COASTAL SEDENTISM DURING THE ATLANTIC PERIOD IN NORDHORDLAND, WESTERN NORWAY? THE MIDDLE AND LATE MESOLITHIC COMPONENTS AT KOTEDALEN

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Coastal sedentism during the Atlantic period in Nordhordland, western Norway ? The Middle and late Mesolithic components at Kotedalen

By

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ABSTRACT

This thesis evaluates the proposition that there was year-round sedentary occupation on the coast of western Norway during the Atlantic period. The modern boundaries of Nordhordland circumscribe a physiographic region that is representative of the fjord indented landscape of western Norway. The seasonal and spatial distribution of food resources available in Nordhordland during the Atlantic period is reconstructed and found to be relatively rich and varied throughout the year, especially in the inner coastal region. The year-round availability of various species of cod is a stabilizing factor. This allows for some degree of flexibility and both seasonally mobile, semi-sedentary and sedentary settlement strategies were possible.

Scenarios for each of these strategies indicate that they are all capable of producing large sites with thick deposits, but it is suggested that the internal characteristics of such sites will differ depending on which settlement system they are a part of. The artifacts, faunal remains and the features from four stratified layers at Kotedalen, a large, multicomponent site located in the inner coastal region of Nordhordland, are evaluated to determine the length of occupation and the kinds of activities they

represent. Kotedalen is situated next to a good fishing location with easy access to resources in other physiographic regions and year-round settlement would have been possible from such a location.

Although data from one site cannot provide clear answers concerning regional settlement patterns, the data from Kotedalen, with its relatively good faunal preservation, identifiable features and stratified layers do provide insight into how one site was used at different points in time. The data from Kotedalen suggest that it was repeatedly reoccupied and that there was some degree of variability in site use. Data from two of the layers indicates that Kotedalen was occupied at least on a semi-sedentary basis, whereas the other two layers are not adequately sampled, but appear to show more sporadic use.

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1 INTRODUCTION

1.1 The Problem

Research in the late 1970s and early 1980s concerning settlement patterns of hunter-gatherers in Scandinavia focused attention away from the seasonally mobile view of hunter-gatherers towards a view where a more sedentary or semi-sedentary way of life prevailed, particulary in coastal areas with access to a variety of both marine and terrestrial resources (Broadbent 1979, Clark 1983, Engelstad 1983, Price and Brinch Petersen 1987, Renouf 1984, Rowley-Conwy 1983, Zvelebil 1981, among others). A year-round sedentary or semi-sedentary settlement pattern was also proposed for coastal areas throughout the Mesolithic of western Norway (Indrelid 1978, Mikkelsen 1978), but this has not been rigorously tested, nor until recently examined in chronological detail (Nygård 1987, 1990; Bergsvik 1991; Bruen Olsen 1992). Most of the works cited above examine archaeological sites that are younger than 6500 years old; however, in most of these areas the general characteristics of the food resources would have been similar during the entire Atlantic Period and it would not be unreasonable to expect earlier evidence of sedentary or semi-sedentary occupations. The question addressed in this thesis is: was there sedentary year-round occupation along the coast of western Norway during the Mesolithic and, if so, when did it begin? Although it may be impossible to answer such a question with certainty, it needs to be addressed and alternatives considered since it has implications for how we perceive and interpret the entire historical sequence in this region. More specifically, it greatly influences our perception of the questions surrounding the development of technological and social complexity and the adoption of agriculture in this region.

1.2 Mobility, sedentism, permanence, stability

Some form of mobility is an essential part of all hunter-gatherer subsistence and settlement strategies as it is the single most important tool humans have for dealing with variability in the spatial and seasonal availability of essential resources and for maintaining contact with one another. Over the past 10 years much of the theoretical discussion concerning hunter-gatherer subsistence and settlement systems has focused on the distinction, elaborated by Binford (1980), between logistically mobile collectors and residentially mobile foragers and the different kinds of sites these two methods of resource procurement leave in the archaeological record. The distinction is relevant at a very general level, but as Binford himself points out (1980:19) these are not mutually exclusive (Eder 1984; Kelly 1985:301) nor do they represent two ends of a mobility continuum

(Chatters 1987:336). The polarization of the concepts of residential and logistical mobility hides much of the variability in hunter-gatherer adaptations. To various degrees both residential and logistical mobility are part of all hunter-gatherer subsistence and settlement systems, as foragers also move logistically, and collectors move their residences either seasonally, yearly or even less frequently. Whether foraging or collecting strategies are used and to what degree depends partially on the seasonal and spatial distribution of individual resources and the resource composition within a specific region. In resource rich areas, with subsistence resources available year-round, alternative strategies are possible and different combinations of these two solutions for resource procurement can and do exist (Eder 1984).

