standing on the deck of the ship. The women were crying, the dogs were howling, and the men had to huddle to decide who is going where (Marcus 1995:85; Tester and Kulchyski 1994:145).

Tester and Kulchyski (1994:143) state that the *CD Howe* left Port Harrison without a clear idea of how families were to be divided up, or where specific families were to be settled; Resolute Bay, Craig Harbour, or Cape Herschel. This would seem to suggest that government officials were unaware that the break up of extended families on the *CD Howe* would have effectively undermined the traditional organization of production of the Inuit groups involved. This, in turn, would have affected their ability to provide for themselves in an environment that was already hostile and unfamiliar. Thus, while the High Arctic Relocations of the 1950's arguably represented an attempt by the Canadian government to provide a long term solution to Inuit 'poverty', the relocations actually had the opposite effect.

Another way in which the fabric of the Inuit extended family was threatened by Canadian Government initiatives was through the promotion of local handicrafts. By the early 1960's, a significant portion of the Inuit population had been moved into settlements, and practically every adult had been transformed into a simple-commodity producer (Mitchell 1996:xiv). Carvings now replaced fox pelts as a means of generating a steady income. Carvers, like all simple commodity producers, were able to retain some semblance of control over their work because 1) they owned their own tools, and 2) they were able to integrate carving into a 'work cycle' that included subsistence hunting and social assistance (Mitchell 1996:xiv). However, the H.B.C and Northern Cooperatives

(CO-OP's) set prices for carvings and, to a certain extent, determined what was to be made. According to Mitchell (1996:271), the transformation of Inuit into simple-commodity producers served to undermine the economic solidarity of the extended family, and promoted the dominance of the nuclear family as a basic socioeconomic unit of production and consumption. Mitchell (1996:301) states that unlike many indigenous economic activities, carving represented competitive rather than cooperative labour, in that the quarrying and selection of soapstone was done by individual carvers. Once acquired, the working of the stone often became a task of the immediate family, with the husband roughing out the carving, and the wife assisting with the polishing (Mitchell 1996:301). Finished carvings were then sold to the CO-OP for cash and/or goods. Thus, the CO-OP fostered the notion of "personal reward for individual effort"; carvers worked for themselves and their immediate families, and like Inuit with wage-earning jobs, were hesitant to share the fruits of their labours with more distant relatives. Finally, by cross-cutting lines of kinship and ethnic affiliation through its message of Inuit working together to build something that would benefit all, traditional camp/group identity was lost (Mitchell 1996:449).

Government Housing Programs in the Canadian Arctic

Perhaps the greatest threat to the traditional Inuit extended family (*ilagiit)* came from the Government housing programs which were introduced into the Canadian Arctic in the 1950's. In many ways, housing programs represented an extension of the Canadian government's attempt to establish a standard of living for Inuit families which was modelled after the small rural hamlets and villages of the south. Damas (1969) refers to this initiative as the 'hamlet ideal', and it involved the movement of Inuit families from dispersed hunting camps to centralized settlements - complete with all the services and amenities of a southern Canadian town. The migration of Inuit families to centralized towns proceeded at a fairly rapid rate. In areas inhabited by the Netsilik, for example, Damas (1988:129) reports that the number of individuals living in traditional camps dropped from 40% of the population in 1961, to 21% in 1966. The dispersal of traditional camps appears to have begun in the 1950's, and Damas (1988:129) states that by the end of the 1960's, hunting and trapping camps had become a much more secondary type of settlement. Unlike the all-native settlements of the contact-traditional era, communities were now ethnically mixed, with transient Euro-Canadian teachers, administrators, and healthcare workers assuming control over Inuit life. Town life for Inuit families was not, however, without its problems. Perhaps the most pressing of these problems involved the lack of adequate housing.

With the election of John Diefenbaker in 1957, and his 'New National Policy' aimed at increasing the accessibility of northern resources, both national and international attention was inadvertently drawn to northern aboriginal peoples and the issue of housing (Nixon 1984:128). Increasing numbers of Euro-Canadians were visiting Canada's Arctic regions, and many found time to comment on what they considered to be the deplorable living conditions of the Inuit (Department of Northern Affairs and Natural Resources 1960:74-80; Nixon 1984:128). In memoranda and letters, references were frequently made to poor housing conditions, and its subsequent impact on Inuit health (Duffy 1988:24). In a memorandum to Dr. L.E.C Davies, on the 2nd of May, 1958, for example, Miss W. Jeffrey, a Registered Nurse, clearly attributes an instance of infant mortality to substandard housing conditions. She writes:

> "The Eskimo family had moved to a much smaller house which had no porch, and the Arctic air blew through the door straight onto the baby, who was only dressed in a small shirt. The steam was still going. That night, the parents went to sleep, the primus stove, which was providing the heating, went out, and the baby was found by the parents at 8:15 am, dead and cold. The temperature was 21 below zero. The cause of death was probably broncho-pneumonia and exposure" (Department of Northern Affairs and National Resources 1960:77).

Many of the Inuit who had settled around D.E.W line stations in areas such as Cambridge Bay, had been manufacturing "shanty houses" using rocks, sod, and the remains of packing crates salvaged from local dumps (Figures 28 & 29 [Duffy 1988:26; Nixon 1984:124; Redgrave 1986:48]). These shanties were typically one roomed structures which resembled traditional dwellings in terms of the layout of household space (Redgrave 1986:49). However, unlike snow houses and tents which could be abandoned, rebuilt, and/or moved when they became too dirty, the shanty houses built by Inuit were largely immovable, and their wooden floors were extremely difficult to keep clean (Redgrave 1986:49). Consequently, many of these houses were considered unsanitary by western standards. When asked to describe the interiors of such dwellings, one long time resident of Resolute Bay remarked that while the level of house-keeping varied dramatically between Inuit families, some houses were extremely unhygienic with "blood

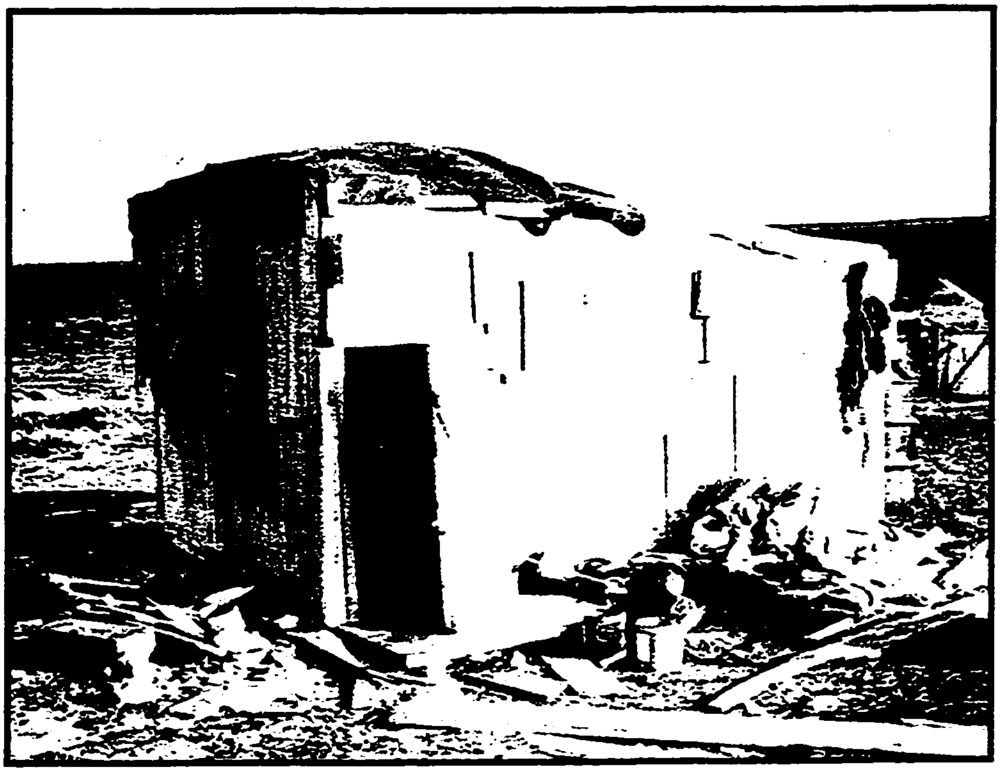


FIGURE 28. Example of an Inuit 'shanty' house (after Dept. Of Northern Affairs and National Resources 1960:54)

FIGURE 29. Inuit family standing in front of a 'shanty' house constructed from scrap lumber (after Dept. Of Northern Affairs and National Resources 1960:54)

three feet up the walls, and floors sticky with blubber" (Welch, pers.com., 1996). Furthermore, many health care professionals felt that the overcrowding of families in drafty, damp shanty houses and canvas tents was contributing significantly to the increasing occurrence of respiratory ailments such as pneumonia, and tuberculosis among Inuit groups (Department of Northern Affairs and National Resources 1960:5-8; Grygier, 1994; Redgrave 1986:49;Yates 1970:48).

In 1960, the Indian and Northern Health Services and Department of National Health and Welfare, in cooperation with the Northern Administration Branch and the Department of Northern Affairs and National Resources, published a report entitled "Eskimo Housing and Mortality". Relying mainly on photographs, the report attempted to demonstrate graphically the correlation between high instances of Inuit mortality and substandard housing conditions in the Canadian North (Department of Northern Affairs and National Resources 1960:5). The photographs in the report depicted the exteriors and interiors of traditional Inuit house forms such as the snow house; semi-subterranean sod house; and skin tent, as well as non-traditional house forms such as the canvas walled tent; 'shanty' house, and the wooden framed houses supplied to Inuit employees of the Canadian Government. Pictures of Inuit dwellings which had been neatly organized in a very western fashion, were approvingly captioned with words like "tidy", "proper", and "clean". Such images were juxtaposed with photographs of the interiors of dwellings in varying degrees of disarray. Slabs of caribou meat were often shown lying on the floors of the various houses amidst jumbles of cooking pots, pans, primus kerosene stoves, boxes, and the family's meager personal possessions. The report, along with the testimonies of various Euro-Canadian observers, suggested that a crisis in Northern housing existed in the Canadian Arctic. In response, the Canadian Government rapidly embarked on a series of "crash" housing programs (Duffy, 1988:38; Buchanan 1981:25; Thomas 1969:1; Redgrave, 1986:50;).

Early Government House Designs and Housing Programs: 1959 - 1965.

Prior to the publishing of "Eskimo Mortality and Housing", a number of experiments in arctic housing for Inuit peoples had already begun to take place. Many of these experimental houses were the products of the Building Research Division of the National Research Council of Canada, as well as the initiatives of certain R.C.M.P officials and Northern Service Officers (Nixon 1984:124). Government officials in Ottawa had stipulated that such houses were to be designed to meet a minimum of 50 sq. foot per person, with capital costs for the construction of each dwelling not to exceed .20 cents per sq. foot (Buchanan 1981:13; Duffy 1988:31; Nixon 1984:120). In addition, building professionals were told that in order to keep housing affordable to Inuit families, heating costs should be standardized at $2.00 per day (Buchanan 1981:12; Duffy 1988:31; Nixon 1984:121).

One of the first attempts to design and construct a house which fit these criteria was initiated at Cape Dorset, in 1956 (Department of Northern Affairs and National Resources 1960:67; Duffy 1988:32; Nixon, 1984). The houses themselves more or less resembled a traditional '*iglu*'; only rather than being built from snow, these dwellings were constructed from 6" translucent styrofoam blocks which were held together by an adhesive seal (Figure 30)(Department of Northern Affairs and National Resources 1960:67). Mounted on wooden floors, these structures were roughly 14 ft in diameter, and were designed to accommodate a small, nuclear family (Department of Northern Affairs and National Resources 1960:67). The use of styrofoam as a building material had a number of advantages; it was relatively inexpensive, easy to work with, translucent so that light could enter into the dwelling, and it possessed superior insulating properties which brought daily heating costs to below the $2.00 standard imposed by the Canadian Government (Department of Northern Affairs and National Resources 1960:67). Furthermore, because the dwelling closely resembled an '*iglu*', building professionals felt that it conformed to a type of architecture basic to Inuit culture (Nixon 1984:121). The styrofoam blocks, however, were found to be highly susceptible to degredation through prolonged exposure to ultraviolet light, and therefore required frequent painting for protection from sunlight (Department of Northern Affairs and Natural Resources 1960:67). In addition, although the blocks themselves were cast using fire-retardant materials, at least one Inuit tenant is known to have lost his life when the styrofoam *iglu* he was living in caught fire (Pitseolak and Eber 1993:34). Regardless, Nixon (1984:121) reports that many of the units built in Cape Dorset remained in constant use between 1956 and 1959, withstanding normal use and not suffering from any serious forms of deterioration.

In 1957, a second type of styrofoam dwelling known as the 'quonset', was constructed for testing in Frobisher Bay (Iqaluit, [Figure 31, Department of Northern Affairs and

FIGURE 30. Example of a styrofoam iglu built at Cape Dorset (after Dept. Of Northern Affairs and Natural Resources 1960:58).

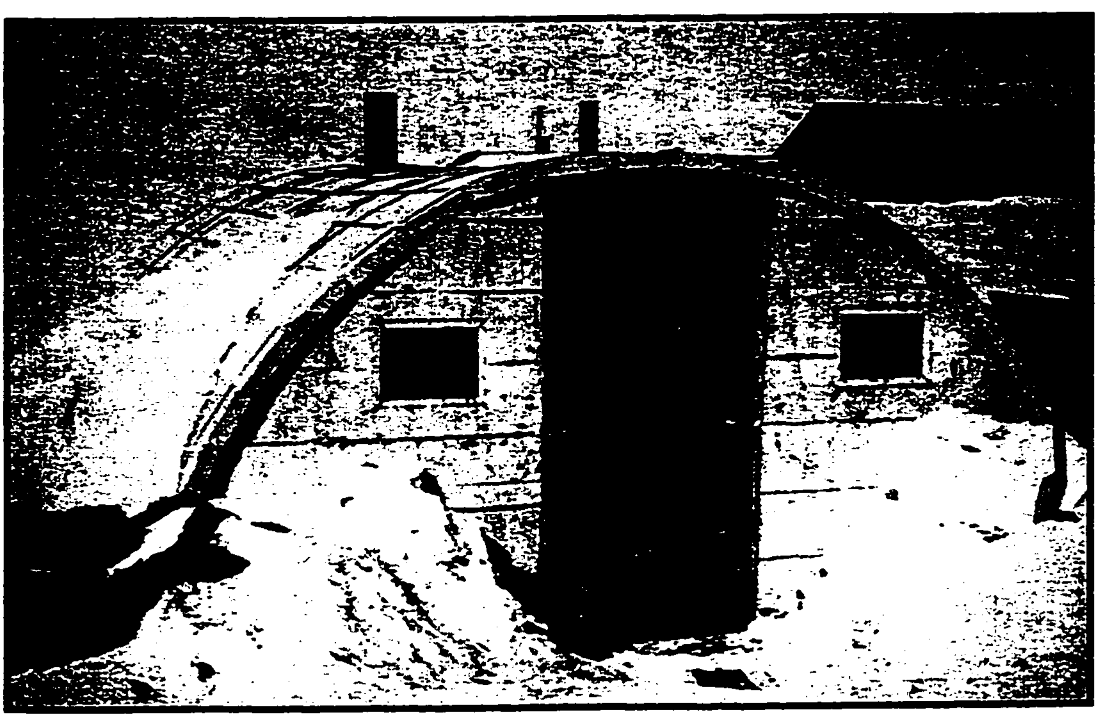


FIGURE 31. Example of a prototype for the quonset-style styrofoam house (after Dept. Of Northern Affairs and National Resources 1960:59).

National Resources 1960:67]). The dwelling itself consisted of a series of plywood arches which were mounted on sills, and then roofed completely with beveled styrofoam panels (Department of Northern Affairs and National Resources 1960:67).The ends of the building were then walled with styrofoam, and windows, door frame, and chimney were installed. The whole structure was designed so that it could be manufactured inside a heated warehouse, and then carried out to the building site fully assembled (Department of Northern Affairs and National Resources 1960:67). The total cost of a 14' X 18' quonset dwelling was estimated at $450 (Department of Northern Affairs and National Resources 1960:67). As with the igloo-style structure, the styrofoam roof panels were extremely susceptible to degredation through ultra-violet rays, and therefore required constant treatment. Regardless, Government reports state that many Inuit respondents preferred the quonset-style house to more conventional Euro-Canadian frame house designs (Department of Northern Affairs and National Resources 1960:67).

At about the same time, members of the R.C.M.P stationed in Canadian Arctic communities began to experiment with double walled canvas tents (Figure 32, [Department of Northern Affairs and National Resources 1960:68]). Like the styrofoam '*iglu*', Government officials felt that because the doubled walled canvas tent was somewhat similar to a traditional house type - the skin tent, it constituted an architectural form which was basic to Inuit culture (Department of Northern Affairs and National Resources 1960:68). The tents consisted of a wooden frame and floor, upon which the canvas inner and outer coverings were affixed. The spaces in between the canvas inner and outer were then filled with 'aerocor fiberglass' for insulation (Department of

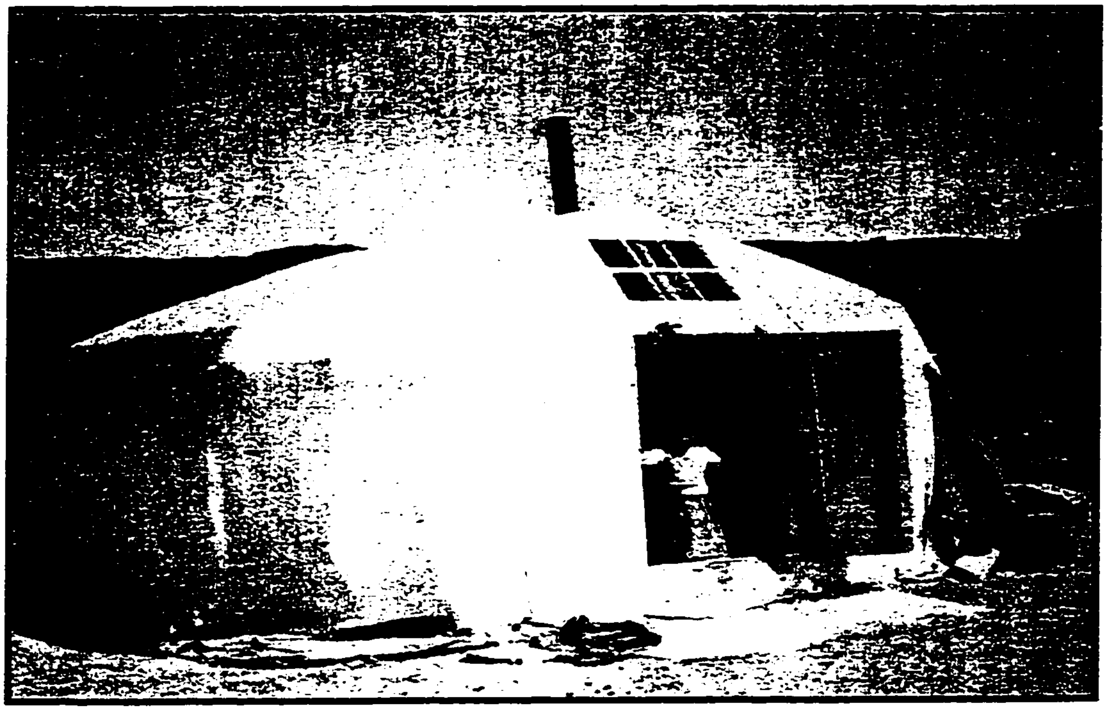


FIGURE 32. Experimental double-walled tent built by R.C.M.P for Inuit in Northern Quebec (after Dept. Of Northern Affairs and National Resources 1960:60)

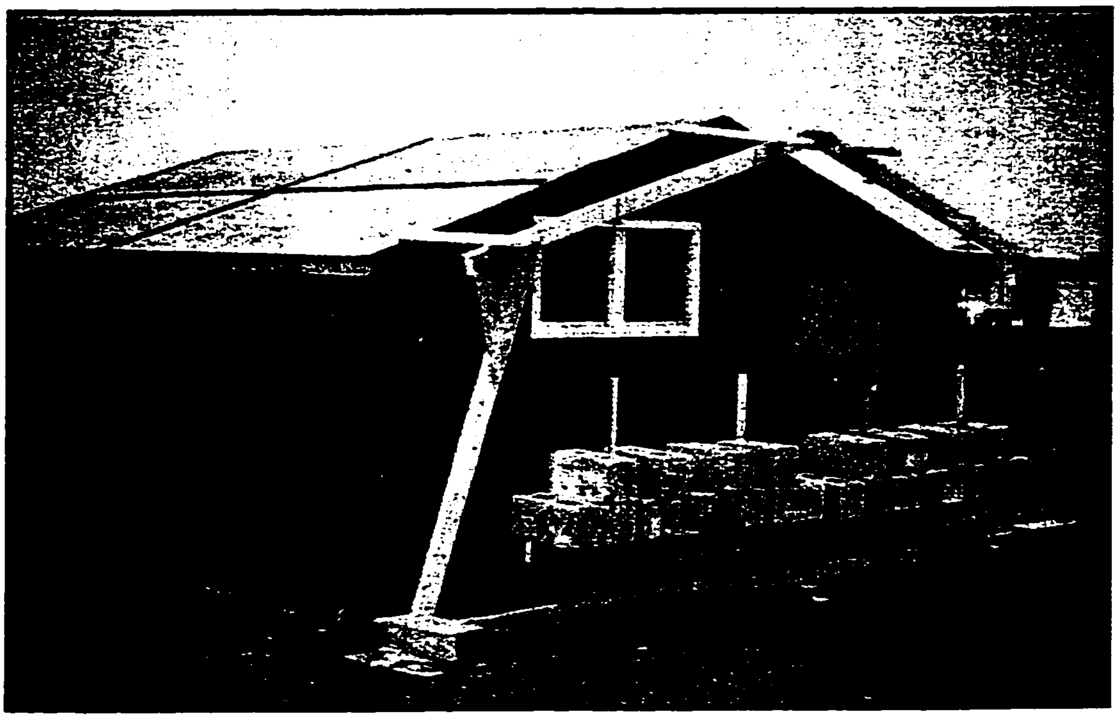


FIGURE 33. Prototype of rigid frame house built by National Research Council of Canada for use by Inuit families (after Dept. Of Northern and National Resources 1960:63)

Northern Affairs and National Resources 1960:68). Such dwellings had a number of disadvantages, in that the outer canvas sheets cost in excess of .35 cents a foot, and were highly susceptible to degredation through exposure to sunlight (Department of Northern Affairs and National Resources 1960:68). Regardless, at the time it was felt that future developments in the manufacturing of less expensive polyurethane nylons would eventually make double walled tents more attractive as a dwelling form in the Canadian arctic (Department of Northern Affairs and National Resources 1960:69).

A further series of experiments in northern housing were carried out in Povungnituk, Northern Quebec, in 1958 (Nixon 1984:124; Department of Northern Affairs and National Resources 1960:69). A series of 'shanty-style' houses were erected using wooden frames which were sheeted inside with aluminum and outside with plywood (Department of Northern Affairs and National Resources 1960:69). Moss, peat, sod, and other cheap natural materials were then employed as insulation (Department of Northern Affairs and National Resources 1960:69). The success of this style of dwelling, however, was the subject of much debate among many Government officials (Nixon 1984:124). While the Building Research Division of the National Research Council concluded that this type of structure was a marked improvement over traditional houses, Health and Welfare officials expressed concern that the high amounts of condensation which formed along the inside walls, due to the use of 'country insulation', would result in health problems (Nixon 1984:124).

A last attempt at experimentally recreating the concentric architectural pattern of many traditional Inuit house forms was the "rigid digit"; a rectilinear, one room structure insulated with rock wool batting (Figure 33)(Department of Northern Affairs and National Resources 1960:69; Nixon 1984:125). Several prototype structures were built in Frobisher Bay (Iqaluit), in 1958-59, at a cost of $420 per unit (Department of Northern Affairs and National Resources 1960:69; Nixon 1984:125). Initial Inuit response to the design was positive, and this resulted in the rigid frame plywood house becoming the design of choice for the first of several low cost housing programs initiated by the Canadian government, beginning in the summer of 1959 (Nixon 1984:125). The design of these houses was later enhanced through the addition of an improved ventilation system, sanitary facilities, a combination heater and cooking oven, and cool storage compartments for meat and other perishables (Department of Northern Affairs and National Resources 1960:69).

In 1959, one hundred and twenty five 12' X 24' one room plywood frame houses were constructed in 14 eastern Arctic communities (Department of Northern Affairs and National Resources 1960:69; Buchanan 1981:13). Referred to as 'matchboxes', these houses were sold to Inuit at a cost of roughly $500 per unit (Department of Northern Affairs and National Resources 1960:69; Buchanan 1981:13). Money was made available for purchasing houses in the form of a one time $1000 subsidy/grant and the Eskimo Loan Fund, and housing loans were repayable at $15 per month over a period of 20 years at 4% interest (Buchanan 1981:13; Redgrave 1986:51). In an effort to ensure that Inuit families remained relatively self-sufficient, the Canadian Government stressed that utility and service costs were not to be subsidized in any way. Consequently, while 'welfare' houses were provided to needy families for free, both subsidized and non-subsidized occupants were required to pay for utilities and services (Buchanan 1981:13; Redgrave 1986:51). This policy had two negative effects on early Inuit housing programs. First, rather than design houses around the lifestyles and cultural values of Inuit families, building professionals instead sought to produce houses which minimized construction materials and utility costs, thereby making them affordable to aboriginal purchasers (Duffy 1988:41). As a consequence, the 12' X 24' matchbox houses were frequently too small to accommodate Inuit families, and over crowding became a common problem (Redgrave 1986:51). Out of 817 one room units surveyed by Government officials in the early 1960's, for example, only 81 contained fewer than 3 occupants (Redgrave 1986:51). Ironically, the Department of Northern Affairs and Natural Resources also found that even though welfare houses had been designed to minimize utility expenses, many Inuit owners were still unable to manage the monthly payments (Redgrave 1986:51; Buchanan 1981:14). Consequently, home owners were almost always in arrears (Redgrave 1986:51; Nixon 1984:141). The over crowding of Inuit families within 512 houses also raised concerns that housing conditions were contributing to high levels of infant mortality, the spread of tuberculosis, and such social ills as drinking and delinquency (Duffy 1988:39). In addition, it was not long before serious flaws in architectural designs, the use of improper building materials, and deficiencies in construction practices became apparent (Strub, 1996). Poorly placed entrances were frequently blocked in winter by drifting snow; windows perpetually iced up; and drafts found their way into houses through floor boards, door frames, and walls (Strub, 1996).