Now that mobility strategies have been considered, it is appropriate to define what is actually meant by sedentism. Rafferty (1985:111) examined this concept in the archaeological literature and found an array of different meanings and terms. The definition adopted here is that sedentary settlements are ones in which at least some portion of the resident group is present at the same location throughout the entire year (ibid.:115). This definition allows for some degree of mobility as a portion of the residential group can be absent from the residential site at various times to perform more specific tasks (ibid.). The problem with this definition is that it is impossible to evaluate taking into account the nature of the archaeological record. How can a residential site occupied year-round be distinguished from one that was occupied for most of the year or from one that was occupied repeatedly in the summer and winter months by the same group of people? It is suggested here that this distinction is not so important as they represent closely related settlement systems that would have had similar implications for the development of technology, social organization, population growth. What is important in this regard is distinguishing semi-sedentary and sedentary settlement patterns from ones in which seasonal mobility is the general rule. This should be possible using the archaeological record and some specific implications for evaluating this are developed in Chapter 4.

The recent emphasis on mobility strategies and sedentary settlements has perhaps diverted attention away from other important factors in regional subsistence and settlement systems. The degree of permanence or the attachment that a group of people has to specific places and regions (Binford 1982, Engelstad 1990) and the stability of settlement are both important aspects of past settlement systems. These can also be evaluated with the kind of data available from archaeological sites. In fact, they provide a means for interpreting an often thorny but pervasive problem in archaeology - that of site reoccupation (Thomas 1984).

1.3 Research strategy

Questions concerning subsistence and settlement patterns must be addressed at two different levels. The regional or intersite level characterizes the types of sites and their spatial distribution relative to each other throughout the region for a specific time period. The site specific or intrasite level focuses on individual sites and addresses what type of occupation(s) they represent. Although both of these are essential for interpreting past settlement systems, the emphasis is placed on the site specific level, with the aim of acquiring a better understanding of the occupational history of large multicomponent sites with thick deposits. Such sites appear in the archaeological record of western Norway (Fig. 1) sometime during the second half of the Mesolithic and have been interpreted as representing sedentary occupations (Nygård 1990).

There are many factors that influence how people organize their settlements within a larger region at a specific period of time and one of these is access to the

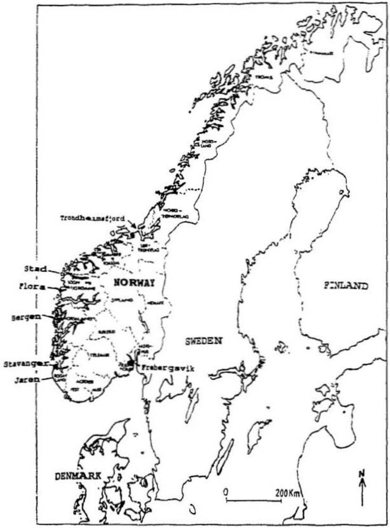

Figure 1. Provinces of Norway

necessary resources for survival. It is therefore essential to have an understanding of the characteristics of the food resources available within the region. As a detailed regional study of the archaeological remains is beyond the scope of this thesis the regional distribution of the resources reconstructed in Chapter 3 provides the primary regional perspective. This reconstruction is used as a basis for developing several likely subsistence and settlement models which in turn are used to generate specific implications for distinguishing different kinds of residential sites. These implications are then evaluated against the features, artifacts and faunal remains from part of a large multicomponent coastal site in western Norway.

If a year-round residential site is to be found, Kotedalen represents a likely candidate. It is located within easy access to both the full range of coastal resources and a majority of the inland resources. Furthermore, the abundant faunal remains preserved at this site, the variety of organic and inorganic artifacts, the possibility of identifying structures and features, and the fact that it was occupied from the Early Mesolithic through the Middle Neolithic provides the kind of data necessary to evaluate these implications.

A brief introduction to the history of Stone Age research in western Norway is provided below. In addition, Chapter 2 describes our current understanding of the natural and cultural history of western Norway. The resources available during the Atlantic Period are reconstructed for Nordhordland and the adjacent mountain plateaus in Chapter 3. Several subsistence and settlement models are presented in Chapter 4 together with a discussion of the implications of these for specific regional and intrasite studies. The results of the excavations at Kotedalen are presented in Chapter 5 and these results are evaluated relative to the implications presented earlier in Chapter 6. The final chapter summarizes the results from this research and outlines some areas where additional research is necessary.