To summarize, many of the problems associated with early housing programs were created because of the expeditious manner in which early housing had been delivered to the Inuit, in an urgent attempt to alleviate their perceived suffering. As a consequence, prior to 1965, little or no research had been directed towards how houses and housing programs could have been designed to best accommodate Inuit cultural values, and the rigors of an arctic climate (Redgrave 1986:53; Strub, 1996). Furthermore, the "wild experimentation' in early northern housing which led to such designs as the "styrofoam iglu" was likely attributable to the fact that the makers of housing policy in the Canadian Arctic during the post-war period were a small and relatively isolated group of individuals who were given more or less free reign to operate (Nixon1984:127) . By the end of the 1950's, attempts to design houses which were culturally familiar to Inuit had been abandoned in favor of creating houses which were facsimiles of those used in Southern Canada (Nixon 1984:127). One of the reasons for this change in policy concerned the ever-increasing presence of Euro-Canadians working in the Arctic (Nixon 1984:131). In order to entice geologists, health care workers, teachers, and businessmen to move north, southern-style houses complete with all amenities were being built along side experimental low cost houses supplied by the Government for Inuit (Nixon 1984:131). This set up a notable dichotomy between white and native housing, prompting some observers to accuse the government of instituting a "racist housing policy" in the North (Nixon 1984:131). In response, the Canadian Government attempted to design a housing program which would correct the inadequacies of previous initiatives.

The Eskimo Rental Housing Program

The Eskimo Rental Housing Program[15] , introduced in 1965, focused on *renting* rather than *purchasing* housing by Inuit families (Buchanan 1981:14 ;Duffy 1988:36; Nixon 1984:146; Redgrave 1986:51; Yates 1970:46). Hence, the Canadian Government and the Inuit entered into a new type of relationship, in which the former assumed the role of landlord, and the latter that of tenant. The *Eskimo Rental Housing Program* was initially set to run for a period of 5 years, and supply approximately 1560 rental units at an estimated cost of 12.5 million dollars (Redgrave 1986:52; Yates 1970:46-47). In order to make payments more manageable, rents were scaled to match the income of each family; starting at $2.00 per month and rising to a maximum of $67 for a three bedroom house (Buchanan 1981:15; Duffy 1988:42; Nixon 1984:145; Redgrave 1986:52). The three bedroom 720 sq foot bungalow was introduced as a new and improved type of house design, and was to replace the one room 'stop gap' houses which had been built for Inuit in the 1950's (Figure 34, [Duffy 1988:38]). In addition, all houses now came fully equipped with such items as an arborite-topped kitchen table, melmac place settings for 4, cleaning equipment, cooking utensils, a double bed for the parents, and bunk beds for the children (Redgrave 1986:52; Thompson 1969:36-37).

The Eskimo Rental Housing Program consisted of three phases. In the first phase, the concept of rent and servicing costs were explained to Inuit tenants. A review of research

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In 1968, the rental scheme was expanded to include other aboriginal groups within Canada, and the program was renamed the Northern Rental Housing Program (Redgrave 1986:52).

FIGURE 34. Inuit family members stand in front of a new multi-bedroom bungalow in Cape Dorset (after Dept. Of Northern Affairs and National Resources 1960:44)

into housing programs in the Canadian North by Redgrave (1986), Buchanan (1981) and Nixon (1984), as well as interviews conducted by myself in the Hamlet of Resolute Bay during the summer of 1996, reveal that this initial phase was relatively unsuccessful. Renting remains to this day a poorly understood concept among Inuit families, many of whom are unsure as to where rent money goes (Redgrave 1986:126). Government officials had the formidable task of making it clear to Inuit tenants that rent money did not go towards paying off a house; rather it represented a never-ending financial obligation to the Government (Redgrave 1986:126). Furthermore, while rental costs continued to climb in response to increasing servicing and building costs, many Inuit attribute rent hikes to the greed of the Government (Redgrave 1986:126). Increasing rent payments was an issue raised by every one of the informants I interviewed in the Hamlet of Resolute Bay. One Elder remarked that the Government had told him that his rent of $2.00 per month would never increase. Redgrave (1986:127) reports similar sentiments expressed by "older renters" in the Inuit community of Gjoa Haven; many of whom believed that rents would remain at $2.00 per month forever. The statement of one respondent interviewed by Redgrave (1986:127) illustrates the perception that by raising rents, the Government was taking advantage of Inuit dependency on Euro-Canadian houses:

> "We didn't ask for houses. The Government sent the houses and nowadays people want to live in them all the time. Maybe the Government knows the people won't move out, and that's why they keep putting the rent higher"

Not surprisingly, numerous Inuit families are constantly in arrears with their rental payments. The manager of the Housing Association Office in Resolute Bay, for example, remarked that tenants were encouraged to make any rental payment, no matter how small, to offset the large debts which they are accumulating. Reasons for not paying rent include: 1) the prioritizing of expenses in such a way that those associated with groceries, and going out onto the land take precedence over rent; 2) resentment by wage-earners who pay higher rents than their unemployed neighbors, yet occupy comparable houses; 3) a show of solidarity with other non-paying neighbors; and 4) a show of defiance among individuals who believe that the Government is just out to take their money (Redgrave 1986:133). Thus, because southern-based property management practices had no parallel in traditional Inuit culture, phase 1 of the Eskimo Rental Housing Program was largely unsuccessful.

The second phase of the Eskimo Rental Housing Program involved the implementation of education classes which focused on teaching Euro-Canadian home-making skills to Inuit families (Buchanan 1981:16; Duffy 1988:44; Redgrave 1986:54; Thomas and Thompson 1972:11). A report prepared by C.M. Bolger, Director of the Department of Indian Affairs and Northern Development in 1967, entitled "Eskimo Program Will Train Eskimos in Modern Living", outlined the objectives of these education programs. The report states that (Inuit) tenants, both men and women, "will learn such household skills as the use and maintenance of oil ranges and heaters, proper organization of equipment and furniture, as well as other skills necessary for the proper maintenance of a household" (Figure 35, [Department of Indian and Northern Affairs,

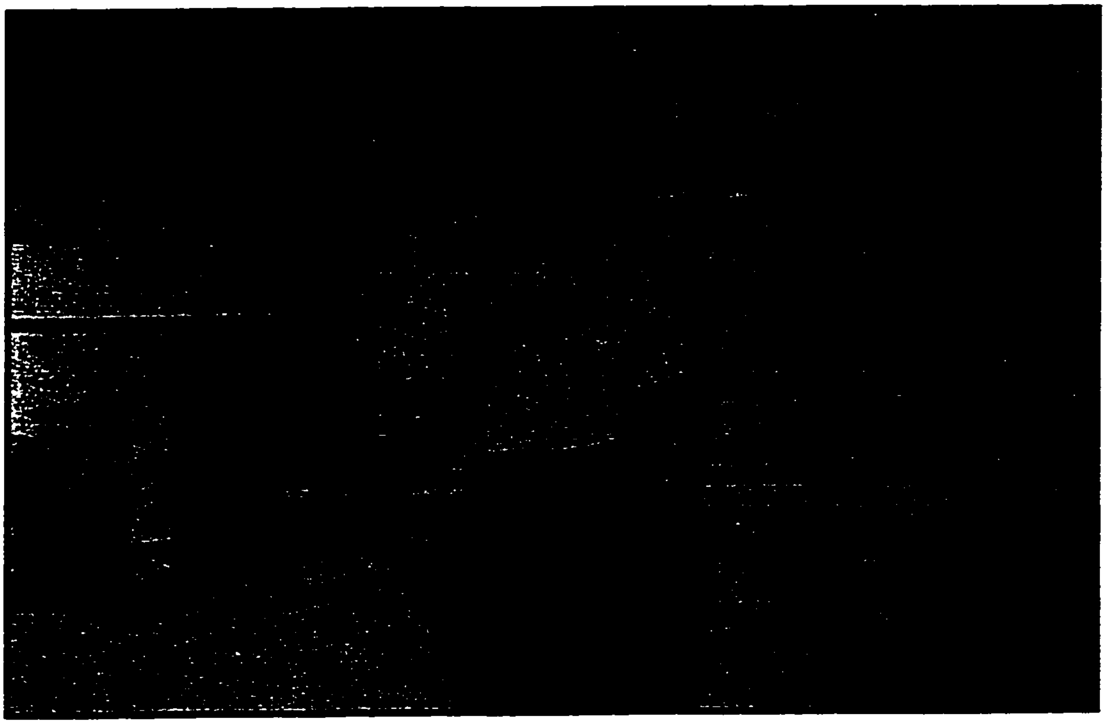

FIGURE 35. An Inuit woman prepares a meal in a 'modern' Euro-Canadian kitchen.

1967]). Thomas (1969) and Thompson and Thompson (1972) provide an interesting critique of phase two initiatives, including the various home economics programs initiated in many northern communities at this time. Thomas and Thompson (1972:13) remark that many of these programs were designed around the assumption that Inuit families had already adopted southern Canadian cultural values. However, fieldwork conducted by the authors in a number of small arctic communities revealed the continuation of traditional cultural practices; many of which conflicted with, and undermined the goals of government-sponsored adult education classes (Thomas and Thompson 1972:13). To illustrate, within the traditional Inuit household, men were responsible for harvesting animals, while women were responsible for the redistribution, preparation, and management of food stores (Thomas and Thompson 1972:13).With the appearance of trading posts, men assumed the responsibility of purchasing non-traditional food items. This fact was overlooked by home economics classes which assumed that Inuit women, like their Euro-Canadian counterparts, performed shopping duties. Consequently nutritional information was misdirected towards women (Thomas and Thompson 1972:13). Furthermore, the cooking classes attended by Inuit women concentrated on the preparation of multi-dish meals involving frying, baking, and boiling. These types of meals required preplanning, and therefore the adoption of rigid cooking and eating schedules. Within the traditional Inuit household, single dish meals were prepared almost exclusively by boiling, and cooking and eating were commonly carried out in an unplanned and opportunistic manner (Thomas and Thompson 1972:13). Thus, many Inuit families continued to use traditional cooking practices on non-traditional food items. This resulted in poor nutrition, as Euro-Canadian foods intended to be served in combination with other dishes, were served instead as single dish meals (Thomas and Thompson 1972:13). Many Inuit women also regarded adult education classes as social outings, and rarely took them seriously (Thomas and Thompson 1972:15). Finally, Thompson (1969) reports that Government-sponsored adult education classes contributed to Inuit women's loss of self esteem in the modern household. Courses in housekeeping, offered by government officials, often caused a woman to lose face in the community. Since it is believed that the "wifely duties" of housework are supposed to have been learned prior to marriage, it was implied that a woman who attended such classes was a "poor wife" (Thompson 1969:20). Thus, an unawareness of the continuation of traditional cultural practices within Inuit households served to undermine the success of many phase 2 initiatives.

The third and final phase of the Eskimo Rental Housing Program sought to organize local Housing Associations in all Canadian Arctic communities to carry out the day to day administration of rental housing for Inuit (Buchanan 1981:16; Duffy 1988:44; Redgrave 1986:54; Thomas and Thompson 1972:11). Housing associations were initially organized by the Department of Indian and Northern Affairs in 1966, and were intended to serve as a link between the Inuit tenant and the larger NWT Housing Corporation (Redgrave 1986:54). These smaller community-based housing associations typically drew their membership from tenants living within the community; many of whom were heads of households. As housing associations were native-run, Redgrave (1986) has suggested that they essentially became 'middlemen agencies' in dealings between Inuit and the Federal

Government. Surficially, the creation of these organizations implied that Inuit were being given more control over the management of their daily affairs. In actuality, however, Redgrave (1986) has suggested that because housing issues are among the most contentious in any Inuit community, phase three initiatives had the effect of deflecting housing dissatisfaction away from the Government, and towards the local Housing Association. The housing officers and staff of Community Housing Associations are frequently placed in uncomfortable and stressful situations when dealing with the housing problems of their relatives and neighbors. Redgrave (1986:116), for example, states that in the Kikitak Housing Association of Gjoa Haven, housing officers and staff regard the allocation of houses as the most stressful and difficult job they face. According to Redgrave (1986:117), housing allocation is extremely disputatious because it often works against traditional family alliances and values concerning the sharing and redistribution of resources. Because housing stock is limited, houses are perceived as a scarce resource, and this frequently results in competition among some families, and the formation of alliances between others (Redgrave 1986:117). In Gjoa Haven, Redgrave (1986:120) states that individuals are sometimes able to secure new houses for themselves by 'bullying' weaker board members, or by having a member of the board as a close relative. In one particular instance, a family simply moved into a new house without permission (Redgrave 1986:120). While members of the board disapproved of the action, they nevertheless accepted it and did nothing to remove the family (Redgrave 1986:120).

Housing associations were also made responsible for enforcing the rules of use for rental housing. In Resolute Bay, for example, carving is prohibited in all houses because of health risks caused by dust. In addition, with the possible exception of installing shelves, tenants are prohibited from making modifications to their houses; for example, removing or adding walls, doors, and rooms. With the introduction of multi-bedroom houses under the new Eskimo Rental Housing Program, many Inuit families would continue the practice of sleeping together in a single room, and using the additional bedrooms as storage areas or workshops (Nixon 1984:150; Thomas and Thompson 1972:15;). Housing officers attempted to discourage such practices for health and moral reasons (Thomas and Thompson 1972:15). Instead, Inuit families were encouraged to adopt the Euro-Canadian pattern in which persons of varying ages and different sexes occupy separate sleeping areas (Thomas and Thompson 1972:15). The use of Government Rental houses in traditional ways (butchering seals in living rooms; storing seal meat in bathtubs; repairing and maintaining engines and hunting equipment in kitchens) was also discouraged by local Housing Associations (Buchanan 1981:26; Thomas and Thompson 1972:15; Redgrave 1986:7). Such inappropriate uses of houses were monitored through monthly spot-checks by housing officers, and enforced using veiled threats of eviction[16] and/or relocation to a smaller house (Buchanan 1981:79).

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The manager of the Housing Association office in Resolute Bay informed me that eviction of problem tenants is rarely, if ever an option.

Housing Conditions in Arctic Communities after 1970

While housing conditions for Inuit generally improved during the 1960's and 1970's, noticeable differences continued to exist between houses occupied by Inuit, and those occupied by white Euro-Canadians (Nixon 1984:37). The teachers, business people, healthcare, and construction workers who were arriving in the North were accustomed to living accommodations which were much more luxurious than those provided for the Inuit (Thomas and Thompson 1972:19). Consequently, they were frequently supplied with better built, better furnished houses (Thomas and Thompson 1972:19). Such differences did not go unrecognized - especially among young Inuit, and a potential stress was created between these two ethnic groups (Thomas and Thompson 1972:19). These tensions were fueled by other factors, such as the implementation of Euro-Canadian justice and education systems, and increases in social problems such as alcohol and drug abuse.

In an attempt to alleviate such tensions and integrate whites and Inuit together, a number of ambitious architectural schemes were devised. Multi-story apartment complexes designed by Moshe Safdie were constructed in Frobisher Bay (Iqaluit), and visionary Swedish architect Ralph Erskine was commissioned by the Canadian Government to design a new town site at Resolute Bay (Collymore 1982:10; Egelius 1990:78-80; Strub 1996:89). Erskine's work in particular was somewhat revolutionary, in that it made a concerted effort to establish a line of communication between building professionals and Inuit tenants (Collymore 1982:14). Erskine was extremely concerned with power relations between whites and Inuit. In response, he attempted to develop architectural designs in which one ethnic group was not given an advantage over the other (Collymore 1982:14). Inuit residents were asked for their input in selecting a location for the new town site, and in housing preferences (apartment-style houses or free-standing family dwellings [Collymore 1982:14]).The resulting town plan resembled a walled medieval town, with a large, continuous faceted building enclosing the town center on its east, west, and north sides (Figure 36 [Collymore 1982:23]). This large perimeter structure was designed to accommodate the town hall, hotel, apartments for transient white workers, and a Hudson's Bay Company store (Collymore 1982:23). Within the perimeter structure, and thus protected from wind and drifting snow, were numerous free-standing single family dwellings (intended for Inuit) and an outdoor recreation center (Collymore 1982:23). Erskine felt that his walled town provided both Inuit and white residents with a feeling of togetherness, protection, and identity (Collymore 1982:133). Work on the new town site began in 1974, and by 1977 the first section of the perimeter building had been completed. However, in 1978 the Federal Government withdrew its support for the project, due to decreasing oil and gas exploration activities in the High Arctic (Collymore 1982:133). Plans for completing the new town site have since been placed on hold indefinitely (Figure 37).

Respondents interviewed in Resolute Bay during the summer of 1996 recall that the single apartment complex which was constructed was occupied mainly by transient white workers. A single Inuit family did move into one of the apartments, but a dislike for sharing walls with neighbors, and a lack of storage space eventually prompted them to seek accommodation elsewhere. This structure presently stands abandoned along the east

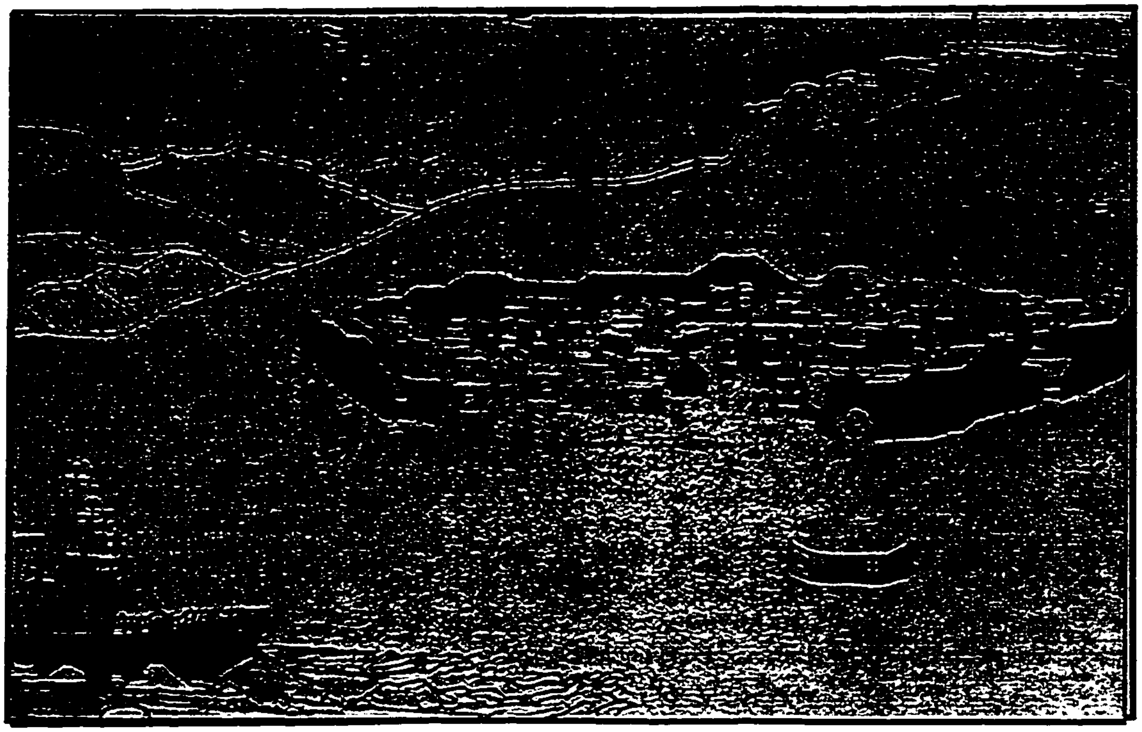


FIGURE 36. Sketch of Town Plan proposed for Resolute Bay, N.W.T, by Ralph Erskine. (After Egelius 1990:79)

FIGURE 37. Erskine's abandoned apartment complex in Resolute Bay; as it appeared in August of 1996.

edge of town. While Erskine's vision of the 'ideal' arctic town may in retrospective seem somewhat ill-conceived, it nevertheless represents one of the first attempts to engineer buildings and communities which addressed social problems in the North, and not just those associated with the environment and escalating building costs.

Contemporary Attitudes Towards Government Housing and Housing Programs: A Case Study from Resolute Bay.

During the summer of 1996, I undertook a pilot study intended to document the experiences of Inuit Elders who were old enough to recall moving from traditional houses to Government-subsidized Euro-Canadian housing in the 1950's. It was also my intention to interview younger Inuit and record their impressions of house designs and housing programs currently in use in the Hamlet of Resolute Bay. Finally, I planned to interview a Hamlet office employee, and the manager of the Resolute Bay Housing Association, as a means of gaining an insight into how community housing and housing programs were perceived by administrators. The interviews were conducted over a one week period, from July 13 to the 20th, 1996 under the terms and conditions set forth by the Nunavut Research Institute (Scientific Research Licence #0205296N-A), and the Joint Faculties Ethics Research Committee at the University of Calgary.

Resolute Bay is located on the south coast of Cornwallis Island, and lies approximately 970 air miles northeast of Yellowknife, and 2,140 air miles northwest of Montreal. The Inuit community was founded in 1953 by the Canadian Government. Inuit families from

Pond Inlet (Baffin Island) and Inukjuak (Northern Quebec) who were relocated to the area initially supported themselves by hunting and trapping, and later through wage-labor jobs at a military airbase, located 6 ½ km inland from the Inuit settlement. Hunting and trapping activities continue to play an important economic and cultural role in the community. During the late 1960's and early 1970's, the growth of oil and gas exploration activities in the region suggested impending growth for the community of Resolute Bay. However, when oil and gas activities ceased in the mid to late 1970's, plans for community development were placed on hold. At present, Resolute Bay serves as a service center for transportation and communication activities in the Canadian High Arctic. Polar tourism is also emerging as a major industry in this region, and many Inuit residents generate income by guiding tours and carving. In addition, members of the community have found both full time and seasonal employment in the private sector (Polaris Operations, Cominco Ltd), and through the Canadian Government.

1) Interviews with Elders

Two Elders consented to be interviewed for the study; one male originally from Pond Inlet (X), and one female originally from Inukjuak (Y). Both of these individuals had spent a considerable portion of their childhood and early adult life living in traditional Inuit dwellings; primarily skin and/or canvas tents in the summer; and snow houses (Inukjuak Elder) and sod houses (Pond Inlet Elder) in the winter. When asked to compare traditional houses to Euro-Canadian houses, both Elders stated that it took many years until they felt at home in Government housing. Elder (X) attributed his feelings to the fact that, unlike traditional houses, the interiors of early NTR[17] houses had been divided up to create additional rooms. Elder (X) further remarked that while houses today were comfortable, the houses he built for himself in the 1940's were warmer and better constructed. Elaborating further, this individual stated that one of the reasons (Inuit) people preferred the houses they built for themselves was that they were *their* houses, and that they could modify them as they needed. When asked how he would change the design of the house he presently occupied if given the opportunity, Elder (X) explained that he had not even considered this, because if he did "the Housing Association would have my head". As mentioned previously, Housing Associations enforced strict rules against the modification of rental houses, and the statement made by Elder (X) suggests that the architectural inflexibility of modern housing is one of the ways in which traditional and non-traditional house forms differed from one another. Elders (X) and (Y) also made reference to the fact that many of the early houses lacked porches which are important for storing meat and hunting equipment. As traditional (skin and sinew) and modern (iron and steel) hunting equipment could not be brought indoors because humidity changes would cause corrosion and degradation, access to such storage areas is almost essential.

Elder (Y) occupied a large 4 bedroom house, which she shared with her handicapped nephew whom she looked after. Although the house had been designed to accommodate a much larger household, Elder (Y) nevertheless used all of the rooms in her house for

17

NTR refers to the Northwest Territories Rental Houses which were supplied to Inuit families via Government Housing initiatives.

various functions. These functions included storage, sleeping quarters for herself and nephew, and as accommodation for friends and relatives who were constantly visiting with her. Redgrave (1986:121) explains that in Gjoa Haven, small households are occasionally provided with large houses by the Housing Association if they provide a community service; for example, supplying accommodation to visitors from other communities. Elder (Y)'s statements that she frequently billeted visitors to the community suggests that she occupied a large house for similar reasons. Elder (Y) stated that having lived in snow houses as a youngster, she appreciated Government houses because they were warm and dry place to raise children. Elder (Y)'s only complaint with Euro-Canadian houses were the "tall houses" (two and three story houses) which have been constructed in the community. Elder (Y) stated that it was difficult for old people to climb stairs in these types of buildings, and that this made visiting difficult for her.

2) Interviews with Young Adults

The two younger Inuit who consented to be interviewed were between 30 and 40 years of age. Person (A) was a male who was in the process of building a storage shed/workshop out of packing crates and scrap lumber when approached to be interviewed. Person (A) commented on the lack of storage space in Government houses, and stated that he was building this shed to provide a place for working on his snow machine during the winter months. Rather than rent, Person (A) explained that he had recently purchased a house through the ACCESS Program. The ACCESS Program is a government initiative which encourages Inuit families to move out of public housing and into private housing. In many ways, the ACCESS Program represents a reversal of the aims and objectives of the Eskimo Rental Housing Program, and it ostensibly reflects a desire for the Government to reduce maintenance and repair costs by transferring them directly to Inuit owners. The house purchased by Person (A) is a retrofitted NTR house originally built in the 1970's. Person (A) remarked that it is often cheaper to buy one of these old prefabricated houses and fix it up, than it is to rent new public houses.

Person (B) is a female who was also in the process of building a storage shed/workshop adjacent to her house when I approached her to be interviewed. Person (B) lives in a large 3 bedroom house with her Euro-Canadian husband and four year old child. Person (B) is the daughter of Elder (X), and remembers growing up with 12 other family members in a one room house, built by her father out of scrap lumber. Like the other respondents, Person (B) stated that there exists a need for increased storage and work space within houses. Another problem indicated by Person (B), which was also mentioned by the other respondents, was the almost constant shifting of houses on their gravel pads, thereby creating a need for frequent maintenance. Person (B) attributes this problem to the use of inexpensive contractors by the Housing Corporation. When asked to evaluate the benefits and disadvantages of renting versus owning houses, Person (B) remarked that most people who decide to buy houses end up with 15 year mortgages which they say are too long. Person (B) stated that rental costs are also high, and that 60% of the earnings of every working person living in a household go towards rent.

Observations made by Person (B) suggest that over the past 30 years, there has been a demographic trend in Resolute Bay towards smaller household sizes with fewer generations living under the same roof, and more young men seeking to establish their own households. To illustrate, Person (B) remarked that there are an increasing number of single males in the community who require housing, yet are rejected because families get priority over them. Consequently, if such individuals are considered as ineligible bachelors by others in the community, they are destined to remain as members of their parents household indefinitely. Occasionally, one of a limited number of one bedroom 'bachelor' houses becomes available, and a single person can move in and establish his/her own household. While there exists an obvious need for the construction of more of these 'bachelor' houses, Person (B) remarked that the housing corporation does not consider them as cost effective because if a young man does start a family, he almost immediately has to be re-assigned to a larger house. When asked what kinds of changes she would make to her house if she were able, Person (B) responded that she would prefer a two story house in which the bedrooms occupy a separate floor, rather than open directly off of the living room as they do in her present home. Increasing privacy regulation seems to have been a motivating factor for Person (B)'s response.

3) Interviews with Administrators

Person (C), a white Euro-Canadian female between 30 and 40 years of age, was the acting manager of the Resolute Bay Housing Association at the time of the study. As manager, Person (C)'s responsibilities include the day to day administration of housing in the community; for example, rent collection, housing allocation, arranging for repair and maintenance, and dealing with the problems and concerns of tenants. In addition to the manager, the Housing Association uses a three member board; all of whom are Inuit, to provide input on housing issues which affect the community. An Elder frequently sits on the board as one of the three advisors. Person (C) explained that there were 3 types of houses in the community; NTR (Northwest Territory Rental) houses, staff houses for Government employees, and public houses. Through the ACCESS Program, Person (C) explained that the NWT Housing corporation hopes to eventually replace public houses with retrofitted NTR's which were being sold to Inuit families at a reasonable cost.

Person (C) outlined a number of problems currently facing the Housing Association. First and foremost among these is the matter of rent payments. As in many other arctic communities, tenants in Resolute Bay are often in arrears with their rent; sometimes people forget or simply cannot afford to pay. While I was interviewing Person (C), one young woman came into the Housing office expressing concern over a letter she had received from the NWT Housing Corporation in regard to her rent arrears. The young woman stated that she was afraid that she might be evicted. Person (C) reassured her that this would not happen, and asked her to bring in 10 dollars to put towards her debt. She was informed that the amount she paid was inconsequential; what mattered was that she was making an effort to contribute something to her arrears. Afterwards, Person (C) explained to me that government letters are frequently misinterpreted by Inuit tenants. In one example, Person (C) stated that a young woman in the community had been hired by the Housing Association to translate some new housing policies into Inuktitut. Unfortunately, due to the inexperience of the translator, the letter was translated incorrectly, leaving many Elders confused and worried because they thought that they were being evicted. Problems also exist in terms of how rent is scaled between households. As 20% of the total income of the household goes towards rent, households with many wage earners pay much higher rents than those of comparable size with fewer wage earners. When asked if imbalances in rental costs between households was a cause of friction within the community, Person (C) responded "sometimes, yes". Overcrowding was also identified by Person (C) as an important problem in the community. In one house in Resolute Bay, for example, four nuclear families were living under one roof. Person (C) felt that such overcrowding contributed greatly to family conflicts, and remarked that in the aforementioned household, conflict was listed among the reasons given by family members who wished to move out. Person (C) also agreed that the demand for housing among single young men within the community is not being met. She went on to say that the two 1 bedroom 'bachelor' houses in the community are currently being refitted, and that they are "a real mess" because the young men who were tenants failed to take care of them. Person (C) further explained that this problem is relatively unique to young males because many young women remain living in their mother's households where they can receive assistance in child care. When asked how she thought housing could be improved in the community, Person (C) replied that increasing work and storage space would be a good idea, as would increasing the privacy of some areas of the house. In regard to the latter point, Person (C) remarked that she felt that children were currently exposed to a lot of what she considered to be "bad situations"; for example, people engaging in substance abuse, sexual intercourse, etc.

Person (D) works as an administrator in the Hamlet office in Resolute Bay. In relating her own experiences living in government houses, Person (D) stated that she had lived in 6 different houses during her life in the community. At first, this seems like a remarkable number of moves for a single household to make, especially given the diminutive size of the housing stock in Resolute Bay. Further discussion with Person (D), however, revealed that many households have adopted the practice of 'house trading' as a means of coping with changing family sizes in light of the limited availability of new houses. By way of example, suppose family (1) has three young children (one of which was recently acquired through adoption), and family (2) has three older children who now spend most of the year at a residential school in Pond Inlet. In order to better accommodate the shifting compositions of both households, it would not be uncommon for these two families to 'swap' houses. This represents an extremely innovative way of dealing with the problem of fluctuating household sizes in a community with limited housing stock. Person (D) also reiterated the sentiments of other respondents in identifying the need for more storage and work space in houses; more houses for single young men, and the need for some kind of rent control to keep houses affordable.

In summary, a number of interesting perspectives on house designs and housing programs were revealed in discussions with each of the respondents. Among Elders, it would seem that 1) the internal division of an open space into separate rooms; 2) the inability to make architectural modifications to accommodate changing household sizes, and facilitate traditional lifestyles; 3) the use of 'inferior' construction practices; and 4) the creation of barriers which impede contact with other members of the community (i.e. stairs, fewer rooms to accommodate visitors); served to distinguish Euro-Canadian houses from traditional Inuit dwellings. Among younger Inuit tenants, housing concerns tended to focus on 1) the lack of storage and work space; 2) high cost of rents; and 3) an increasing need for larger houses with more privacy. Furthermore, the manager of the Housing Association and the Hamlet administrator drew attention to the existence of important demographic changes occurring within the community; specifically 1) the increasing number of single young men who require housing; and 2) an overall trend towards the formation of smaller households with fewer individuals living under the same roof.

Analyzing the Relationship Between 'Household' and 'House Form' in the Canadian Arctic

In order to understand how Inuit families were transformed through Euro-Canadian architecture, it is necessary to identify the ways in which these dwellings differed from traditional Inuit houses. Some of these differences were defined in the previous section, using data acquired through interviews with Inuit Elders old enough to recall the experience of moving from traditional houses to Euro-Canadian Government houses. Many of the theoretical and methodological approaches outlined in Chapter 5 provide additional avenues for both identifying architectural disunity between traditional Inuit and

Euro-Canadian house forms, as well as inform on how such disunity affected change on the organization of Inuit households. To reiterate, the approaches of Bourdieu (1977), Giddens (1984), Hillier and Hanson (1984), Goffman (1959, 1974), Foucault (1982), Markus (1993), and Sibley (1996) were summarized collectively in terms of the following basic tenets:

1) Daily routines and activities serve to 'socialize' people into society

2) Daily routines and activities are governed by local 'rules' which generate and reproduce the social structure.

3) These 'rules' are anchored to specific spatial and temporal contexts.

4) The spatial organization of built environments are designed to meet the requirements of specific clusters of local 'rules' and the activities/interactions they frame.

5) The degree to which spaces are 'rule-bound' can vary within a single building, and across different building types.

6) The degree to which spaces are 'rule-bound' or framed is determined largely by cultural factors (e.g power relations, notions of sacred and profane, etc).

These tenets have important implications for understanding the nature of the relationship between culture change, and the changing nature of the built environment. Because local 'rules' and the activities and encounters they *frame* require specific spatial contexts, the introduction of new rules and routines should also be accompanied by the introduction of new spatial orders within the built environment. In Chapter 6, this relationship was used to explain the emergence of a new space syntax within historic Inuit snow houses. What happens, however, when built environments change before the people living within them do? The Euro-Canadian houses supplied by the Canadian Government in the post-war era constituted spatial environments *framed* by rules which governed the activities and daily routines of a different ethnic group - the southern Euro-Canadian family. Such houses were designed around the concept of the nuclear family, which had emerged after the second world war as a dominant socioeconomic form in southern Canada (Miron, 1988). At the time of their initial introduction, however, the extended family *(ilagiit)* still functioned as a basic socioeconomic unit of production in Inuit society; a fact which was discussed in some detail in Chapter 4. From this perspective, it seems likely that early Government Housing Programs in the Canadian Arctic constituted a mis-match between household and house form; with the latter exacting change on the former.

Deciphering the Space Syntax of the Traditional Inuit and Euro-Canadian House Form

As discussed in Chapter 5, grammatical approaches treat the spatial organization of buildings and settlements as a 'language'; complete with syntactic rules which generate and modulate how spaces, and the people within them, are connected together (i.e Glassie, 1975; Hillier and Hanson, 1984). Two distinctive space syntaxes, defined by Hillier and Hanson (1984), have already been discussed in some detail. Briefly, spatial solidarity is defined by contiguity and encounter, in which inhabitants built relations with individuals residing within the larger community. This is accomplished by weakening the control of movement between community and dwelling (Figure 38). Transpatial solidarity, on the other hand, is defined by analogy and isolation; and is an arrangement of space based on exclusion, and the systematic control of encounters with others. In transpatial solidarity, the inhabitants of dwellings emphasize relations with each other and down play relations with individuals residing within the community. This is manifest spatially in the rigid division of interior space, which formally structures how inhabitants relate to one another, while at the same time distancing them from the community outside (Figure 39).

While syntactic rules can govern *how* spaces are connected together, we have seen that the *use* of space is often determined by local 'rules' (Giddens, 1984; Goffman, 1974). Irving Goffman (1974) defines spaces as *frames*; that is, rule bound spatial settings which govern social events. Spatial settings are *strongly framed* when individuals must conduct themselves in very specific ways, and *weakly framed* when the behaviors and actions of individuals are less formal. According to Goffman (1974), the clusters of rules associated with *frames* bring meaning to activities, and organize the involvement of participants. Participants *break frame* when they engage in an activity or act in a way which is deemed inappropriate for a specific spatial setting.

If we examine traditional Inuit house forms and Euro-Canadian Government houses in terms of Hillier and Hanson's (1984) concepts of transpatial and spatial solidarity, and Goffman's (1974) concept of rule-bound spatial settings (*Frame Analysis)*, a number of

FIGURE 38

SPATIAL SOLIDARITY

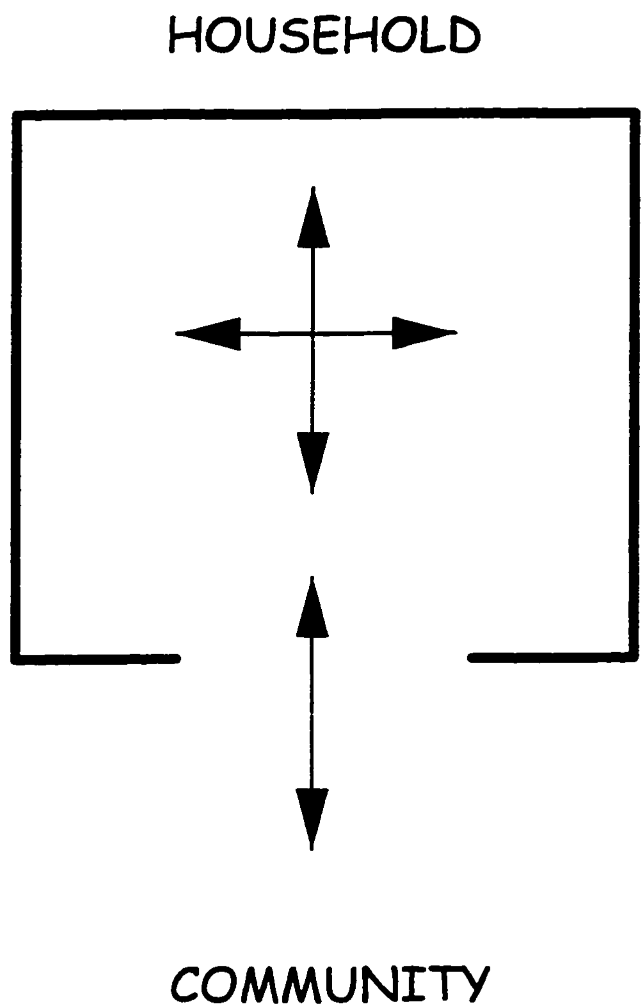
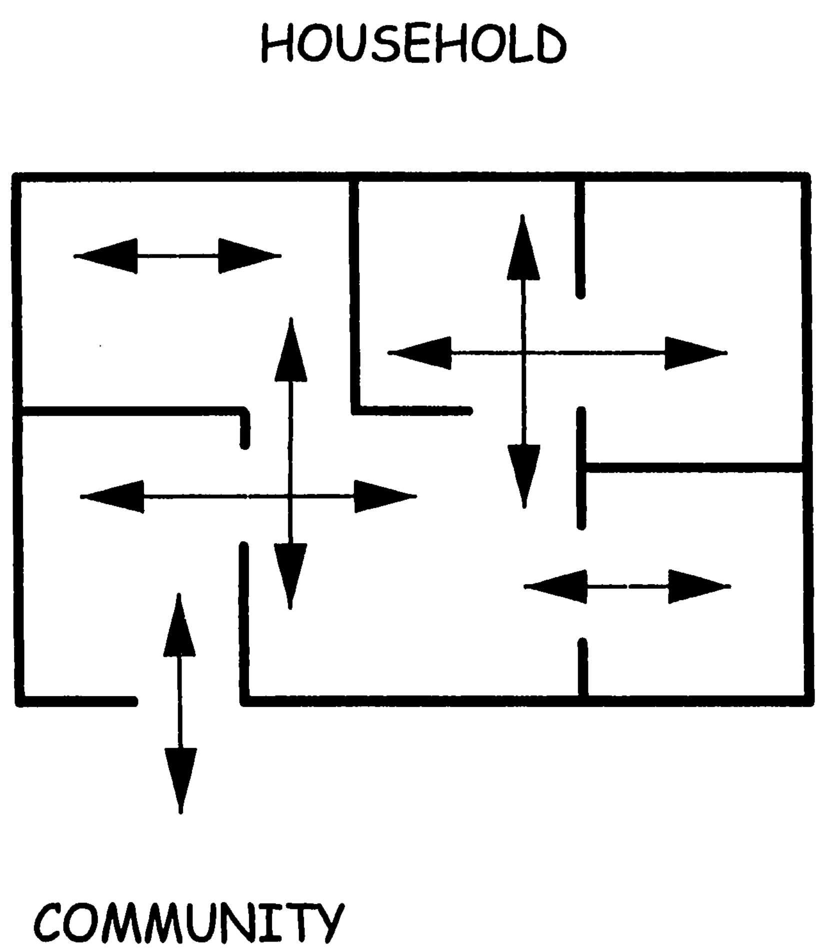


FIGURE 39

TRANSPATIAL SOLIDARITY



interesting differences emerge. The spatial properties of traditional Inuit house forms are perhaps best summarized in a quote by Edmond Carpenter (1959), who states:

> ".....visually and acoustically, the *iglu* is open; a labyrinth alive with the movements of crowded people. No static walls arrest the eye or ear, but voices and laughter come from several directions and the eye can glance through here, past there, catching glimpses of the activities of nearly everybody".

Although traditional Inuit house forms were frequently constructed using different types of materials, and occupied during different seasons, each of these forms retains a similar pattern of spatial organization. In unattached and communal houses, individual families centred many of their daily activities on the sleeping platform, where they socialized, manufactured and maintained tools and clothing, and slept together as a unit (Balikci 1970:80; Boas 1964[1888]:136; Mathiassen 1928:145 [Figure 40]). The sleeping platform also provided family members with a vantage point from which the actions and behaviours of other household members could be monitored effectively. Furthermore, cooking appears to have been the only domestic activity which was executed repeatedly from a single spatial location. Thus, the space syntax of the traditional Inuit houses is an expression of spatial solidarity in which spaces are socially open and *weakly framed*. Through this form of spatial organization, movement both within the dwelling, and between the dwelling and the community, remained relatively unimpeded.

In contrast, the spatial qualities of the Euro-Canadian house form are perhaps best summarized in a quote by Beresford and Rivlin (1969) who state that

> "The typical modern American apparently puts a high value on having a separate dwelling unit, into which he can retreat with his wife, if he has one, and his minor children but no one else, and close the door. He is reluctant to share a dwelling with relatives outside his nuclear family, or to live as a roomer and a boarder in the household of another non-relative".

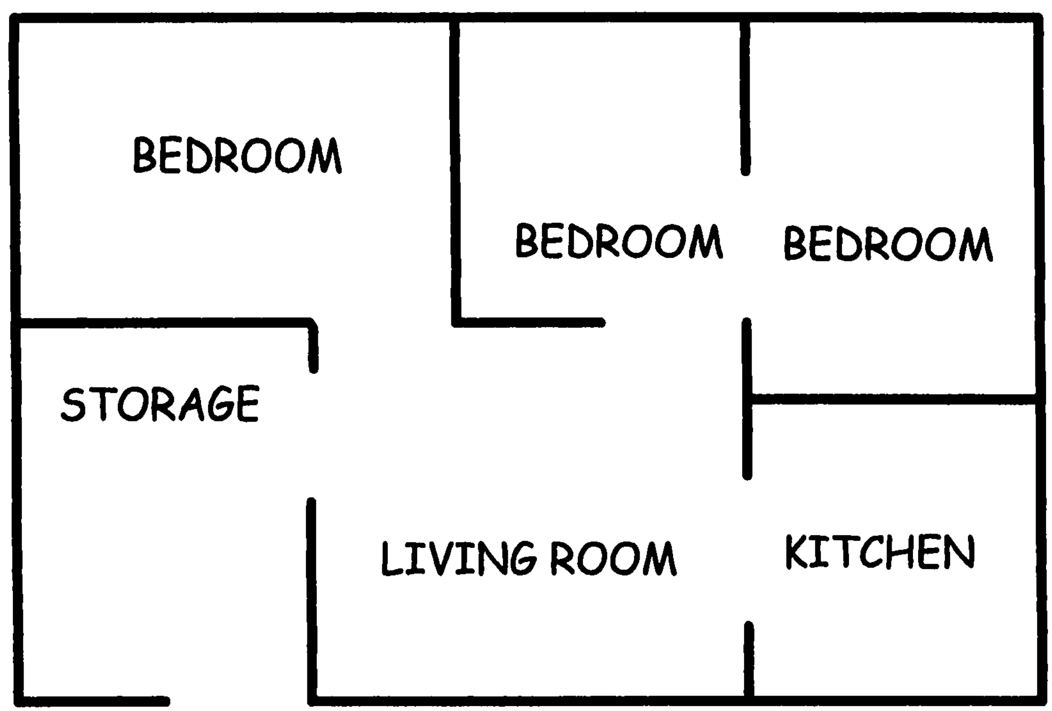
Within the Euro-Canadian house form, activities are tethered to specific spatial locations (Figure 41). Hence, kitchens are used for cooking and eating activities, living rooms for entertainment activities, bathrooms for hygiene activities, and bedrooms for intimacy and sleeping. The rigidly defined spatial settings of such activities also serve to segregate family members from one another, and separate rooms with doors prevent individuals from monitoring the activities, actions, and behaviors of others. Furthermore, tenants involved in rental agreements have to abide by the rules of the landlord, or face eviction. Thus, the space syntax of Euro-Canadian house is an expression of transpatial solidarity, in which enclosed spaces are *strongly framed* by the rules of the owner. This form of spatial organization has the effect of both controlling the actions and movements of family members within the dwelling, and impeding movement between the dwelling and the community.

The Transformation of the Traditional Inuit Household through the Space Syntax of the Euro-Canadian House.

Having established that the spatial organization of traditional Inuit house forms and Euro-Canadian rental houses are generated by two different space syntaxes, what effect

FIGURE 40. Spatial Syntax of the Traditional Inuit House Form - Family Activities Centered on the Sleeping Platform

FIGURE 41. Transpatial Syntax of the Euro-Canadian House Form - Family Activities are Spatially Segregated and Distributed throughout the House.



did Canadian Government Housing and Housing Programs have on Inuit families at the time of their introduction? In the early days of Arctic Housing Programs, Inuit families frequently *broke frame* by using rooms in traditional ways; for example, butchering animals in living rooms, and repairing snow machines in kitchens (Figure 42 [Thomas and Thompson 1972:15]). However, with the implementation of the Eskimo Rental Housing Program and the establishment of local Housing Authorities, strict 'rules' were administered which governed how rooms in houses could and could not be used. Parents, for example, were urged to sleep in bedrooms separate from those of their children for moral and health reasons. The one double sheet and two single sheets provided by rental programs for bedding, served to symbolically demarcate both the size of the nuclear family and their sleeping patterns; in separate rooms rather than in one collective group (Nixon 1984:50). Inuit tenants were also discouraged from engaging in manufacturing and maintenance activities indoors, and prevented from modifying their houses to make them more user-friendly (Nixon 1984:50). The inappropriate use of houses was monitored through frequent spot checks performed by the local Housing Association, and housing rules were enforced using veiled threats of eviction, or relocation to a smaller house (Redgrave 1986:133).

In Chapter 5, I outlined Giddens' (1984) argument based on Bettelheim's (1960) observations of middle class jews interred in Dachau and Buchenwald during the Second World War, that the disruption of existing daily routines through the introduction of new local 'rules' and spatial settings results in the resocialization of individuals and the production of new social structures. I would argue that the transpatial syntax of the Euro-

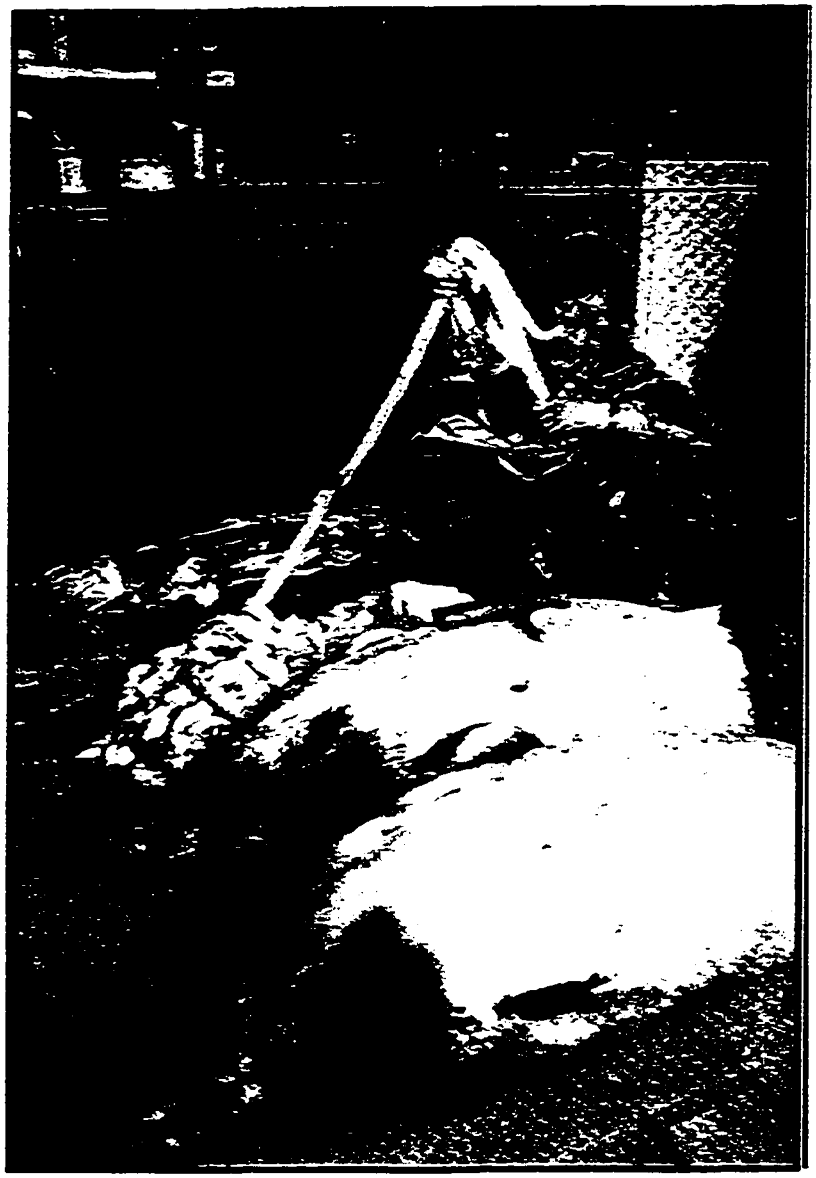


FIGURE 42. An Inuit Tenant "Breaks Frame" by butchering seals on the floor of a Government house (photo after Jenness and Rivers 1989:29)

Canadian house, coupled with the *strongly framed* spaces it contained, had the effect of restructuring the daily activities and routines of the traditional Inuit household around those of the southern Canadian nuclear family. Subsequently, this restructuring contributed to the dissolution of the extended family - the basic socioeconomic unit of production in traditional Inuit society at that time.

At this point, it is appropriate to ask why the Canadian Government might have placed a vested interest in restructuring the traditional Inuit household around Euro-Canadian concepts of the nuclear family. The answer may lie in the difficulties many Government Departments experienced in delivering social programs to Inuit in the 1950's and 60's. By way of illustration, because family allowance and welfare programs had initially been designed around the concept of the Euro-Canadian nuclear family, they tended not to function well within the context of the traditional Inuit extended family. Unlike Euro-Canadian families, for example, in which children belonged to a single, specific nuclear family, Inuit children were raised by the extended family, and moved extensively throughout its various kin networks (Tester and Kulchyski 1994:73). With the introduction of family allowance payments, however, children suddenly became a source of income. Consequently, parents would often allow their children to be 'adopted' by needy individuals; for example childless couples or Elderly persons (Tester and Kulchyski 1994:73). Traditionally, such adoptions would have strengthened social bonds between extended family members, as well as provide the foster parents with a renewed sense of economic security via the addition of a future productive hunter or seamstress. To the Inuit, Family Allowance benefits only served to augment such economic security. The

Canadian government, however, viewed this as an attempt to 'cheat' the system, and instituted measures to regulate and control the adoption of children within and among Inuit families (Tester and Kulchyski 1994:73). Registerers, for example, were instructed to be on the look out for "elderly widows attempting to adopt a child to care for her in her old age", or single women adopting in order to receive family allowance (Tester and Kulchyski 1994:73). Clearly then, it was in the best interest of the Canadian Government to transform the traditional extended Inuit family into a form which it could more effectively service. Thus, because Euro-Canadian house designs and housing programs imposed the daily routines and cultural values of the southern Canadian nuclear family on Inuit households, they helped to ensure the successful completion of this process. As households are typically conservative by nature, it is logical that such a transformation would have been attempted through the introduction of Euro-Canadian patterns of house-keeping.

Summary

In summary, an examination of the socioeconomic impact of 19th century European exploration, the Commercial Whaling Era, and the Fur Trade on Inuit groups inhabiting the eastern and central Canadian Arctic reveals that the extended family (*ilagiit)* remained the basic socioeconomic unit of production in Inuit society up until the Settlement Era of the 1950's. At this time, government officials began attempts to assimilate Inuit families into a broader Canadian economic and social reality through the introduction of health care, education, and housing programs. A review of the history of government housing programs and house designs reveals that they were designed around the concept of the nuclear family, which had emerged after the Second World War as a dominant socioeconomic form in southern Canada (Miron, 1988). Analysis of the floor plans of traditional and Euro-Canadian houses, and ethnographic research conducted in the Hamlet of Resolute Bay indicate that the following factors define the architectural disunity which exists between traditional Inuit and Euro-Canadian house forms:

A) Ethnoarchaeological data suggests that among Inuit Elders: 1) the internal division of an open space into separate rooms; 2) the inability to make architectural modifications to accommodate changing household sizes and facilitate traditional lifestyles; 3) the use of 'inferior' construction practices; and 4) the creation of barriers which impede contact with other members of the community (i.e. stairs, multi-story buildings); served to distinguish Euro-Canadian houses from traditional Inuit dwellings. Among younger Inuit tenants, housing concerns tended to focus on: 1) the lack of storage and work space; 2) high cost of rents; and 3) an increasing need for larger houses with more privacy. Furthermore, Hamlet administrators drew attention to the fact that Euro-Canadian house designs and housing programs had failed to keep up with important demographic changes occurring within the community; specifically, 1) the increasing number of single young men who require housing; and 2) an overall trend towards the formation of smaller households with fewer individuals living under the same roof.

B) The grammatical approaches of Hillier and Hanson (1984) and the *Frame Analysis* of Goffman (1974) demonstrate that traditional and non-traditional built forms are generated by two distinctive space syntaxes. To reiterate, the space syntax of the traditional Inuit house is an expression of spatial solidarity in which spaces are socially open and *weakly framed.* In contrast, the space syntax of Euro-Canadian house is an expression of transpatial solidarity, in which spaces are enclosed, compartmentalized, and *strongly framed* by the rules of Euro-Canadian culture. The combined effects of these architectural differences were that Inuit family members were spatially redistributed within houses in accordance with the practices of Euro-Canadian nuclear families. Furthermore, while Euro-Canadian domestic activities were accommodated spatially within Government houses, traditional activities were spatially marginalized, in that they were either relegated to outside areas, or to special purpose structures ('shanty' work shops) constructed from scrap lumber. I have argued that this contributed to the dissolution of the extended family - the basic socioeconomic unit of production in traditional Inuit society.

CHAPTER EIGHT. CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Introduction

In this dissertation, I have presented a history of house forms used by Inuit in the eastern Canadian Arctic, from AD.1000 to present. By focusing on three particular types of dwellings; the semi-subterranean whale bone house, the snow house, and the Euro-Canadian Government house, I have demonstrated that changes in house selection, design, and use, can be correlated with specific environmental and social factors which have impacted on Inuit families over the past one thousand years. In Chapter 5, I argued that variability in the exterior architectural forms taken by Thule semi-subterranean whale bone houses reflect decisions made by their builders as to how their designs could be suitably adapted to accommodate fluctuations in the availability of key building materials, and in anticipated use-life. In Chapter 6, I argued that variability in the patterning of space within Neoeskimo winter houses of different time periods was generated by the formation of new socioeconomic alliances within households, following the abandonment of bowhead whaling in the central and eastern Canadian arctic (AD. 1400-1600). The implication that social processes are reflected in the spatial organization of traditional Inuit architecture was then used in Chapter 7 as a baseline for understanding the impact that Euro-Canadian architecture has had on traditional Inuit households during the

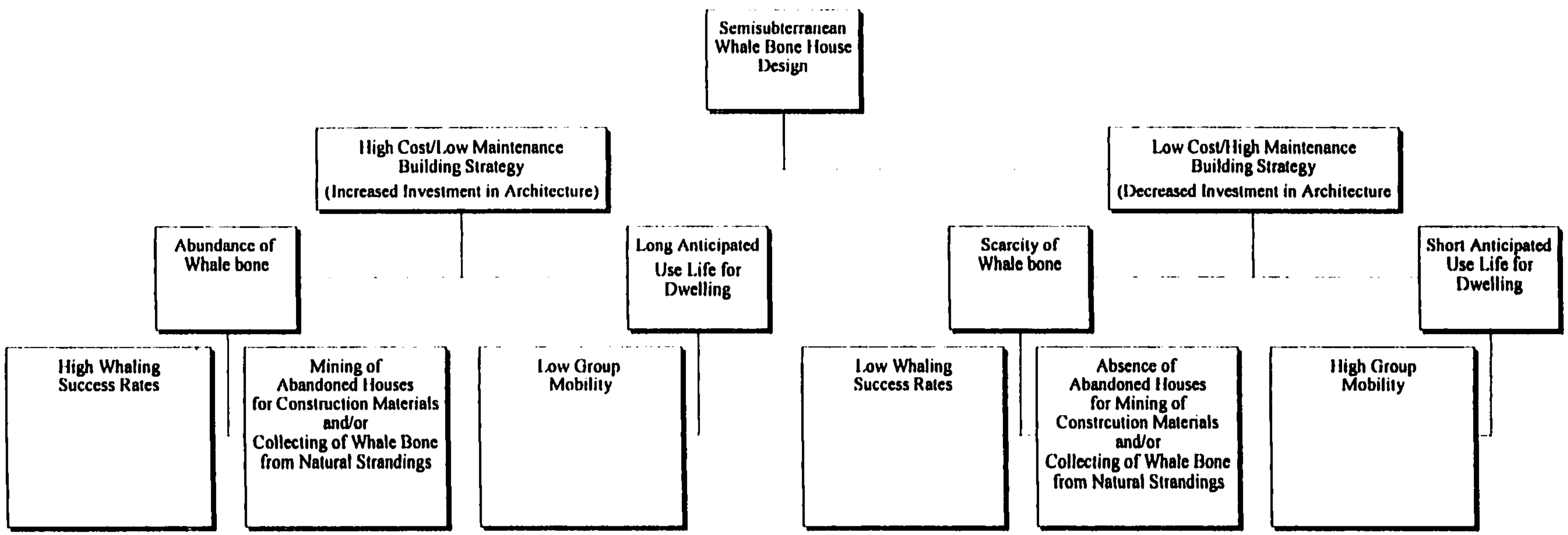
Settlement Era (1950 to present). In this chapter, I summarize the results of my analysis of Thule-Inuit architecture, and recommend avenues for future research.

1) Neoskimo Architecture as 'Artifact'

In Chapter 6, the various architectural attributes of Thule whale bone houses recorded at two archaeological sites in the Canadian High Arctic were explored using computer-aided design and drafting tools, and multivariate statistical analysis. These procedures resulted in the identification of significant architectural variability among Thule whale bone houses at the Deblicquy site (QiLe-1) and the Black Point site (QkLe-1). The architectural variability associated with each site has been attributed to 1) the implementation of low cost/high maintenance building strategies, 2) the implementation of high cost/low maintenance building strategies, and 3) the post-occupational removal of building materials from abandoned dwellings by later Neoeskimo groups.

A decision tree is used here to summarize the factors which ostensibly influence the selection of a particular building strategy (Figure 43). House designs which reflect low cost/high maintenance building strategies are typically small, narrow dwellings enclosed using either the flat-roofed design described by McGhee (1984) and Park (1988), or roof frameworks constructed primarily from ribs, as described by Maxwell (1985). This type of building strategy was likely employed during periods of whale bone scarcity, or when the anticipated use-life for a dwelling was limited to a single season. In contrast, house designs which reflect high cost/low maintenance building strategies are typically larger

FIGURE 43. Decision Tree for the Design of Thule Semisubterranean House Forms



dwellings, with wider diameters, and self-supporting roof frameworks constructed primarily from mandibles and maxillae, as described by McCartney (1979). This type of building strategy was likely employed during periods when whale bone was more abundant, and/or when the anticipated use-life of a dwelling was much longer. While similar types of building strategies were identified at both sites, house designs at Black Point appear to reflect a greater reliance on low cost elements. The architectural evidence seems to suggest, for example, that rib-roofed dwellings were much more frequent than flat-roofed ones. I have suggested that the construction of smaller houses with narrow, equal-sized lobes built from ribs ostensibly represents either 1) an adaptation of Thule architecture to whale bone scarcity, or 2) a decreased investment in architecture due to a shorter anticipated use-life for Black Point dwellings. While the former suggests lower whaling success rates for Black Point occupants, the latter posits a different functional and seasonal use for the site, namely autumn caribou hunting.

An awareness of the interface which exists between the plan/design of a Thule dwelling, and the types of elements required to enclose it, has broad implications for the interpretation of Thule culture. For example, the identification of disjunctive design and building strategies may reflect differences in group mobility; the function and seasonality of site occupation, controlled access to 'high cost' building materials by individuals of status, or environmental factors creating a scarcity of 'high cost' building materials at certain locations, and/or during certain time periods. I suggest that this type of variability has been masked by traditional archaeological practices which treat all Thule houses lacking in whale bone as the product of a single process, namely, the post-occupational disturbance and removal of whale bone by later Inuit groups.

2) Neoeskimo Architecture as 'Container of Space'

In Chapter 5, a number of theories were outlined which suggest collectively that 1) local 'rules' *frame* human activities and interactions which, in turn, reproduce the social structure of a culture, and 2) this process is both facilitated by, and reflected in, the spatial organization of the built environment (Bourdieu, 1977; Foucault, 1982; Giddens, 1984; Goffman, 1959,1974; Hillier and Hanson, 1984; Markus, 1993; Sibley, 1996). One of the implications of this supposition is that because local 'rules' and the activities and encounters they *frame* require specific spatial contexts, the introduction of new rules and routines should also be accompanied by the introduction of new spatial orders within the built environment. With the abandonment of whaling between AD. 1400-1600, the daily routines and activities which served to 'socialize' individuals into Thule society necessarily changed. Subsequently, because the local 'rules' which governed these new routines and activities had to be anchored to specific spatial and temporal contexts, a new space syntax emerged - one which was based on transpatial rather than spatial solidarity. The hierarchical distribution of living space (transpatial solidarity) within snow houses, for example, seems to correlate with the respect-obedience (*nalartuk*) subsystem of the extended family, in which father-son relations become central to the bonding of nuclear families into extended families (*ilagiit*). It is important to note, however, that transpatial and spatial solidarity exist not as absolutes, but as points along a continuum (Figure 44). Hence, these two space syntaxes reflect a shift *towards* the emphasis of socioeconomic relations at the level of the household (increasing transpatial solidarity), and *away from* the emphasis of socioeconomic relations at the level of the community (decreasing spatial solidarity). After AD 1500, the extended family emerged as the essential socioeconomic unit of production in Inuit society. Economic and social relations thus became more focused on the formation and maintenance of cooperative alliances within individual households, and less focused on the formation and maintenance of cooperative alliances among different households within the community. This is not to suggest that community level cooperation ceased entirely; only that a greater emphasis was now placed on socioeconomic relations operating at the level of the household.

With regard to McGhee's (1984) suggestion that historic Inuit societies were less socially complex than Thule culture, the spatial data presented here would seem to imply that it was not the *level* of complexity which changed, but the *location* in which it occurred. Many Neoeskimo archaeologists have argued that the locus of complexity in Classic Thule society was the winter community, and that such complexity is frequently reflected in the highly structured arrangement and use of site space at many Classic Thule winter villages (Grier and Savelle, 1994). With the abandonment of whaling, however, the locus of social complexity was essentially moved 'indoors' and out onto the sea ice - far away from the eyes of archaeologists. I began Chapter 7 by citing Mauss's (1979[1906]) classic monograph in which he argued that the snow house existed as the synchronic locus of social complexity within the context of the seasonal round of ethnographically known

Inuit cultures. Following Mauss, I would likewise argue that from a diachronic perspective, the snow house emerged as a locus of social complexity among historic Inuit cultures. Consequently, in developing models for the emergence of Inuit society *in absentia* of the snow house complex, archaeologists run the risk of underestimating the complexity of later Inuit culture.

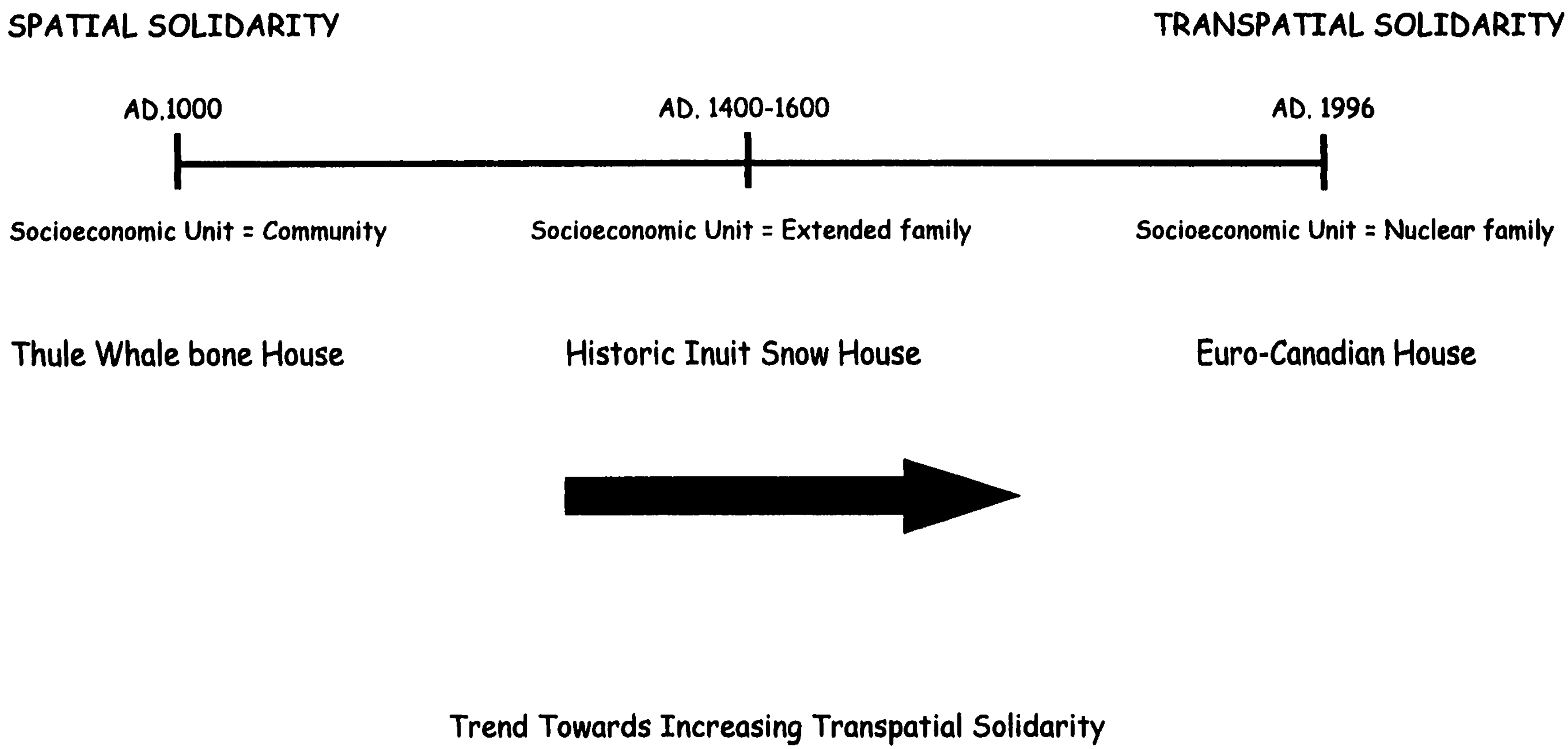
3) The Transformation of the Traditional Inuit Household Through Euro-Canadian Architecture: A Round Peg in a Square Hole ?

McGuire and Schiffer (1983:279) state that as house users become increasingly disenfranchised from design and construction processes, the potential for conflict and dissatisfaction in house form increases substantially. The following factors support McGuire and Schiffer's (1983) axiom, and define the architectural disunity which exists between traditional Inuit and Euro-Canadian house forms:

Ethnoarchaeological data suggests that among Inuit Elders: 1) the internal division of an open space into separate rooms; 2) the inability to make architectural modifications to accommodate changing household sizes and facilitate traditional lifestyles; 3) the use of 'inferior' construction practices; and 4) the creation of barriers which impede contact with other members of the community (i.e. stairs, multi-story buildings); served to distinguish Euro-Canadian houses from traditional Inuit dwellings. Among younger Inuit tenants, housing concerns tended to focus on, 1) the lack of storage and work space; 2) high cost of rents; and 3) an increasing need for larger houses with more privacy. Furthermore, Hamlet administrators drew attention to the fact that Euro-Canadian house designs and housing programs had failed to keep up with important demographic changes occurring within the community; specifically, 1) the increasing number of single young men who require housing; and 2) an overall trend towards the formation of smaller households with fewer individuals living under the same roof.

The grammatical approaches of Hillier and Hanson (1984) and the *Frame Analysis* of Goffman (1974) provide additional information on the architectural differences which exist between traditional Inuit and Euro-Canadian architectural forms, and the impact that these differences have had on Inuit households. These approaches demonstrate that traditional and non-traditional built forms are generated by two distinctive space syntaxes. To reiterate, the space syntax of the traditional Inuit house is an expression of spatial solidarity in which spaces are socially open and *weakly framed*. In contrast, the space syntax of Euro-Canadian house is an expression of transpatial solidarity, in which enclosed spaces are *strongly framed* by the rules of Euro-Canadian culture. At this point, the reader has likely realized that in Chapter 7 I argued that the space syntax of the snow house complex existed as an expression of transpatial rather than spatial solidarity. Remember, however, that these two concepts represent a difference in *degree*, rather than in *kind*. This relationship is illustrated graphically in Figure 44, which situates traditional Inuit and Euro-Canadian house forms within a continuum ranging from spatial to transpatial solidarity. Consequently, while the spatial organization of a traditional Inuit snow house is more *transpatial* than that of a Thule whale bone house, it remains much more *spatial* than that of a Euro-Canadian house. The increasing levels of transpatial

FIGURE 44. The Changing Space Syntax of House Forms Used by Inuit Families in the Eastern Canadian Arctic



solidarity expressed by Euro-Canadian households over traditional Inuit households is perhaps best summarized in quotes by Koerte (1974) and Shorter (1977). In the first quote, Koerte (1974) explains that:

> "A common pattern in the north was the *iglu* cluster, with an open ended fluid quality of space...which offered a *degree of privacy* to the various subgroups of the larger family or clan without sacrificing a *strong sense of shared space and togetherness*, even though the latter may well have been more acoustic than visual"(*italics* my emphasis).

Thus, the space syntax of the traditional Inuit snow house exists as an expression of the *transpatial* solidarity of the extended family relative to the community, and the *spatial solidarity* of nuclear families within the extended family.

In contrast, Shorter (1975:205) argues that following the Second World War, there was an increasing emphasis on social ties within the Western nuclear family, as opposed to ties with the rest of the community (including relatives). He states:

> The nuclear family is a state of mind rather than a particular kind of structure or set of household arrangements. It has little to do with whether the generations can live together or whether Aunt Mary stays in the spare bedroom... What really distinguishes the nuclear family...from other patterns of family life in Western society is a special sense of *solidarity* that separates the domestic unit from the surrounding community. Its members feel that they ...enjoy a privileged emotional climate they must protect from outside intrusion, through privacy and isolation" (*italics* my emphasis)

Thus, the space syntax of the Euro-Canadian house exists as an expression of the transpatial solidarity of the nuclear family relative to both the community **and** the extended family.

The conclusions of the space syntax and Frame Analysis studies are significant in that they corroborate the ethnographic data collected from respondents in Resolute Bay. To Illustrate, when Elder (X) uses the division of open spaces into separate rooms as a criterion for distinguishing between government houses and traditional houses, he is essentially commenting on the transpatial qualities of Euro-Canadian architecture. Elder (X)'s later remark that it was for precisely this reason that it took him a long time to feel at home in Government houses, further supports the notion that the transpatial syntax of Euro-Canadian house forms generated spatial environments which were 'alien' to Inuit. Likewise, the frequent references made by Inuit respondents to the tenancy 'rules' of the Housing Association, which controlled the use of household space; the prevention of house modification, the scaling and monthly payment of rents/mortgages, and the allocation of housing, corroborates the notion that Euro-Canadian house forms were spatial environments which were *strongly framed* by the 'rules' of another culture. This stands in contrast to traditional Inuit house forms, which I have argued were *weakly framed* spatial environments in which the use of space was relatively unstructured and largely opportunistic.

Like Shorter (1977), Beresford and Rivlin (1966) have commented that North American nuclear families place a high value on privacy, and the space syntax which generates the spatial organization of the Euro-Canadian house clearly reflects this.

Consequently, I have argued that the Canadian Government essentially imposed new social structures on Inuit culture through the introduction of Euro-Canadian architecture and western concepts of property management (i.e rental programs, rules of tenancy). There was nothing inherently sinister in the actions of the Canadian Government in this regard. Government officials in the 1950's perceived the Inuit, not as a distinct culture, but as a group of impoverished Canadians whose standard of living needed to be elevated to the levels enjoyed by other Canadian citizens. The break-up of Inuit extended families aboard the *C.D. Howe* for resettlement in Resolute Bay, Craig Harbor, and Cape Hershel, detailed in Chapter 7, demonstrates that Government officials were unfamiliar with what constituted a northern aboriginal 'family group' in the 1950's (Tester and Kulchyski 1994:145). Had these officials recognized the socioeconomic importance of the extended family, they would have realized that their actions were essentially undermining the very enterprise they hoped to succeed in, namely the creation of self-sufficient Inuit communities in the Canadian High Arctic. Thus, many Government administrators believed they were acting in the best interests of the Inuit when they initiated Social Housing Programs in the Canadian North.

Recommendations for Future Research

The search for social processes embedded in the floor plans and structural frameworks of various traditional Inuit and Euro-Canadian house forms has yielded a number of potential avenues for future research. First, the use of computer-aided design and drafting

(C.A.D.D) systems as tools for recording and analyzing Neoeskimo architecture provides archaeologists and Inuit communities with an inventory and permanent record of the various cultural features present at any given archaeological site. Elsewhere, I have suggested that it is for precisely this reason that C.AD.D could be utilized as a powerful tool in the management of cultural resources in the Canadian Arctic (Dawson and Hendrickson, 1995). Furthermore, the two dimensional C.A.D.D images of houses from Deblicquy site and the Black Point site could easily be used to create three dimensional renderings of Thule whale bone dwellings (Figures 45 & 46). Peterson, Fracchia, and Hayden (1995) have recently constructed a computer-generated 'virtual pit house' based on archaeological information collected from the Keatley Creek Site in British Columbia. Peterson *et al.* (1995:32) demonstrate that such three dimensional models can provide archaeologists with valuable insights into how the structure of a dwelling can influence the use of internal space. In addition, because many C.A.D.D-based images allow the user to selectively hide and display various aspects of an image, they contain an interactive element which makes them suitable for use in multi-media applications, and as teaching aids in public archaeology programs.

Second, I have suggested that the implementation of different building strategies at the Deblicquy site and the Black Point site may reflect either 1) an adaptation of Thule architecture to whale bone scarcity, 2) variation in anticipated group mobility; 3) a non-cetacean subsistence focus; and/or 4) controls placed on the redistribution of high cost building materials by high status individuals (*umialiqs*). Each of these suppositions needs

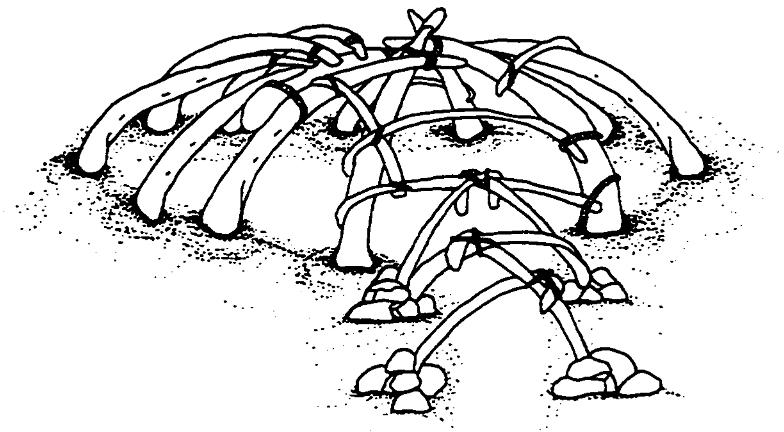


FIGURE 45. Three dimensional reconstruction of House 4; Deblicquy Site (Qile-1), Bathurst Island.

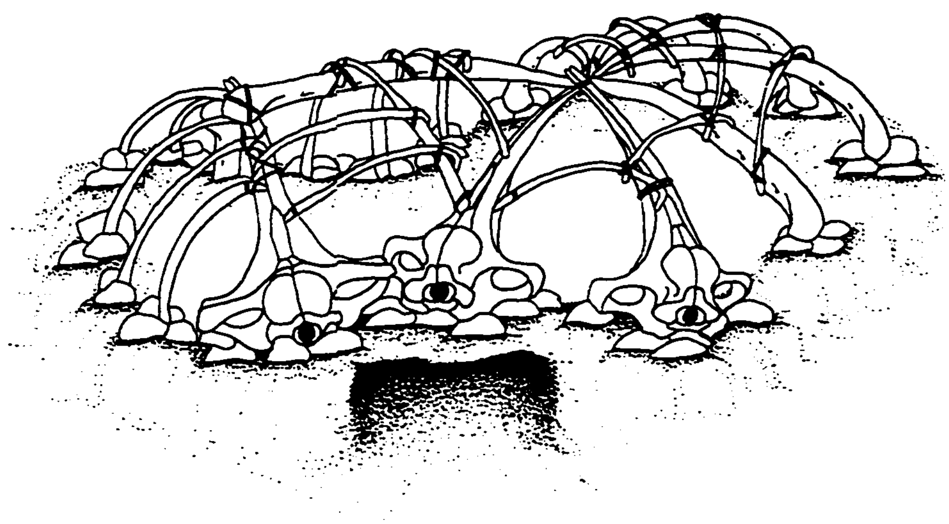


FIGURE 46. Three dimensional reconstruction of House 8; Deblicquy Site (QkLe-1), Bathurst Island.

to be tested using more traditional, excavation-oriented approaches. However, the non-excavation oriented approaches developed here could be used to evaluate further Savelle and McCartney's 'zonation' of central and eastern Arctic into three distinct regions, based on the inferred relative abundance of bowhead whales (see McCartney and Savelle, 1993; Savelle and McCartney, 1991;1994). For example, one might expect that high cost/low maintenance building strategies would be more prevalent in zones of high whale abundance (the core zone), while low cost/high maintenance building strategies would be more evident in zones where bowheads were less frequent (the peripheral zone).

Third, further research needs to be directed towards examining the ways in which traditional Inuit house forms and Euro-Canadian house forms differ from one another, and in analyzing the impact that these differences continue to have on Inuit households. Field research conducted in the Hamlet of Resolute Bay shows that Government house designs and Housing Programs have failed to keep up with various demographic trends which have occurred within the community over the past 40 years. There exists currently a need for housing which can accommodate the growing number of single young people within the community who wish to form their own households. It might be possible to redesign and renovate Erskine's derelict apartment complex (discussed in Chapter 8) in such a way that it could provide housing which would be appropriate for such individuals. Furthermore, interviews conducted with Inuit residents identified a need for more storage and heated work spaces within the community. This problem might be alleviated through the erection of a single, large prefabricated structure which would provide residents with an area for carving, and repairing and storing equipment. Alternatively, residents could arrange to use work space in one of the large, pre-existing structures presently used to house graders and other heavy equipment. While such cooperative use of space between Inuit residents and Government employees would require scheduling so as not to create activity conflicts, it would nevertheless provide a low cost solution to the aforementioned problem.

The recent application of computer-based knowledge acquisition tools such as Expert Systems (ES) for gathering traditional environmental knowledge among aboriginal groups holds promise for analyzing how Inuit families use space in Euro-Canadian houses. ES programs such as KSSO (developed in the Computer Science Department at the University of Calgary) are rooted in Personal Construct Theory (see Shaw and Gaines, 1996), and seek to organize traditional knowledge around constructs used by a particular aboriginal group. In a similar way, ES programs could be used to acquire and analyze traditional knowledge relating to the use of space by Inuit households. Comparisons of space use (activity locations; activity scheduling; activity conflicts) could then be made among Inuit households of varying compositions (i.e young households verses households comprised of older, more traditionally minded individuals), and between Inuit and Euro-Canadian households. Although the identification of converging and diverging patterns of space use between such households would be extremely interesting from an anthropological perspective, such information would be indispensable in designing and constructing dwellings which more readily accommodate Inuit families. Inuit households today more closely resemble Euro-Canadian households than they did 40 years ago. Nevertheless, on-going field research in the Hamlet of Resolute Bay reveals that Inuit families continue to *break frame* in Government houses by using them in traditional ways. Porches and railings in front of houses, for example, are used to support caribou skins; polar bear hides are staked off in front of houses; and dogs are tied up next to sleds, all-terrain cycles, and snow machines. Inside many houses, a large chunk of caribou meat is often seen sitting on the kitchen floor, for anyone to help themselves to. Such practices attest to the continuation of land-based pursuits, and traditional patterns of sharing within and among households. Clearly, archaeology and ethnoarchaeology can provide a unique and useful perspective for understanding the important differences which exist between traditional Inuit and Euro-Canadian households. Such a perspective may be of value in designing what Rapoport (1980) refers to as "culturally sustaining" built environments; that is to say, houses which better reflect and sustain the values and lifestyles of Inuit families living in Canadian Arctic communities today.

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Appendices

APPENDIX ONE: DESCRIPTIONS AND C.A.D.D DRAWINGS OF HOUSES FROM THE DEBLICQUY SITE (QiLe-1).

In Appendix 1, I provide a brief description of each semi-subterranean house recorded at the Deblicquy site. Plan views of those semi-subterranean houses which were drawn in detail during the 1994 field season are also presented. A frequency table of architecturally significant bowhead elements for each house can be found in Chapter 5; Table 1.

House 1.

House 1 is a relatively well defined, single-lobed, semi-subterranean dwelling. The house is ovate in shape, with a small kitchen alcove located to the left of the entrance tunnel and partially defined by an upright bowhead whale skull base. A small hole is evident in the skull base, just above the foramen magnum. The house is oriented roughly northwest-southeast, with the entrance tunnel opening towards the southeast. A piece of whale bone with evidence of adzing was found just off of the house mound. Mandibles are in greater abundance than maxillae, and most are oriented towards the centre of the house pit. In contrast, the few maxillae present are oriented around the rim of the edge of the house mound. Two bowhead crania were placed opposite one another towards the front of the dwelling. This would seem to suggest that the two crania functioned to supported a single mandible which would have spanned the front portion of the dwelling. Other mandibles and maxillae would have then been propped up against the first mandible, forming a flat roof similar to that described by McGhee (1984:21) and Park (1988:166).Ribs occur almost exclusively within the interior of the house pit, suggesting that they were lashed as cross pieces to the house frame prior to its collapse. Vertebrae tend to occur only along the base of the interior pit depression, and were most likely used to consolidate the interior walls, and brace the mandible and maxillae used to form the roof of the dwelling. A single scapula, broken towards its proximal end, was recovered within the interior of the house pit. The scapula's relative proximity to the opening of the entrance tunnel suggest that it may have functioned as a door block. A number of large, flat rocks were recorded on the house mound, and in the interior of the pit depression. Such rocks may have been used to consolidate and stabilize the house mound, and as raw material for the construction of sleeping platforms and lamp stands.

House 2.

House 2 is a small, ovate, single-lobed, semi-subterranean whale bone dwelling. The house is oriented northwest-southeast, with the entrance tunnel opening towards the southeast. The remaining portions of two broken bowhead mandibles protrude upright from the interior of the house depression. These two elements constitute the only bowhead whale bone present within this feature. This paucity of whale bone suggests that House 2 may have been dismantled and mined for raw material, following its abandonment.

House 3.

House 3 is a small, circular, single-lobed semi-subterranean dwelling in an excellent state of preservation. The house is oriented northwest-southeast, with the entrance tunnel opening towards the southeast. The mandibles recorded in House 3 rim the edge of the interior house depression, rather than point towards the centre of the structure. The proximal portion of a large broken mandible occurs in an upright position towards the front of the house, on the left side of the entrance tunnel. Maxillae are more plentiful than mandibles, and are found along the inner rim of the house mound, as well as inside the interior house depression. Ribs occur mainly within the interior house depression. Vertebrae were recorded on the surface of the house mound, and along the base of the interior wall of the dwelling. A large, upright bowhead whale crania is situated on the edge of the interior depression, directly opposite the broken, upright bowhead mandible. Finally, concentrations of large, slab-like rocks were recorded on the house mound, and along the outer edges of the entrance tunnel. A large, unbroken mandible lying approximately 5.37 metres from the entrance of House 3 may have been used to span the upright mandible and skull base. Partial confirmation of this hypothesis was achieved when we were able to successfully place the mandible in question across the skull base and mandible upright. The small diameter of House 3 (2.2 m), and the clustering of ribs within the house depression, suggest that they were used in place of mandibles and maxillae to assemble the roof framework. Whale ribs would have likely been lashed to the mandible spanning the dwelling, and braced at the base of the house mound using mandibles, maxillae, and rocks. A reconstruction of a whale rib roof framework completed by Maxwell (1985:284) at the Shorty site on southeastern Baffin Island, illustrates how this might have been accomplished. Finally, the spatial distribution of rocks over the house mound suggests that they were used to consolidate the mound, and perhaps roof the entrance tunnel.

House 4.

House 4 is a large, bi-lobed semi-subterranean house in an excellent state of preservation. While House 4 appears to be oriented along a northwest-southeast axis, the entrance tunnel for this feature is difficult to define. A detailed examination of the digitized floor plan for this structure suggests that the entrance tunnel likely opened to the southeast. Mandibles and maxillae are abundant throughout this feature. Almost all of the mandibles and maxillae point inwards toward the centre of the house pit depression, suggesting that they now rest more or less where they had originally fallen following the collapse of the roof structure. Ribs occur almost exclusively within the interior pit depression, denoting their use as cross braces for the roof framework. The spatial distributions of vertebrae and rock were confined to the house mound and suggests that they functioned to consolidate the walls of the dwelling. A fragment from the proximal end of a scapula was recorded in the southeast grid unit of the interior house depression, near the proposed entrance tunnel. This would seem to imply its use as a wind break for the entrance passage. Finally, two crania fragments were recorded embedded in the edges of the house mound, opposite to one another. Careful examination of the digitized map of House 4 indicates that two different construction techniques were employed to roof the dwelling. The largest room/lobe appears to have been roofed using mandibles and maxillae, the proximal ends of which were countersunk into the house mound and cantilevered inward, forming a self-supporting, domed superstructure. Ribs would then have been affixed to this roof framework to increase its rigidity. The second, smaller lobe appears to have been roofed using a technique similar to that reported for House 1 and 3. A large mandible was placed diagonally across the edge of the interior depression, and other mandibles and maxillae were propped up against it; one end resting on that first mandible, and the other end resting on the outer house wall. The first mandible may have been supported by a the broken proximal end of an upright mandible, located in the middle of the interior pit depression of the second lobe, and by one of the crania.

House 5.

House 5 is a medium-sized, bi-lobed semi-subterranean dwelling in an excellent state of preservation. The dwelling is oriented in a roughly northeast-southwest direction, with the entrance tunnel opening towards the southwest. Mandibles are far more abundant than maxillae, and both element types point inwards towards the centre of the interior house depression. As with House 4, their alignment would seem to suggest that these elements rest more or less where they would have originally fallen, following the collapse of the roof frame. Ribs occur in a spatially discrete cluster, within the interior depression of the second smaller lobe. The distributions of vertebrae and ribs was confined mainly to the house mound, and likely served to consolidate the interior walls of the house pit. One of the most significant attributes of House 5 is the plethora of bowhead crania it contains. Two large relatively intact crania were placed over the entrance passage of the dwelling. Detailed examinations of the digitized plan of this of this dwelling suggest that a long mandible would have been used to span the interior of the house; one end supported by the crania placed over the door way of the dwelling, and the other end supported by the crania located along the opposing house wall. The orientations of the bowhead elements recorded in House 5 suggest that it would have been roofed in the following manner. Mandibles and maxillae would have been placed across the dwelling, supported by the mandible bridge and the exterior house wall. Ribs would have then been lashed to the mandible/maxillae lattice to increase its structural integrity. The resulting roof would have been not dissimilar to that described by McGhee (1984) and Park (1988); a sloping, flat roof constructed using a minimum of 6 mandibles. In contrast, the smaller lobe appears to have been roofed using a combination of ribs and maxillae. Two large maxillae, supported on one end by bowhead crania, and on the other by the exterior house wall, were used to bridge the smaller lobe. Ribs were then lashed to these two mandibles, forming a roof framework.

House 6.

House 6 is a large bi-lobed semi-subterranean dwelling which shares the mound of House 5. Four upright bowhead crania rim the edge of the interior pit depression of one of the lobes. House 6 is oriented in the same direction as House 5, with its entrance tunnel also opening towards the southwest. Two broken upright mandibles and one broken upright maxilla were recorded on the house mound, in between the interior pit depressions of House 5 and House 6. The positions of these uprights outside of each house suggests that they may represent the remains of a storage rack. Historic Inuit groups frequently used such racks to keep food and equipment off the ground and away from dogs and other scavengers (reference). Aside from the four intact upright bowhead crania, no other bowhead elements were recorded for this feature. Either these elements were removed sometime after the dwelling was abandoned, or it was roofed in some other fashion. The uniqueness of this dwelling suggests that it may have served in some capacity other than as a habitation structure. The presence of the four upright bowhead crania, for example, suggests that this structure may have served as a *karigi*, or communal men's house. The fact that this structure shares a mound with House 5 suggests that the resident of the later dwelling may have been an individual of special status. Such interpretation are merely conjecture, however, and would require verification through excavation.

House 7.

House 7 is a medium sized, bi-lobed semi-subterranean dwelling in a relatively good state of preservation. House 7 is oriented northwest-southeast, with the entrance tunnel opening towards the southeast. Mandibles occur in greater abundance than maxillae, and both element types point inwards towards the centre of the interior house depression. Ribs occur scattered throughout the interior pit depression, with approximately one dozen clustering over the entrance passage. Two scapula fragments were observed within the interior house depression. As with the other houses, the spatial distribution of rocks and vertebrae appear to be confined largely to the house mound, suggesting that they were used to consolidate the interior house walls. Three upright bowhead crania were recorded in this feature; one riming the wall of the smaller lobe, and the remaining two riming the wall of the larger lobe, close to the entrance tunnel. Examination of the orientations of the bowhead elements suggest that House 7 was roofed in the following manner. The large lobe was roofed using mandibles and maxillae, the proximal ends of which were countersunk into the edge of the house mound, cantilevered inwards, and braced using rocks and vertebrae. The close spatial proximity of several maxillae to the three skull bases suggests that these elements were left attached to increase the overall length of the roof beam. McCartney (1980:533) has reported a similar practice at a Thule house excavated at Cape Garry, stating that maxillary-premaxillary jawbones are usually weaker and shorter than mandibles, and were therefor sometimes left attached to the skull base to increase their overall length. The smaller lobe appears to have been roofed using a combination of ribs and jawbones.

House 8.

House 8 is a large, bi-lobed semi-subterranean dwelling in an excellent state of preservation. Mandibles occur in greater abundance than maxillae, and elements of each type were found both riming the edge of the interior depression, and pointing inward towards the centre of the house pit. One mandible portion, adzed off of a larger piece, supports one of the three bowhead crania which were placed over the entrance to this dwelling. The three crania are more or less intact, and may have played both a symbolic and an functional role in the architectural design of this structure. Although ribs occur scattered throughout the interior of the house pit depression, many seem to cluster within the smaller of the two lobes which comprise House 8. Again, the spatial distribution of vertebrae and rocks is confined largely to the house mound, and likely functioned to consolidate the walls of the house pit. Analysis of the digitized plan for House 8 suggests that it was enclosed in the following manner. The large lobe was roofed using mandibles and maxillae, the proximal ends of which were countersunk into the edge of the house mound, cantilevered inwards, and braced using other mandibles and maxillae. The close spatial proximity of several maxillae to the three skull bases suggests that these elements were left attached to increase the overall length of the roof beam. Ribs would have then been lashed across the mandible/maxillae framework to increase its rigidity. The resulting shape of this roof structure would have been that of a self-supporting dome. The smaller lobe appears to have been roofed almost exclusively using ribs, which would have been lashed together to form a smaller dome.

House 9.

House 9 is a large, bi-lobed semi-subterranean house which shares a mound with House 8. House 9 was excavated by Taylor in 1961[18], and a detailed description of this feature can be found in Taylor and McGhee (1981).

House 10.

House 10 is a small, single-lobed, rectilinear semi-subterranean dwelling in a relatively good state of preservation. House 10 is oriented approximately north-south, with the entrance passage opening towards the south. Mandibles and maxillae are scarce and fragmentary in this feature, and occur in random orientations within the house pit. In contrast, ribs are extremely numerous, and were recorded mainly from within the interior house depression. Vertebrae are also plentiful, and tend to cluster at the rear of the structure, on top of the house mound. In addition, several vertebrae were recorded at the front of the dwelling on either side of the entrance passage, suggesting that they may have functioned as lamp stands. Large, flat rocks were found both within the interior pit

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[18]Taylor refers to this structure as House 3 in Taylor and McGhee (1981).

depression, and along the edges of the house mound. The placement and orientation of many of the rocks presupposes that they were used as flagging for walls. Other rocks appear to have been used to construct part of a paved floor. A large scapula encountered at the base of the house mound was possibly used as a wind block for the entrance passage, which is extremely short in comparison to other dwellings at Deblicquy. A single upright bowhead crania was observed midway along the east wall of the structure. Analysis of the digitized plan for House 10 suggests that ribs, rather than mandibles and maxillae, were used primarily to roof this structure. The utilization of ribs was no doubt facilitated by the rectilinear floor plan of the dwelling, in which the length of the dwelling is more that twice its diameter. Thus, the shorter ribs would have easily spanned the width of the structure. The orientation of ribs within the interior of the dwelling indicates that they were crisscrossed and lashed together to form a stretched, self-supporting dome. Again, Maxwell's (1985:285) reconstruction of the whale rib roof framework of a small Thule house at the Shorty site, southeastern Baffin Island, provides an illustration of this type of construction technique. The upright bowhead crania rests directly opposite from a large pile of flat rocks. These may have served to support a mandible 'bridge', to which the whale ribs would have been attached. The presence of a whale rib roof framework, coupled with the absence of any appreciable roof fall in the interior of House 10, suggests that it would have been roofed primarily with skins. Although this would seem to indicate that House 10 functioned as a *qarmat*, the presence of a snow beater, snow knife, and the leg from a sealing stool; all protruding from the edge of the interior depression, allude to the possibility that it was occupied during the winter months. This interpretation supports

Park's (1988) assertion that at least some Thule semi-subterranean winter houses possessed little more than skin roofs.

House 11.

House 11 is a medium-sized, single-lobed, rectilinear semi-subterranean house in a generally good state of preservation. House 11 shares a mound with House 12, and is oriented northeast-southwest, with the entrance tunnel opening towards the southwest. Mandibles are relatively abundant in this feature, with some riming the inside edge of the house pit, and others pointing inwards towards the centre of the house pit depression. Maxillae are fewer in number and more fragmentary, and share orientations similar to those recorded for mandibles. One particularly large maxillae rests on the edge of the interior house depression at the rear of the structure. A small cluster of vertebrae were observed at the front of the dwelling, immediately to the left side of the entrance tunnel. Two scapula fragments were recorded in the interior of the dwelling. The distribution of ribs appears to be confined to the southwest side of the dwelling. Large, flat stones are relatively abundant throughout this feature, and appear to have been used as flagging in the house walls, and as raw material for the construction of the rear sleeping platform and a paved floor. The absence of any appreciable roof fill is evident by the partial exposure of the rear sleeping platform. Upon closer examination, it was revealed that bowhead vertebrae, radii and ulnae had been used as supports for the rear sleeping platform. The rectilinear shape of House 11, combined with its short entrance tunnel, make it very similar in design to House 11. However, the greater abundance of mandibles and maxillae suggest that they played a larger role in the construction of the roof framework. Although House 11 lacked the bowhead crania or rock piles characteristic of many of the other dwellings at the Deblicquy site, it seems likely that a single large mandible would have been used to span the diameter of the dwelling. The proximal end of an upright mandible, sunk into the house mound midway long the northwest wall, probably served to support one end of the mandible bridge. Next, other mandibles, maxillae, and ribs would have been lashed into place; one end supported by the mandible bridge, and the other resting on the exterior house wall. The placement of a single large maxillae along the rear wall of House 11 suggests that it functioned as a brace for the roof framework. As with House 10, the lack of roof fill in the interior of the dwelling suggests that it would have been roofed almost entirely using skins.

House 12.

House 12 is a medium-sized, single-lobed, ovate semi-subterranean dwelling in a relatively good state of preservation. House 12 shares a mound with House 11, and is oriented approximately northwest-southeast with the entrance passage opening towards the southeast. Mandibles and maxillae are scarce, fragmentary, irregularly oriented, and scattered across this feature. Two upright mandibles were recorded midway along the southwest wall of the structure, and directly across from a single upright bowhead crania. Two more crania occur over the entrance to the dwelling. A few vertebrae were recorded scattered across the house mound, and embedded in the interior walls of the house pit depression. The spatial distribution of rocks is confined largely to the house mound, and like the vertebrae, were likely used to consolidate the walls of the dwelling. While ribs were scattered across the dwelling, two large clusters of these elements were recorded at the rear of the dwelling, just off of the house mound proper. Two small scapula fragments were found embedded in the interior wall of the house mound, towards the rear to the structure. Analysis of the digitized floor plan of House 12 indicates that it was probably roofed in a manner similar to that of Houses 10 and 11. A mandible, supported at one end by an upright skull base, and at the other by two upright mandibles, was used to span the diameter of the dwelling at the midpoint of the structure. Ribs, and perhaps other mandibles and maxillae, would have then been lashed into place; one end supported by the mandible bridge, and the other supported by the exterior house wall. As with Houses 10 and 11, the lack of any appreciable roof fill in the interior house depression suggests that the roof framework would have been covered with little more than a skin roof. The presence of a sled shoe partially buried in the entrance passage of House 11 implies its use during the winter months.

House 13.

House 13 is a large, bi-lobed semi-subterranean dwelling in a relatively good state of preservation. Mandibles and maxillae are few in number, fragmentary, irregularly oriented, and scattered across the house mound and interior house depression. Two broken uprights, one a mandible and the other a maxilla, were recorded on either side of the entrance tunnel. Two bowhead crania were observed in House 13; one in the centre of the house pit depression, and the other directly opposite, on the southwestern edge of the interior depression. Vertebrae were recorded both within the interior house depression, and embedded in the house mound. The spatial distributions of the former suggest that they may have been employed as bench supports and/or lamp stands, while the latter were most likely used to consolidate the interior pit walls of the dwelling. Ribs are plentiful, and were recorded scattered across the feature. A large concentration of ribs occurs in close spatial proximity to the entrance passage, and probably represents the remains of the tunnel's roof. A single scapula fragment was recorded on the edge of the house mound. Rocks, like ribs, are also abundant within House 13, and their spatial distribution is confined largely to the house mound proper, suggesting their use as flagging for the construction of house walls. One particularly large, flat rock was placed over the entrance tunnel where the passage opens into the main lobe. Analysis of the digitized pan of house 13 suggests that it was roofed in the following manner. A large maxilla, currently resting in the smaller lobe, may have originally been placed across the two bowhead crania, forming a bridge which would have spanned the diameter of the large lobe. Ribs, and perhaps other mandibles and maxillae, would have then been lashed into place; one end supported by the mandible bridge, and the other supported by the exterior house wall. The nominal diameter of the second smaller lobe (1.5 m) suggests that it could have been enclosed by a framework constructed exclusively from ribs. The entrance passage would have been roofed using much the same type of construction technique. The interior pit depression of House 13 is slightly shallower than that of the previous two houses, suggesting some use of sod in roof construction.

House 14.

House 14 is a large, bi-lobed semi-subterranean dwelling in a poor state of preservation. House 14 is oriented northeast-southwest, with the entrance tunnel opening towards the southwest. The second smaller lobe may have functioned as a kitchen alcove. Very little whale bone was recorded in this feature.

House 15.

House 15 is a small, single-lobed semi-subterranean dwelling in a relatively poor state of preservation. House 15 is oriented northeast-southwest, with the entrance tunnel opening towards the southwest. House 15 was excavated by Taylor during the 1961 field season[19]. A detailed discussion of this dwelling is unwarranted, given that a thorough description of House 15 and its contents exists in Taylor and McGhee (1981).

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[19] Taylor refers to this structure as House 1, in Taylor and McGhee (1981).

House 16.

House 16 is a large, bi-lobed semi-subterranean dwelling in a relatively poor state of preservation. House 16 is oriented northeast-southwest, with the entrance tunnel opening towards the southwest. House 16 was excavated by Taylor during the 1961 field season[20]. A detailed discussion of this dwelling is unwarranted, given that a thorough description of House 16 and its contents exists in Taylor and McGhee (1981). House 16 is notable, however, in that it provides an excellent illustration of how bowhead vertebrae were used as flagging in the pit walls of a semi-subterranean Thule house. A large, complete, bowhead whale scapula recorded on the periphery of this feature, appears to have been drilled on its proximal end.

House 17.

House 17 is a small, ovate, single-lobed semi-subterranean dwelling in a poor state of preservation. House 17 is oriented north-south, with the entrance tunnel opening towards the south. House 17 is situated alone, near the shore of Pond 1. House 14 contains very little whale bone; one maxilla, one upright mandible (broken proximal end), one vertebrae, and two bowhead crania. The larger of the two skull bases occurs over the entrance of the dwelling, and is supported by a large, flat rock.

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[20] Taylor refers to this structure as House 2, in Taylor and McGhee (1981).

House 18.

House 18 is a large, amorphously shaped, semi-subterranean dwelling in an extremely poor state of preservation. House 18 is badly disturbed by frost-cracks. The dwelling is oriented northeast-southwest, with the entrance tunnel opening towards the southwest. The only whale bone recorded within this feature were the broken stumps of two upright mandibles. Quite a few large rocks were visible in the house mound, suggesting their use as flagging in the interior walls of the dwelling.

House 19.

House 19 is a large, bi-lobed, semi-subterranean dwelling in an extremely poor state of preservation. House 19 is oriented roughly northwest-southeast, with the entrance tunnel opening towards the northwest. With the exception of the broken ends of three upright mandibles, very few bowhead whale elements were recorded in this feature.

House 20.

House 20 is a small, ovate, singe-lobed, semi-subterranean dwelling in a poor state of preservation. House 20 is oriented roughly northwest-southeast, with the entrance tunnel opening towards the northwest. With the exception of the broken ends of four upright mandibles, very few bowhead whale elements were recorded for this feature. A large number of rocks were visible on the surface of the house mound, suggesting that they were used as flagging for the interior walls of the dwelling. The remains of a possible platform were also dimly visible.

House 21.

House 21 is a medium-sized, amorphous depression situated immediately in front of House 4, close to the shoreline of Pond 2. House 21 appears to be oriented roughly north-south, with the entrance tunnel opening towards the south. No whale bone was visible at all for this structure. The generally formless appearance of this feature, however, necessitates only its tentative classification as a semi-subterranean dwelling.

House 22.

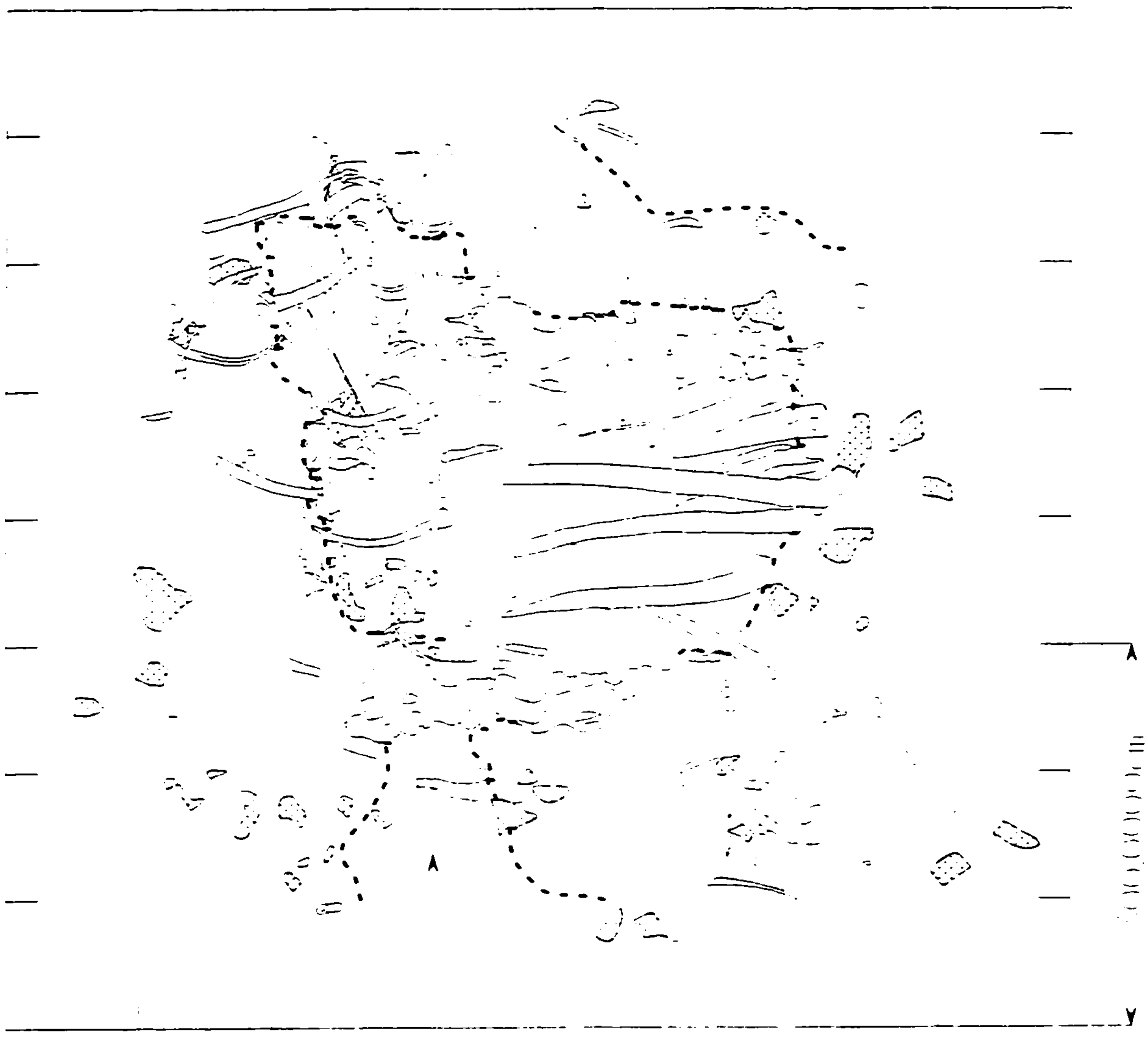
House 22 is a small, ovate, single-lobed, semi-subterranean house in a poor state of preservation. House 22 is oriented roughly in a northeast-southwest direction, with the entrance tunnel opening towards the southwest. House 22 appears as a shallow, house-shaped depression, and is characterized by a complete absence of whale bone.

House 23.

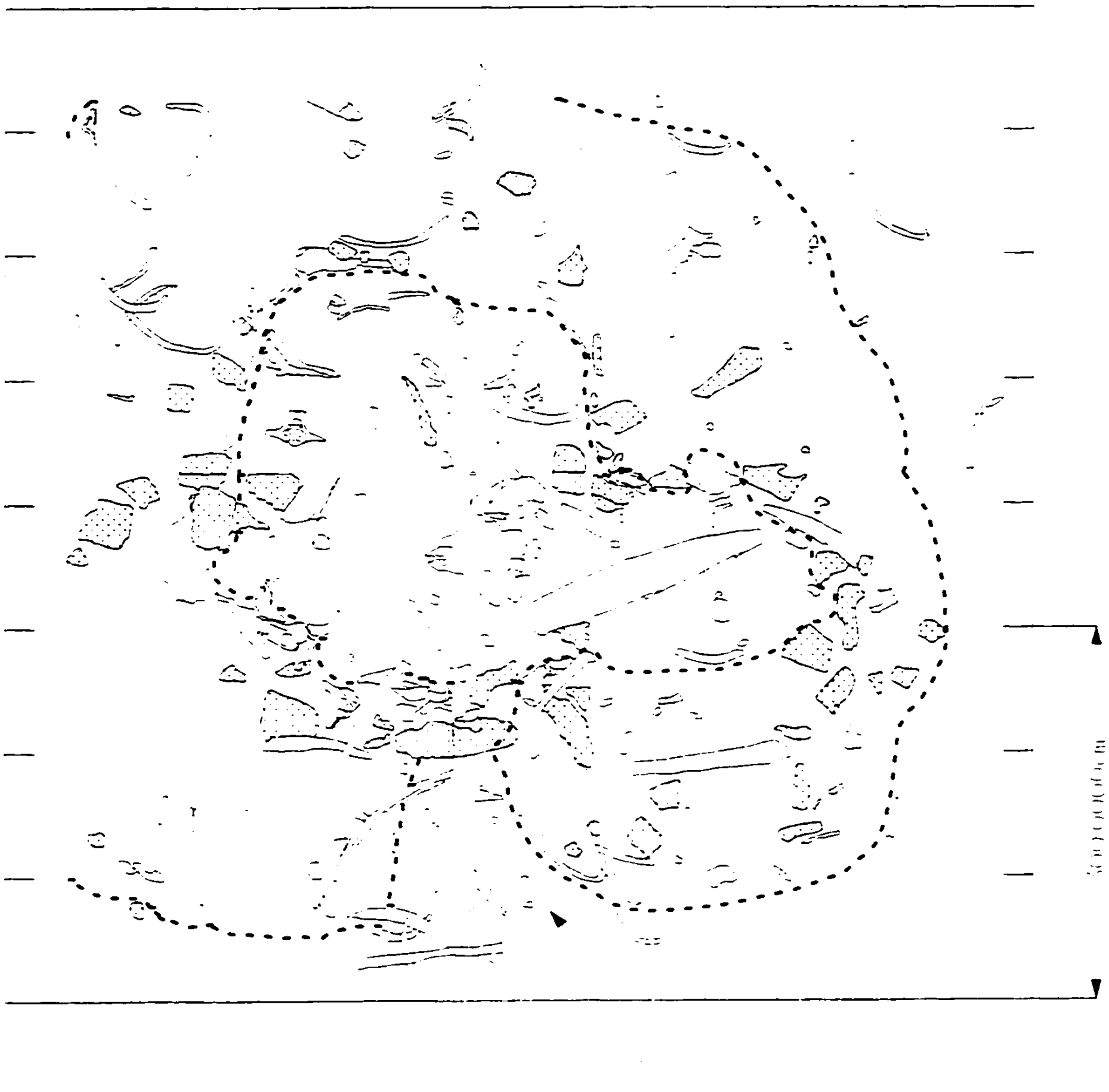
House 23 is a small, ovate, single-lobed semi-subterranean house in a poor state of preservation. House 23 is oriented roughly in a northeast-southwest direction, with the entrance tunnel opening towards the southwest. House 23 appears as a shallow, house-shaped depression, and is characterized by a complete absence of whale bone.

C.A.D.D Drawings of Houses from the Deblicquy Site

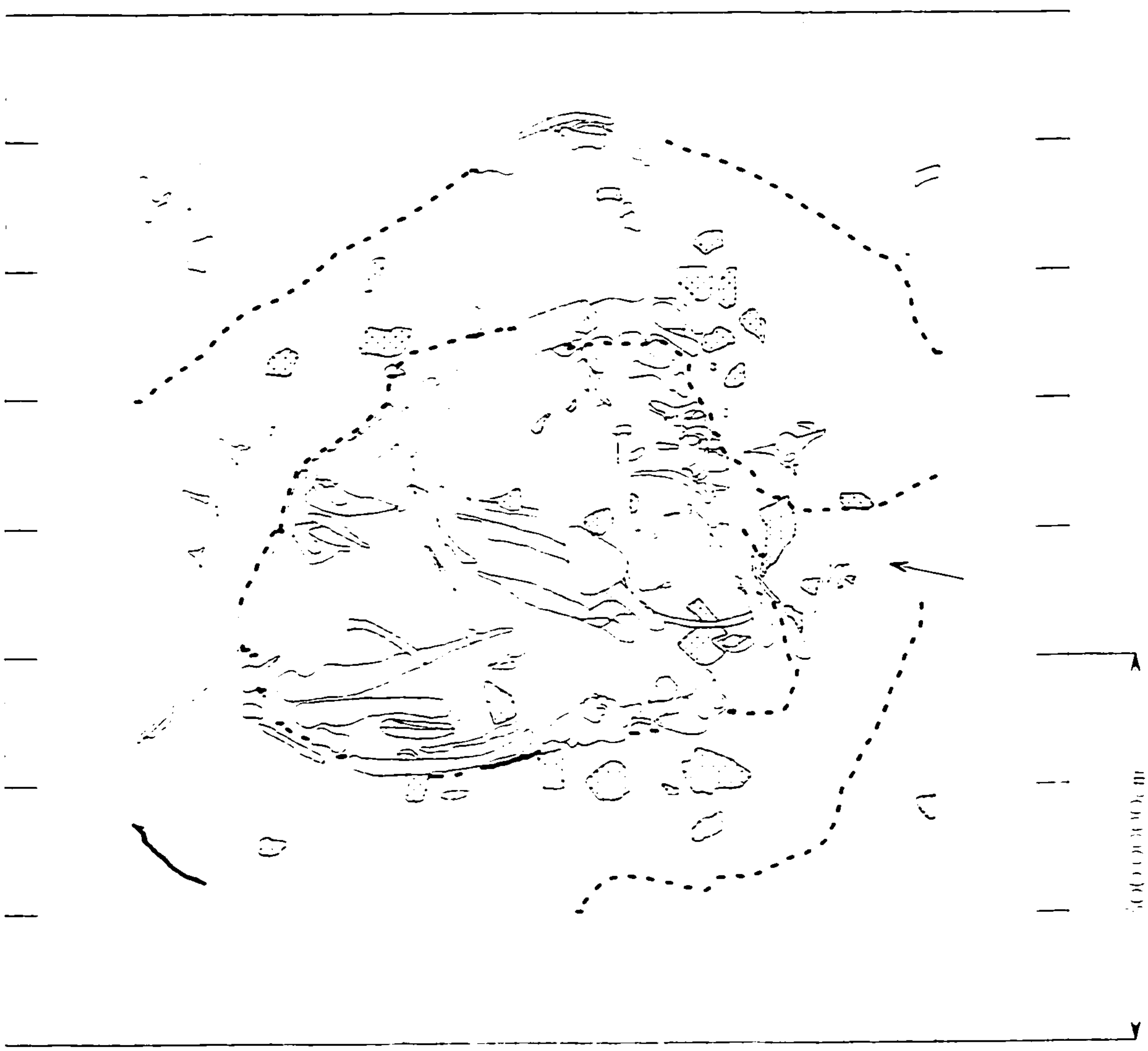
HOUSE 5 - DEBLICQUY SITE (QkLe-1)



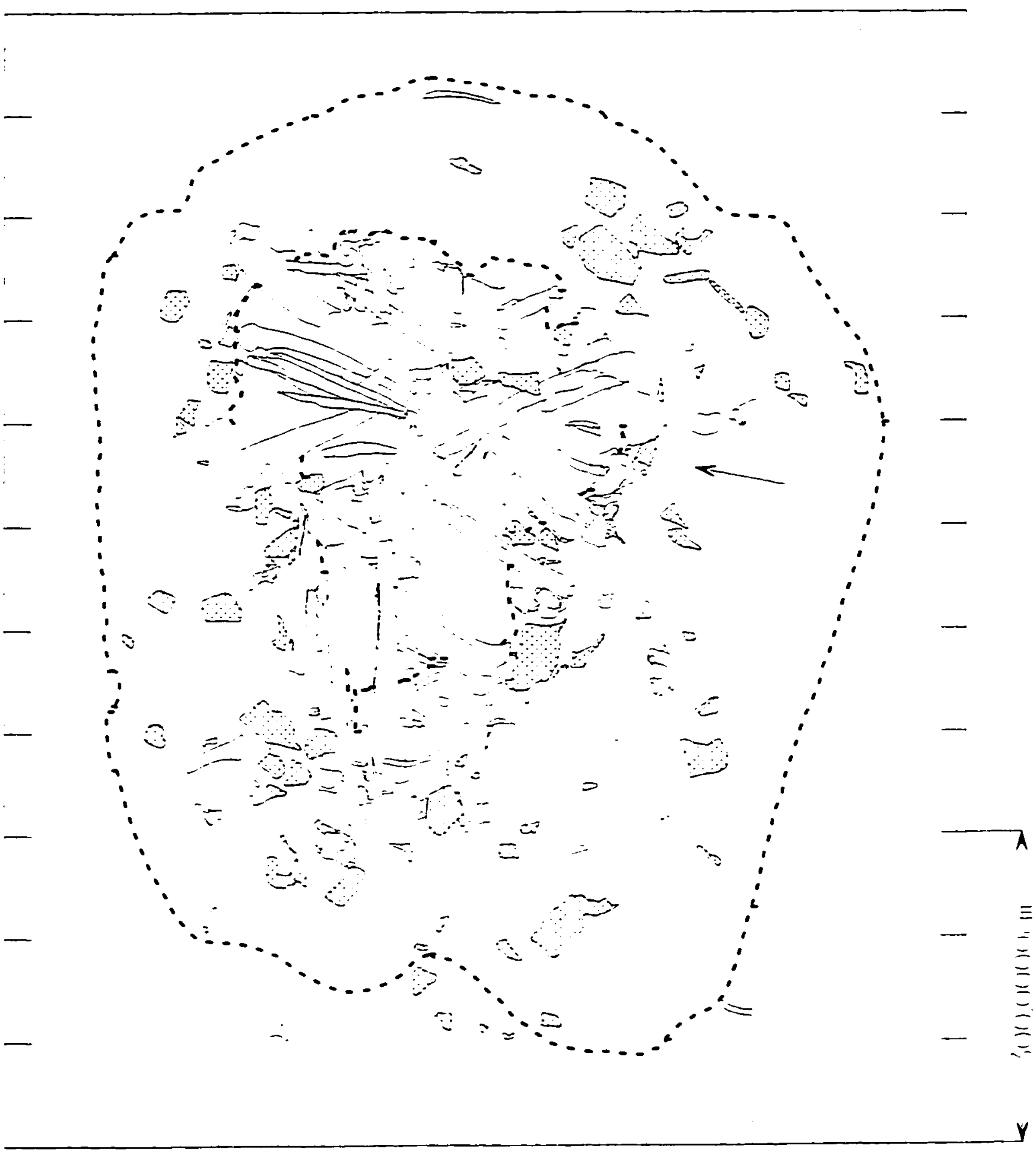
HOUSE 13 - DEBLICQUY SITE (QiLe-1)



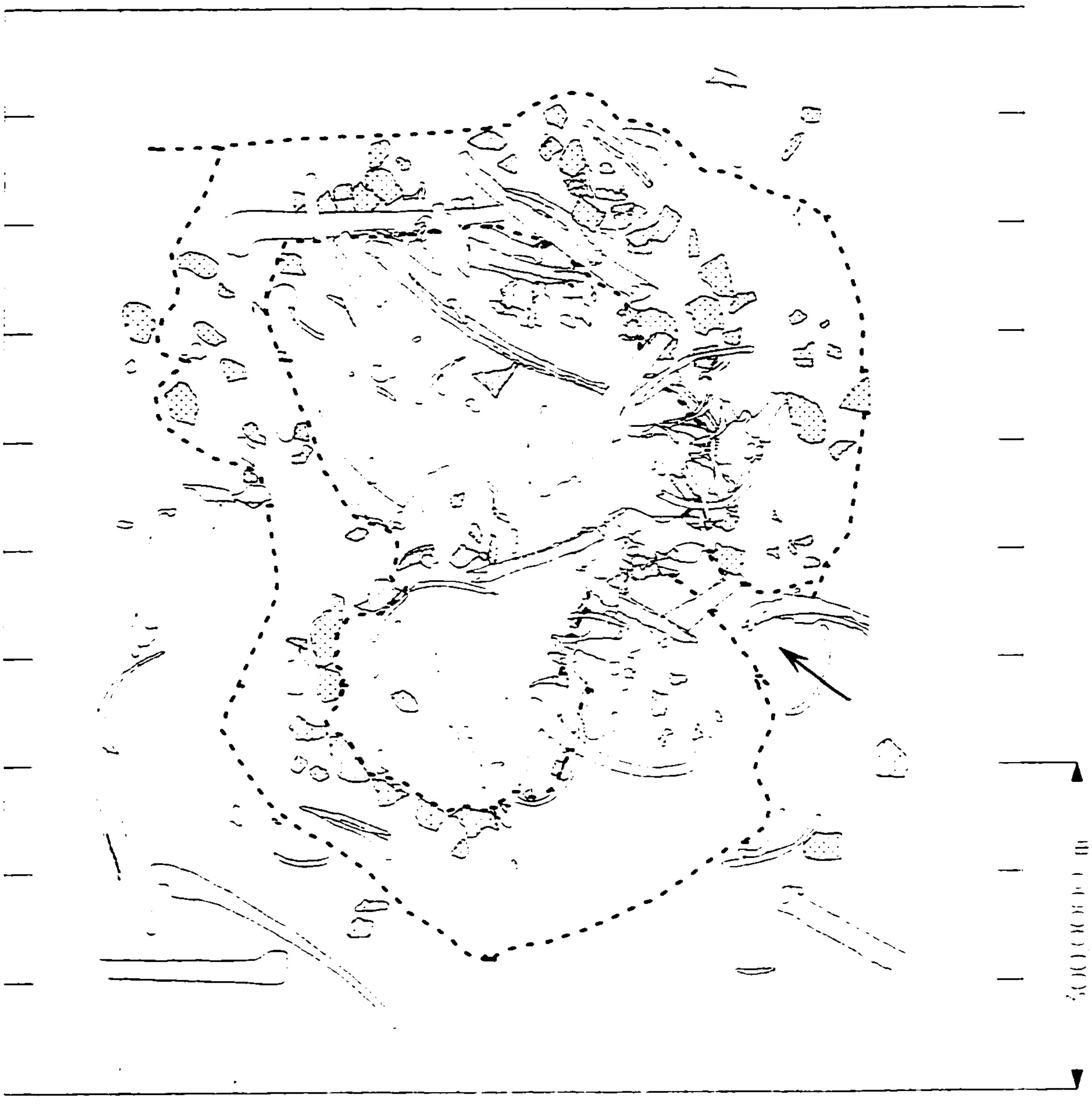
HOUSE 1 - DEBLICQUY SITE (QiLe-1)



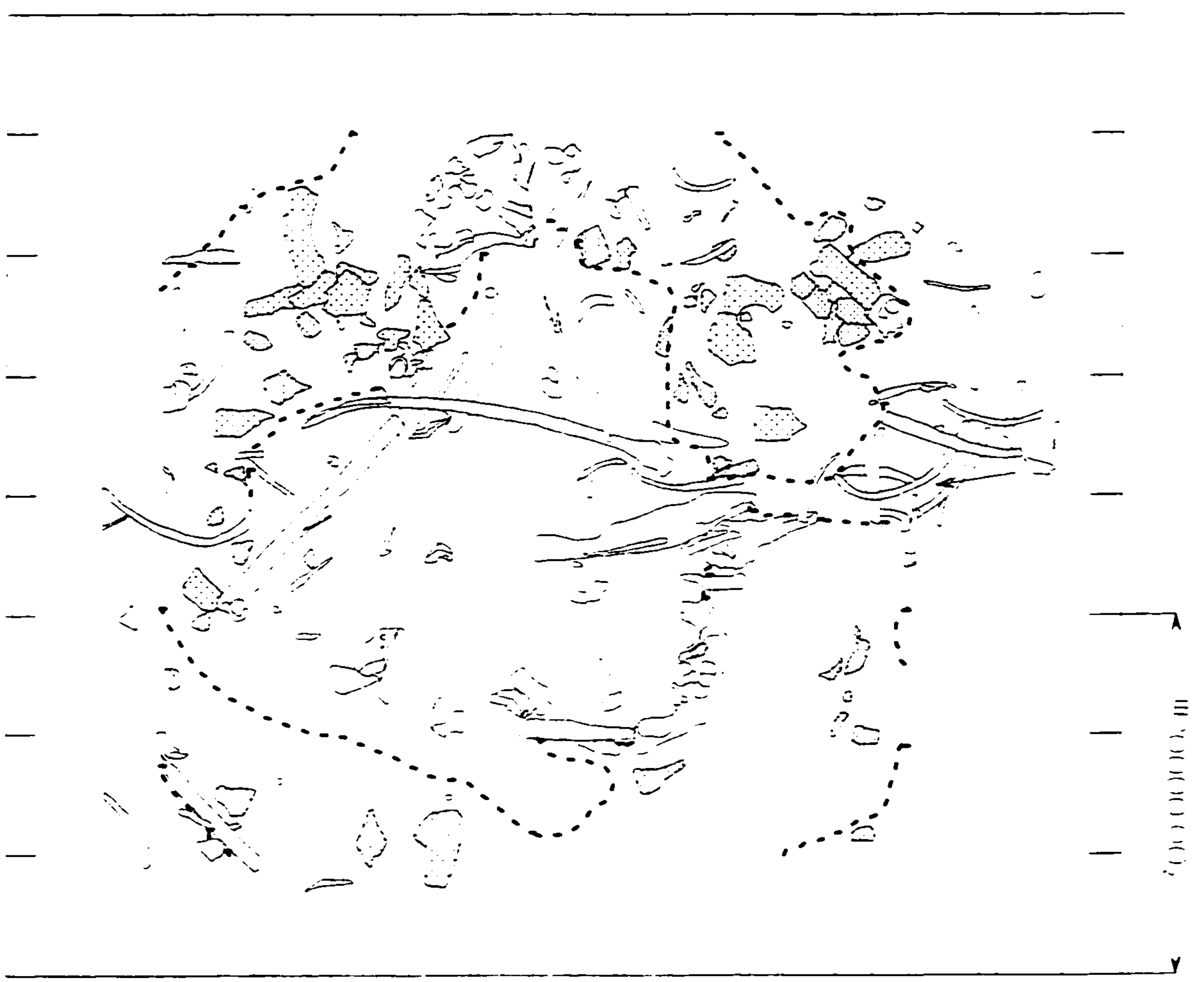
HOUSE 4 - DEBLICQUY SITE (QiLe-1)



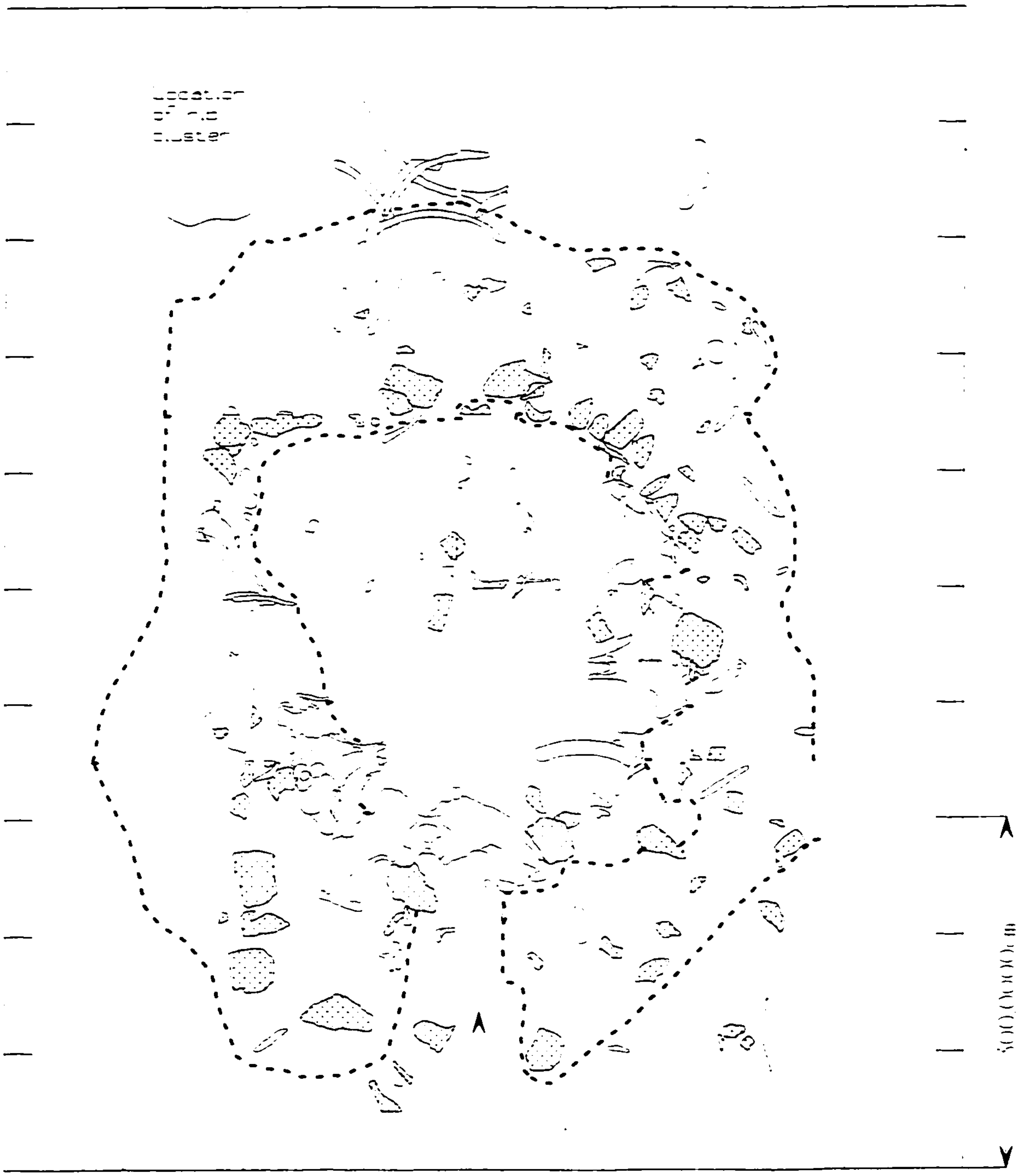
HOUSE 8 - DEBLICQUY SITE (QiLe-1)



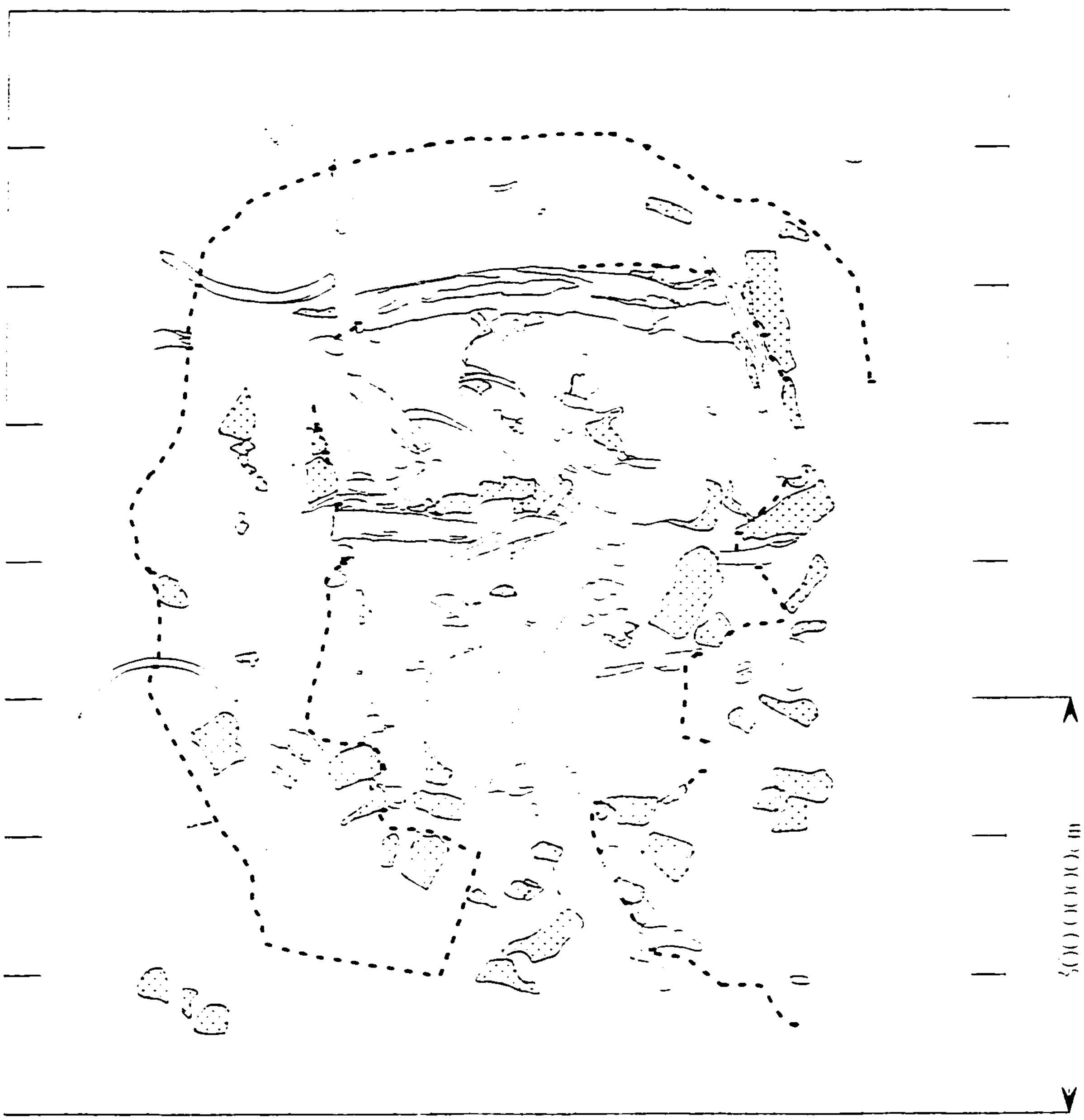
HOUSE 7 - DEBLICQUY SITE (QiLe-1)



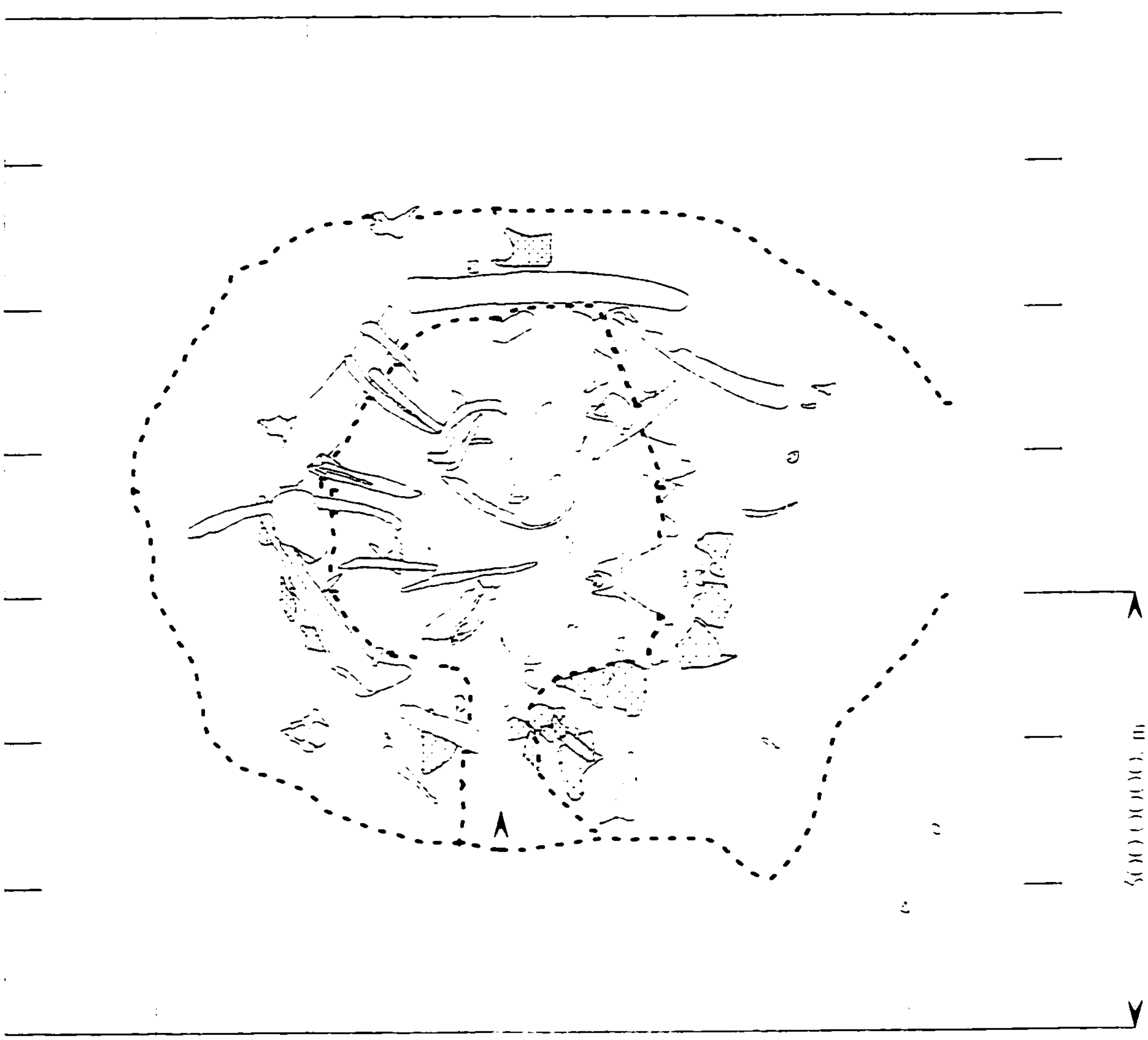
HOUSE 12 - DEBLICQUY SITE (QiLe-1)



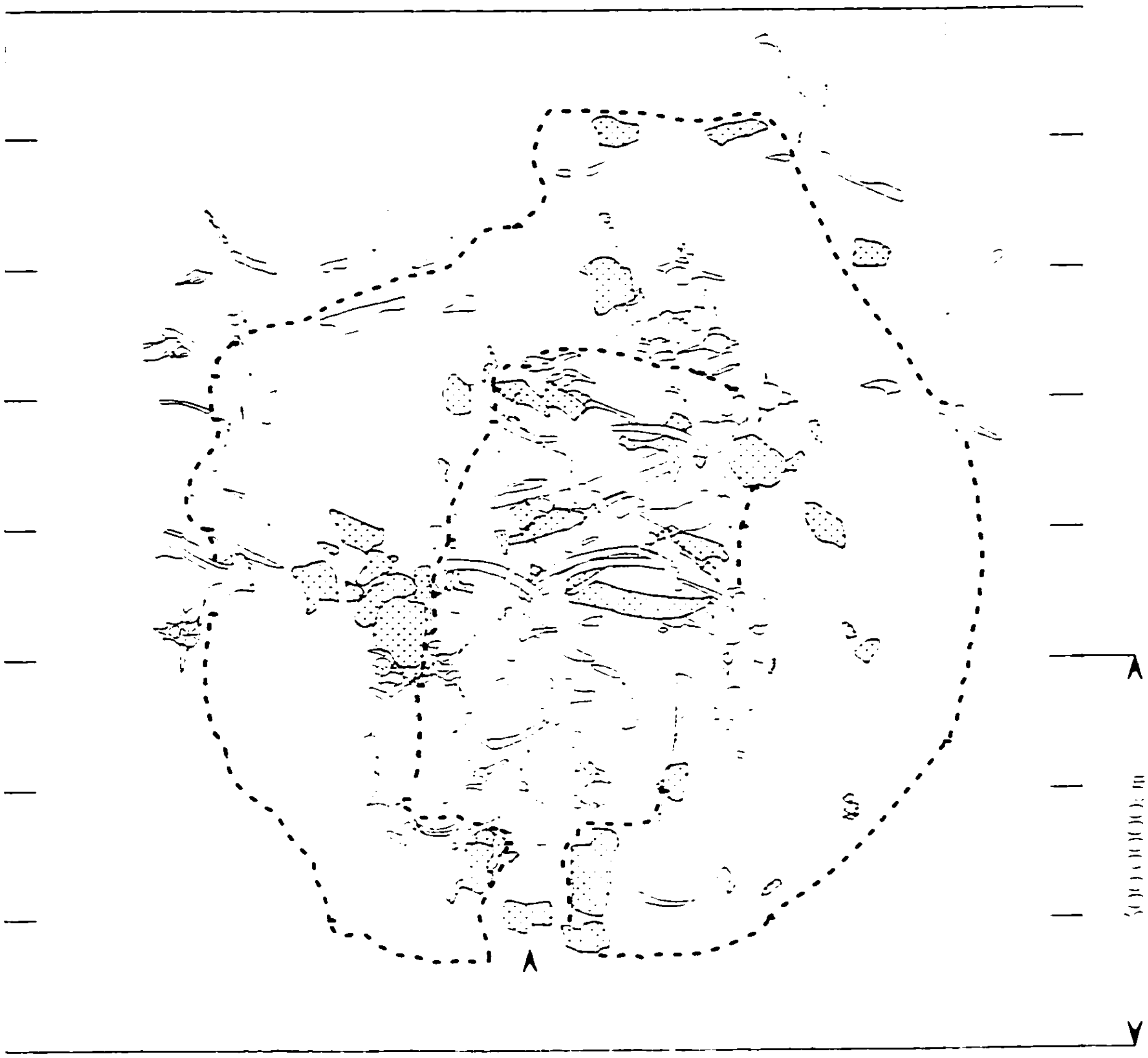
HOUSE 11 - DEBLICQUY SITE (QiLe-1)



HOUSE 3 - DEBLICQUY SITE (QiLe-1)



HOUSE 10 - DEBLICQUY SITE (QiLe-1)



APPENDIX TWO: DESCRIPTIONS AND C.A.D.D DRAWINGS OF HOUSES FROM THE BLACK POINT SITE (QkLe-1).

In Appendix two, I provide a brief description of each semi-subterranean house recorded at the Black Point site. Plan views of those semi-subterranean houses which were drawn in detail during the 1995 field season are also presented. A frequency table architecturally significant bowhead elements for each house can be found in Chapter 5; Table 3).

House 1.

House 1 is a bi-lobed, semi-subterranean winter house in a relatively poor state of preservation. House 1 shares a mound with House 2, and is situated at the north end of the site. The entrance tunnel is difficult to define, but appears to open toward the southeast. A possible compartment room/niche was identified off of the entrance tunnel. Two large clusters of bowhead ribs appear along the north and east edges of the house mound. Non-cetacean faunal material visible on the surface included scatters of spirally fractured caribou bone, and a walrus skull. The walrus skull was found in the center of the house pit depression. One mandible and two maxillae recorded in this feature were in an upright position.

House 2.

House 2 is a well defined, bi-lobed semi-subterranean winter house situated at the north end of the site. Unlike bi-lobed houses at the Deblicquy site, in which lobes were of unequal size, the lobes comprising house 2 share a similar narrow diameter and relatively small internal area. House 2 shares a mound with House 1, and has an entrance tunnel which opens to the east. A small kitchen alcove was recorded on the east side of the entrance tunnel. Two upright bowhead mandibles were observed in this feature. Mandibles and maxillae are fragmentary, irregularly oriented, and few in number. One upright mandible appears to have been adzed or chopped, while the second has been marked by graffiti, which reads "June 5 1960 - 5". A bowhead scapula was recorded near the inside opening of the entrance tunnel, suggesting that it once served as a wind break. Vertebrae are relatively scarce, and are found on the house mound and along the interior wall of the structure; suggesting their use as flagging. A few fragmentary pieces of bowhead crania were recorded on the house mound, well back from the interior depression. Ribs are the most abundant bowhead element in House 2, and are spatially concentrated within the interior depression, and over the entrance passage. Rocks are extremely plentiful, and are spatially distributed across the house mound, with many rimming the edge of the interior house depression. One interesting architectural feature of this house is the placement of the entrance tunnel. Rather than bisecting the two lobes, the entrance tunnel for House 2 appears to have been constructed off of one of the lobes. Finally, a few pieces of antler were found scattered throughout the feature. The comparable diameters and internal areas of the two lobes in House 2, coupled with the high frequencies of ribs recorded within this feature, suggest that a frame work constructed primarily from ribs was used to enclose this dwelling. This rib lattice may have been supported in some fashion by the five upright mandible ends recorded in this house. The spatial clustering of ribs over the entrance tunnel suggests that it was also roofed using ribs. The high frequencies of large, flat rocks imply that this material was used in combination with vertebrae to consolidate the walls of the interior house pit. Alternatively, it may represent the remains of a paved floor which may have been dismantled for house cleaning.

House 3.

House 3 is a bi-lobed semi-subterranean winter house located at the far north of the site. House 3 is adjacent to, but does not share a mound with House 2, and its tunnel entrance opens to the southeast. A compartment room/niche in the first lobe is divided off from the rest of the house by a large, upright slab of rock about 80 cm in length. House 3 appears to have been disturbed by digging in the northeast quadrant of the house. House 3 is characterized by an almost complete absence of whale bone. A small piece of worked antler was identifd on the surface of the interior house depression. A large frost crack was recorded running along the north side of the house

House 4.

House 4 is a bi-lobed, semi-subterranean winter house located just south of Houses 1,2, and 3, and is the most northerly dwelling situated on the back house row. The entrance tunnel for House 4 opens towards the south, making its orientation somewhat unique among Black Point houses. Large bowhead mandible and maxillae fragments were recorded on the east side of the house mound. A large concentration of rocks on the east side of the house mound may represent a storage feature. The house mound is significantly higher on the north side of the feature, while the south side appears to have been subject to significant disturbance. This is likely attributable to frost heaving produced by a large frost crack which runs along the north side of the feature. A high number of large, flat rocks were recorded along the north edge of the house mound; again suggesting that it represents the remains of a paved floor which was removed for house cleaning. A walrus crania was recorded along the north edge of the house mound.

House 5.

House 5 is a single- lobed semi-subterranean winter house located south of House 4, on the second house row. House 5 possesses a very high house mound, and large concentration of rocks were recorded over the region where the entrance passage opens up into the house depression. Mandibles and maxillae are fragmentary, yet relatively numerous when compared with other Black Point houses. Mandibles and maxillae were recorded from within the interior house depression, and were oriented inward towards the center of the house. A number of mandibles and maxillae were found lying at the base of the house mound, towards the rear of the structure. The upright bowhead mandible present in the center of the house appears to have been sawn. Two of the mandibles recorded in this feature were in an upright position. An intact scapula was also recorded just off of the house mound, at the rear of the structure. Ribs were relatively numerous, and occur spatially within the interior of the house depression. A single, intact vertebrae was recorded on the house mound. An extremely large number of large, flat rocks were observed scattered over the entire feature. While some rocks may have been used to consolidate the interior walls of House 5, those remaining plausibly represent the remains of a floor pavement dismantled for house cleaning. A particulary large rock recorded in the interior house depression to the rear of the dwelling, may represent the remains of a sleeping platform. Examination of the digitized plan for House 5 suggests that would have been roofed using a lattice constructed primarily from mandibles and maxillae. The spatial distribution of ribs within the house depression suggests that they functioned as cross-braces in the roof superstructure. In contrast, the entrance tunnel appears to have been enclosed using large, flat rocks. The scattering of building materials (bowhead elements, rocks) over a wide area of the house mound and interior house depression, suggest that this house was dismantled, either for cleaning, or for raw material following its abandonment.

House 6.

House 6 is an ovate to rectangular shaped dwelling which may be either a semi-subterranean winter house or a *qarmat*. The apparent absence of an entrance tunnel further supports the interpretation of this feature as a *qarmat*. The dwelling appears to open towards the northeast. Only two bowhead elements were recorded in this feature, and both were identified as vertebrae.

House 7.

House 7 is a semi-subterranean winter house located along the second house row. House 7 shares a mound with House 6 and House 8. House 7 is oriented in an east-west direction, with the entrance tunnel opening towards the east, and has been badly disturbed by a frost crack. While it is difficult to determine the shape of the dwelling due to the frost crack disturbance, a possible compartment room/niche was identified on the north side of the entrance tunnel. A bowhead scapula was recorded where the entrance tunnel opens into the main part of the house, suggesting that it may have functioned as a wind break. A large bowhead whale radius was also identified within this feature, and it appears to have been adzed.

House 8.

House 8 is a tri-lobed, semi-subterranean winter house located south of House 7, along the second house row. A nicely defined, box shaped, compartment room/niche was identified on the north side of the structure, and may have served as a kitchen area. This compartment was divided into two areas by an upright rock slab. House 8 is oriented in a northeast/southwest direction, with the entrance tunnel opening towards the northeast. The virtual absence of any whale bone makes it extremely difficult to posit how this dwelling was roofed. The extremely narrow diameters of the three lobes which comprise House 8, however, would seem to imply that they could have been easily enclosed using a framework constructed from ribs.

House 9.

House 9 is located immediately south of House 8, along the second house row. House 9 is a rectilinear shaped dwelling which lacks an entrance tunnel. Although this feature is oriented in an east/west direction, the opening of the dwelling is difficult to define. A complete absence of whale bone on the surface of this feature was noted. The lack of entrance tunnel, rectilinear shape of the dwelling, and the complete absence of any whale bone on the surface of the feature suggests that House 9 may have functioned as a *qarmat*.

House 10.

House 10 is an amorphous feature located south of House 9, on the second house row. Both the shape and orientation of the feature are difficult to determine due to heavy disturbance by a large frost crack. The only architecture defining this feature consists of the presence of a single bowhead rib, and a number of upright rocks that may possibly be associated with an entrance tunnel. A single piece of caribou antler was recorded within this feature.

House 11 & 11a.

Houses 11 and 11a are located south of House 10, on the second house row. Both features have been badly disturbed by a large frost crack. The frost crack appears to have bisected what once may have been a single house into two parts (11 & 11a). Both features are better defined on the west side of the frost crack. An intrusive pit was recorded in House 11a, and a bone knife handle and slotted piece of bone were observed on its outer edge. A large bowhead mandible was recorded in House 11a. The shape and orientation of 11 and 11a are difficult to determine, due to the extensive disturbance of this feature.

House 12.

House 12 is located on the second house row, immediately south of Houses 11 and 11a. House 12 is rectilinear in shape, and appears to be oriented in an east/west direction. Approximately 6 upright rocks were recorded in this feature. The rectilinear floor plan of House 12, coupled with the extremely low frequencies of whale bone recorded for this feature, suggest that it may have served as a *qarmat*.

House 13.

House 13 is located on the second house row, immediately south of house 12. House 13 shares a mound with House 14, and is a bi-lobed semi-subterranean winter house. A compartment room/niche was recorded on the south side of the house, and is well defined by upright rocks. A midden-like depression located between, and to the rear of House 13 and 14 suggest that the occupants of both house may have shared a single midden. This might also imply that both houses were occupied contemporaneously. House 13 is oriented in an east/west direction, with an eastward opening entrance tunnel.

House 14.

House 14 is located on the second house row, and shares a mound with House 13. House 14 is defined as a single-lobed semi-subterranean winter house. House 14 is oriented in an east/west direction, with its entrance tunnel opening towards the east. A small compartment room/niche was recorded on the north side of the feature. As mentioned previously, House 14 may share a midden with House 13. Generally, House 14 is not well defined, however, 5 large whale ribs and the proximal portion of a maxilla were recorded within this feature.

House 15.

House 15 is the last house located on the second house row, and is immediately south of House 14. House 14 is a poorly defined and amorphously shaped feature which appears to have been oriented in an east/west direction. The entrance to House 15 most likely opened to the east, but this is difficult to establish. House 15 has been badly disturbed and appears very eroded and worn down. One upright rock was recorded in the center of the feature. Cetacean elements included a cranial fragment and a bowhead rib. A walrus skull was also recorded from within the center of this feature.

House 16.

House 16 is the southern most house located on the first house row (closest to shoreline). House 16 appears to be a single-lobed, shallow semi-subterranean winter house. At the time it was recorded, the eastern-most edge of House 16 was 1.5 m away from the edge of an eroding slope. House 16 contains a number of mandibles and maxillae; all of which occur within the house depression, and at irregular orientations. Ribs were recorded from within the house depression, and from the edge of the house mound. Large, flat rocks occur throughout the interior depression; ostensibly serving as a paved floor. A bone awl was recorded on the surface of House 16. House 16 appears to lack an entrance tunnel, and its orientation is almost indiscernible. Examination of the digitized plan of House 16 failed to reveal how this structure might have been roofed. However, based on the frequencies of bowhead elements, and their spatial proximities to one another, it is possible that House 16 was enclosed using a roof framework constructed from mandibles, maxillae, and ribs. The absence of an entrance tunnel suggests that House 16 may have functioned as a *qarmat*. Alternatively, if the entrance tunnel of House 16 originally opened to the east, then the close proximity of the eastern edge of the house to the eroding slope would suggest that it has long since eroded away.

House 17.

House 17 is located on the first house row, and it shares a mound with House 18. House 17 is a shallow, bi-lobed semi-subterranean house with a rectilinear to ovate floor plan. The east side of the feature is approximately 20 cm from the edge of an eroding slope. A circular compartment room/niche located on the east side of House 17 is nicely defined by rocks. High frequencies of rock within the feature as a whole, suggest that it served an important architectural function. Furthermore, bowhead vertebrae were used to brace the walls of the interior pit depression. Whole and smashed walrus crania were abundant within this feature. In addition, several pieces of flaked muskox bone and spirally fractured caribou bone were also recorded. The orientation of this feature seems to run northwest/southeast, with the entrance tunnel opening to the south/southeast.

House 18.

House 18 is located on the first house row, and it shares a mound with House 17. House 18 is a well defined, bi-lobed, semi-subterranean winter house. Very little whale bone was recorded within this feature. As with House 17, high frequencies of large rocks suggests that they were likely used in wall construction, and to pave the floor of the dwelling's interior. The two lobes which comprise House 18 are comparable in size and diameter, and their narrowness suggests that they were roofed using a framework constructed primarily from ribs. House 18 is oriented in a northeast/southwest direction, with the entrance tunnel opening to the south/southeast. A large number of smashed pinniped crania, as well as spirally fractured caribou bone and antler, were present within this feature.

House 19.

House 19 is located on the north end of the first house row, and is immediately adjacent to a large midden and activity area. House 19 is a large, well defined, bilobed semi-subterranean winter house. The feature is oriented in a northwest/southeast direction, with the entrance tunnel opening towards the south/southeast. The two lobes which comprise House 19 are comparable in size and diameter, and their narrowness suggests that they were roofed using a framework constructed primarily from ribs. Quite a few upright ribs were recorded for this feature, lending further support to this interpretation. High frequencies of rock also characterize this feature, and may have been used in ways similar to those suggested for House 18. In addition, a large slab-like rock was observed over the entrance passage. High frequencies of caribou antler were also apparent throughout the feature. Finally, a large number of holes were observed along the inside edge of the house mound. While some of these holes may be associated with burrowing animals, others are regularly spaced along the inside edge of the house mound. This would suggest that at least a few of these holes may have functioned to support bowhead ribs serving as roof rafters. A total of nine artifacts were recorded on the surface of this feature, and these included a dog tracing, pieces of ground slate, worked bone and antler artifacts, and several pieces of iron and copper.

House 20.

House 20 is located to the north and slightly west of the first house row. Three large bowhead mandibles are adjacent to the house, and were probably moved there some time recently. One of the three mandibles appears to have been sawn, while the other two show signs of adzing. House 20 is an ovate semi-subterranean dwelling with a low house mound, and a northwest/southeast orientation. Two upright rocks appear to define the entrance passage, which opens towards the southeast. One bowhead vertebrae, and a piece of caribou antler were also recorded within this feature. The isolated location of this dwelling, relative to other houses at the site, suggests that it may have functioned as a *karigi*.

House 21.

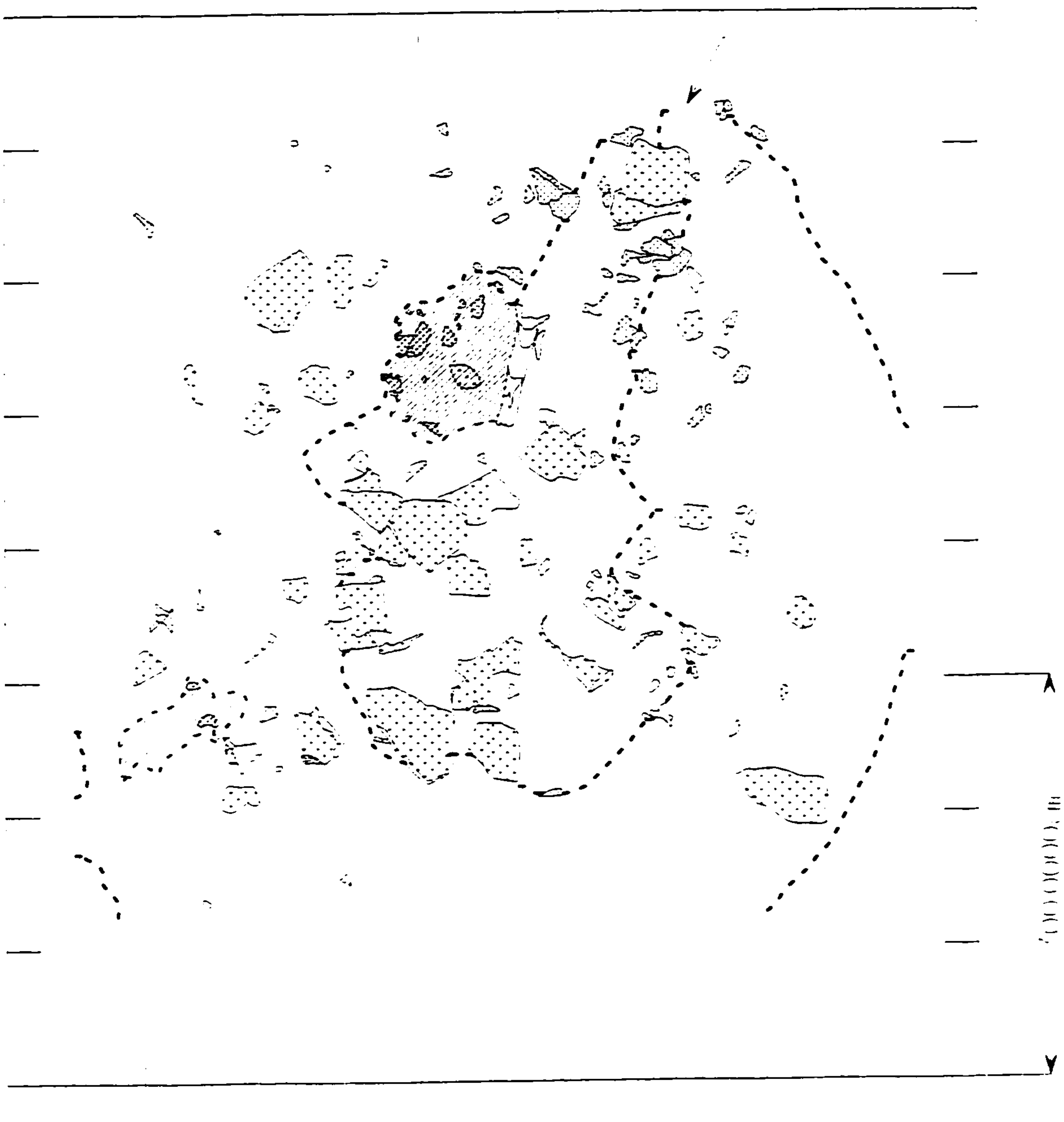
House 21 is situated between the first and second house rows, to the southwest of house 18. Two whale vertebrae and some upright rocks were recorded in an amorphous ovate depression.

House 22.

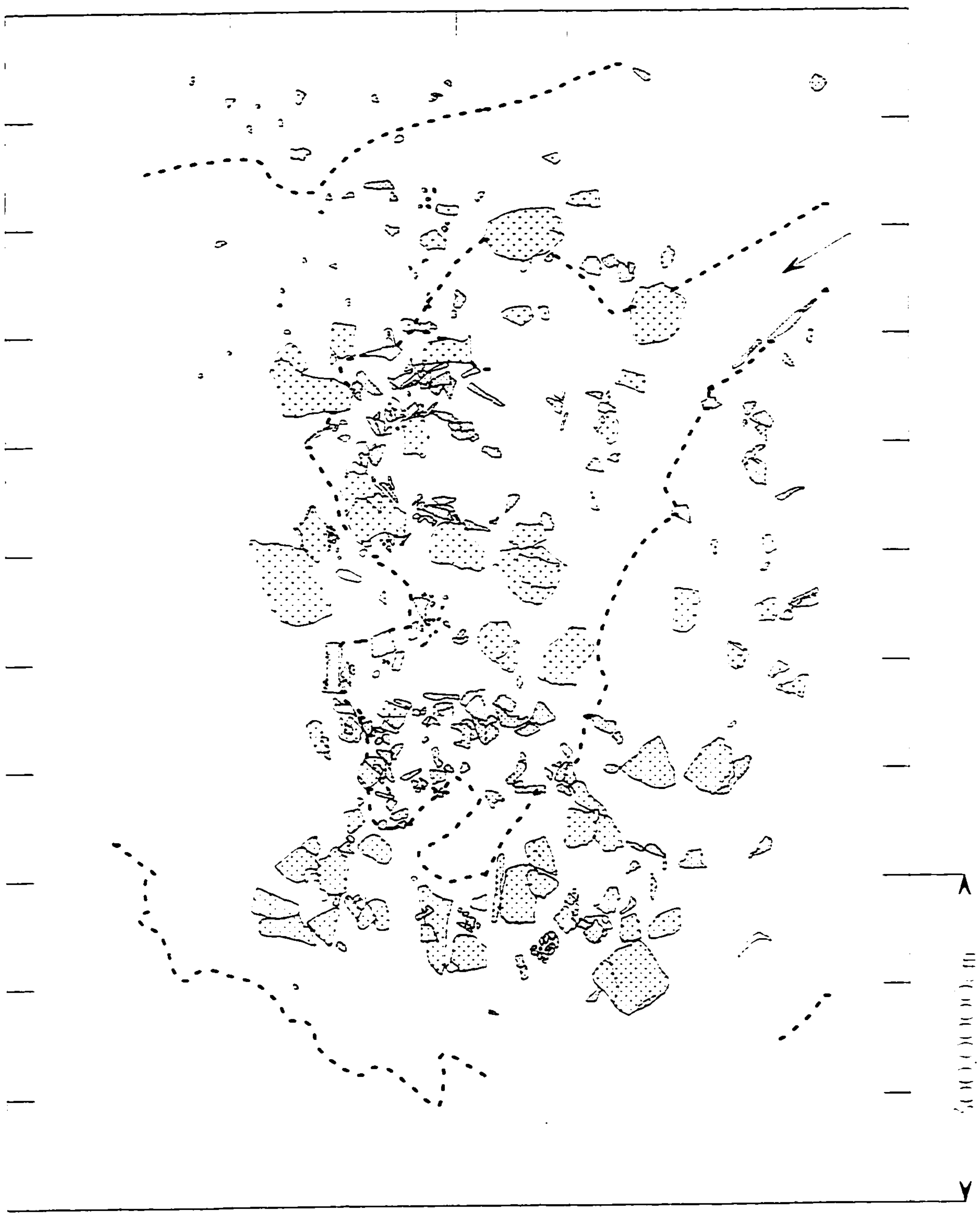
House 22 is located on the south side of a large frost crack that spans the southern portion of the site. House 22 is an amorphous ovate depression. What appeared to be burned sea mammal oil was found covering a rock in the center of the feature, and a small piece of wood was observed along the edge of the house depression.

C.A.D.D Drawings of Houses from the Black Point Site

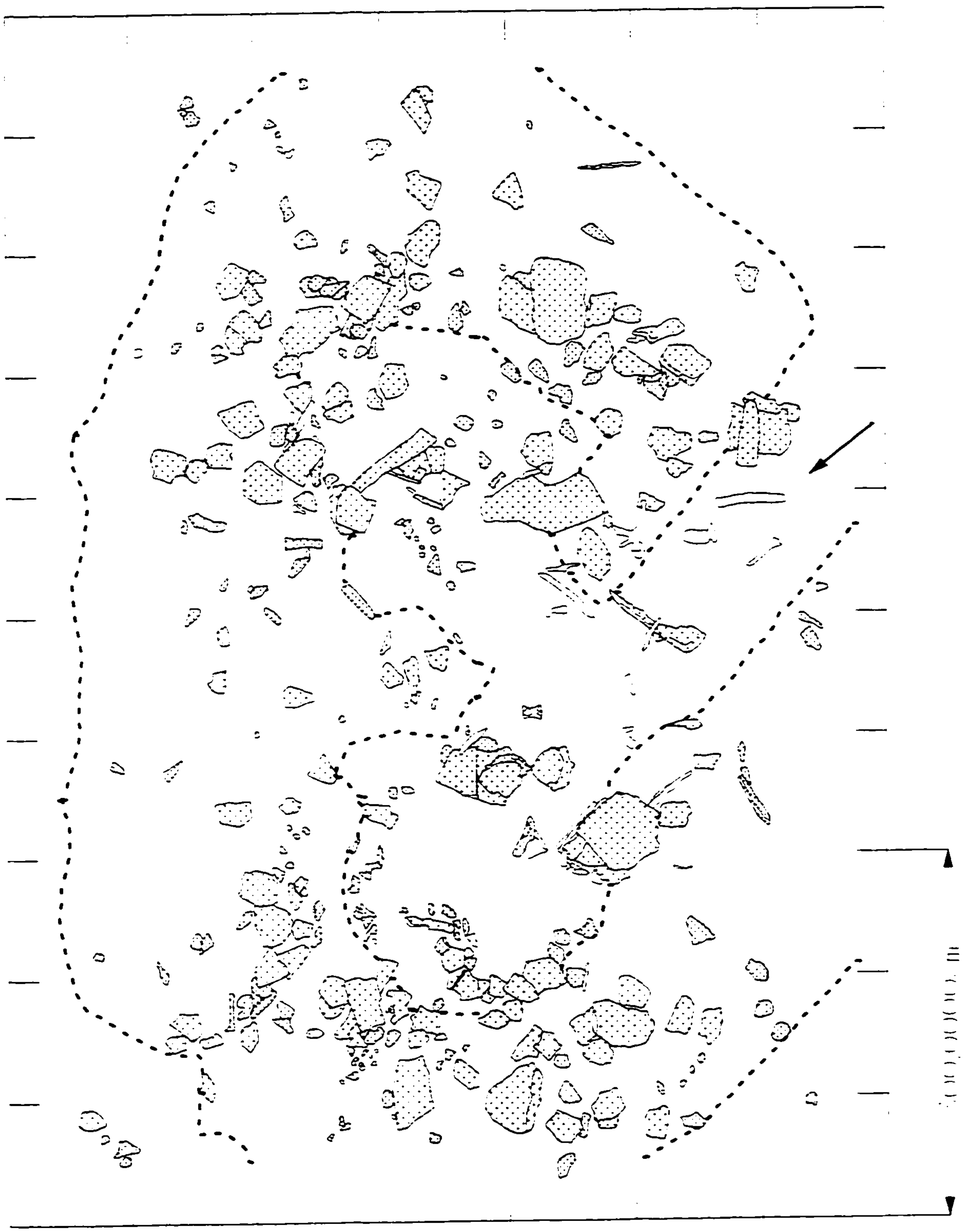
HOUSE 3 - BLACK POINT (QkLe-1)



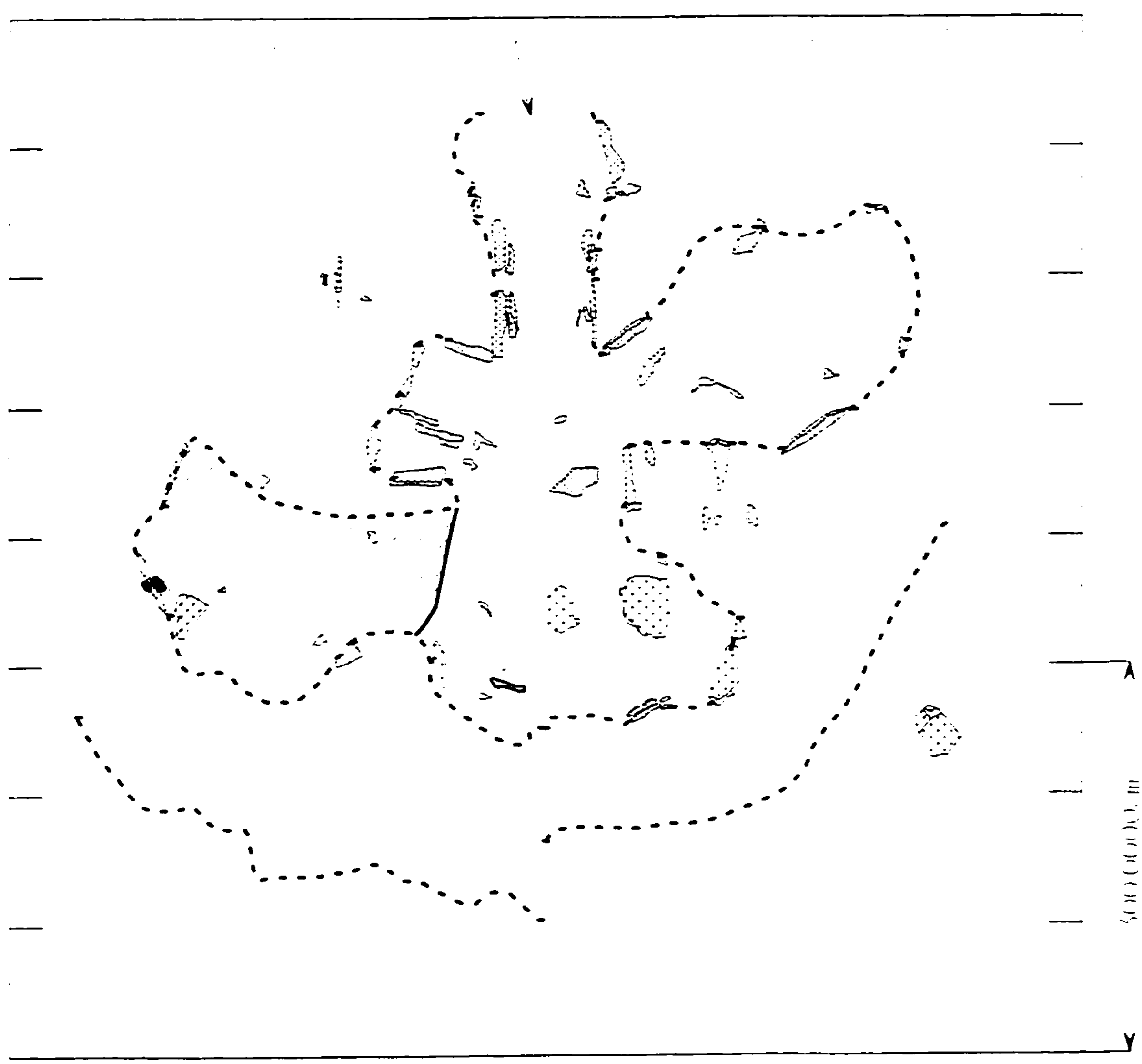
HOUSE 18 - BLACK POINT (QkLe-1)



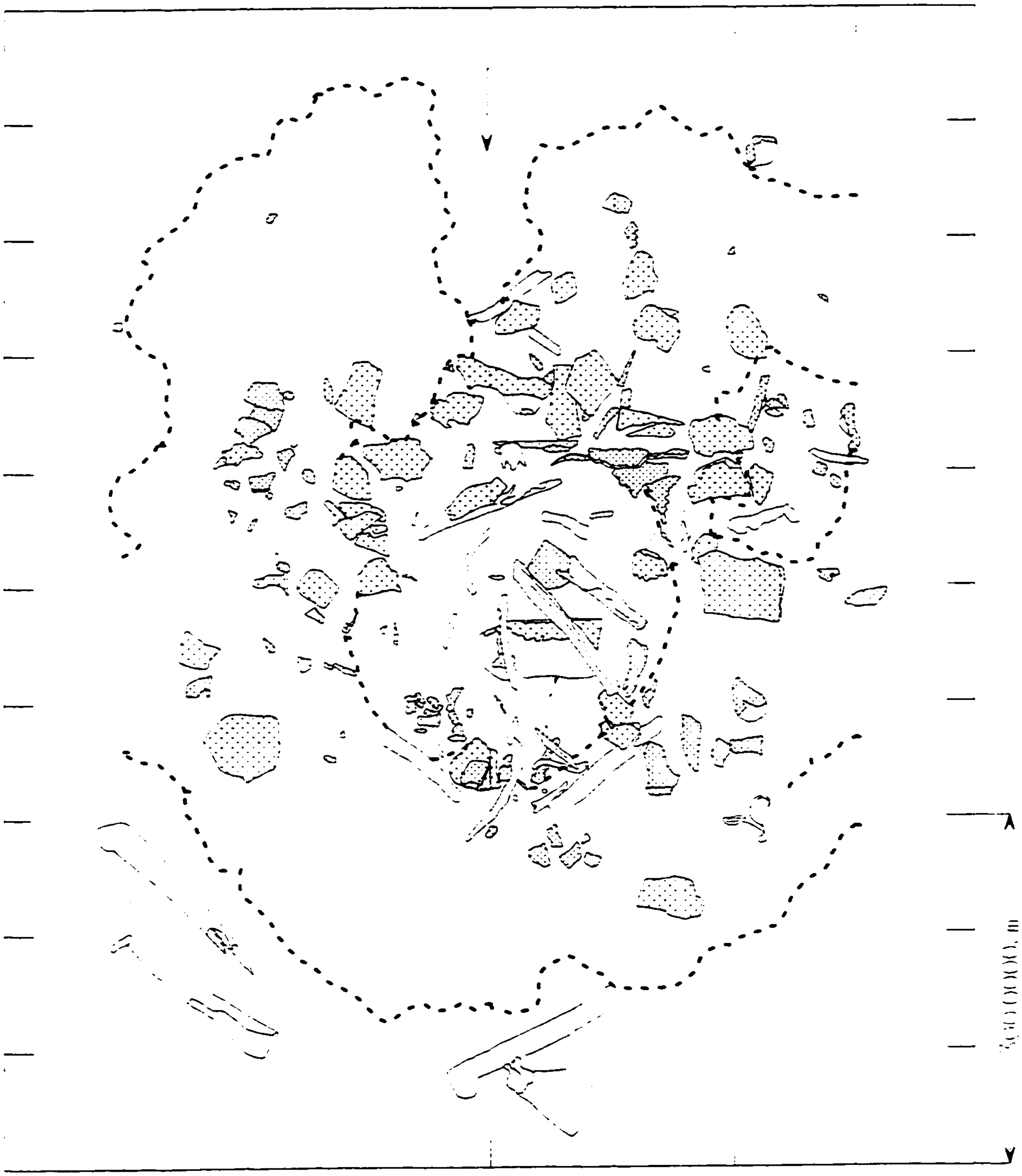
HOUSE 19 - BLACK POINT (QkLe-1)



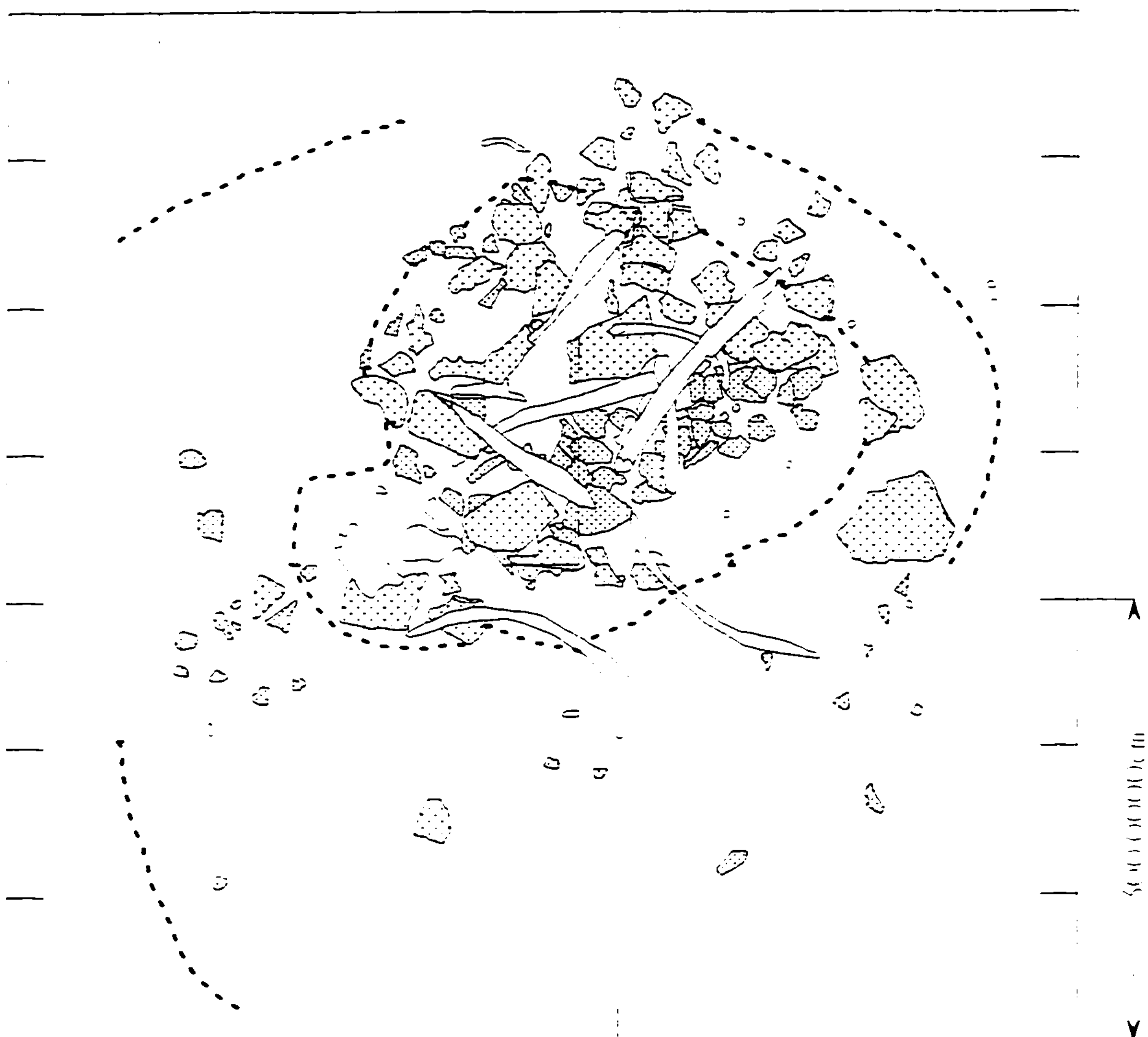
HOUSE 8 - BLACK POINT (QkLe-1)



HOUSE 5 - BLACK POINT (QkLe-1)



HOUSE 16, BLACK POINT (QkLe-1)



HOUSE 2 - BLACK POINT SITE (QkLe-1)

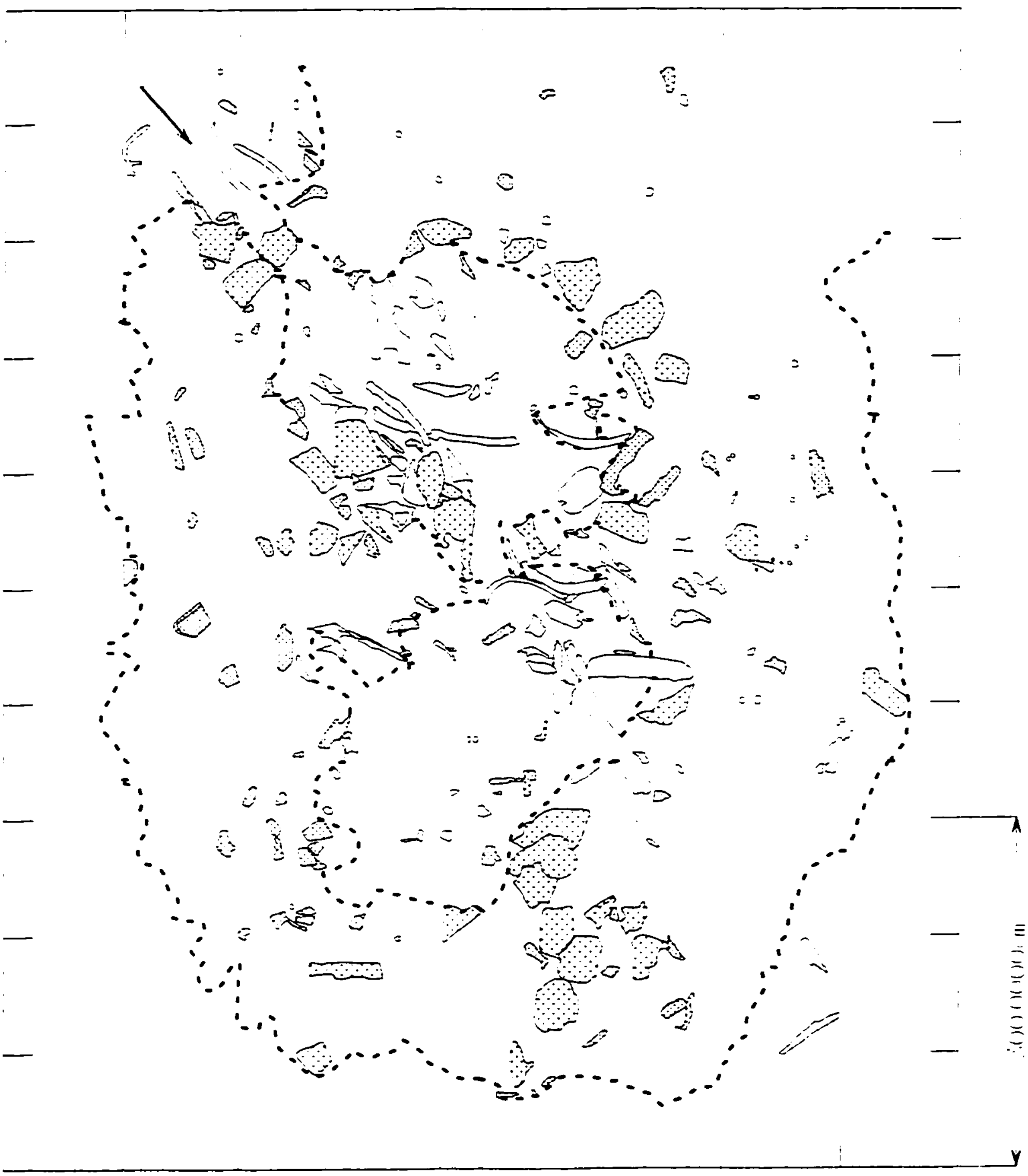


IMAGE EVALUATION TEST TARGET (QA-3)

150mm

6"

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