All dates refer to conventional, uncalibrated radiocarbon dates. The terms "Mesolithic" and "Neolithic" have come to possess both chronological and economic connotations (Bjerck 1986:119), but refer here only to a period of time (Mesolithic: 10,000-5200 BP, Neolithic: 5,200-3500 BP). In addition, the term "Stone Age" will be used to refer to the Mesolithic and Neolithic Periods combined.

1.4 Research objectives

There are five primary objectives for conducting this research. First, a review of the literature concerning the Mesolithic of western Norway has revealed that there has been little research specifically oriented towards the Middle and Late Mesolithic in spite of the large quantity of information available. Second, the emphasis in this thesis is not on chronological questions, which have dominated research on the west Norwegian Mesolithic until recently. Instead, the emphasis is on settlement patterns, which uses the data available in a different manner. Third, Kotedalen represents a unique site for research related to the changes in subsistence strategies throughout the Mesolithic and into the Neolithic Period in western Norway. By focusing on the subsistence base and evaluating whether the Mesolithic components represent year-round sedentary occupation, this will provide a baseline from which to evaluate later changes. Fourth, this research contributes in a general way to recent investigations concerning the role of sedentary coastal foragers in the cultural development of Scandinavia. Finally, the degree of mobility has implications for the social structure (and vice versa) and must be evaluated in order to address questions concerning the interaction between neighboring groups of people.

1.5 Stone Age research in western Norway

Professional archaeology in western Norway began around 1874 when a separate department of archaeology (Historisk-antikvarisk) was formed within the museum at Bergen. The research interest of archaeologists in Bergen at that time was on the Iron Age (Klindt-Jensen 1975:98) and it was not until 1901 that the first article related to the Stone Age was published (Shetelig 1901). For the next thirty years intensive research on the Stone Age of coastal areas of western Norway was undertaken (Bjørn 1923, 1924, 1928, 1929; Brøgger 1907, 1908, 1909, 1910, 1913; Bøe 1923; Nummedal 1920, 1924; Rygh 1910, 1912; Shetelig 1922). This activity was inspired by questions concerning the origins of the first inhabitants of Norway and the "archaic" nature of the Fosna Culture or "flint-plac" sites that had been found. The other Stone Age culture identified at the time was referred to as the Nøstvet Culture and these sites were distinguished by the presence of a distinctive axe form. Explanations of culture change were based primarily on migration theories and archaeologists were dependent on the comparative chronologies established more firmly in Denmark and northern Europe.

From 1930 to 1960 the quantity of research on the Stone Age of this area decreased markedly (Bull 1936; Bøe 1934; 1942; Hinsch 1954; Lund 1951) and most of the publications represent reappraisals and general syntheses of earlier work (Clark 1936; Freundt 1948; Gjessing 1945; Shetelig 1964; Indrelid 1975:1). Excavations at this time focused on the various cave sites in western Norway. Archaeologists were still dependent on chronologies established in northern Europe. Now, in addition to migration, diffusion was used for explaining culture change and broad, sweeping generalizations were made.

Around 1960 research on the Stone Age increased and since then there has been continued professional interest in the Mesolithic of western Norway. The initial resurgence in activity was sparked by several large surveys of mountain plateaus that were conducted in conjunction with the hydroelectric development of those areas in the 1960s (Hagen 1963; Johansen 1969, 1971; Martens and Hagen 1961). Over 1,000 stone age sites were identified in the highland region (Indrelid 1975:1). Less work was done along the coast at this time (Bakka 1964; Bakka and Kaland 1971). The data collected during these surveys were to have profound affects on the development of Mesolithic research, as they demanded a reappraisal of traditional typologies, chronologies, and explanations of change.

In 1975 two articles were published that re-evaluated the traditional Fosna/Nøstvet typology for the Mesolithic in southern Norway (Indrelid 1975; Mikkelsen 1975). These set the guidelines for establishing a new chronology that was based not on comparisons with northern Europe, but on typological comparisons of radiocarbon dated assemblages within defined regions of southern Norway. A transition phase was placed between the Fosna and Nøstvet Traditions ca. 7,000-9,000 BP. It had not been recognized earlier in western Norway because most of the sites associated with shorelines from this period were either eroded or deeply buried during the Tapes Transgression (Bjerck 1986:105). This created a false impression that Fosna and Nøstvet were two unrelated traditions. The implication was that the Nøstvet Tradition was actually an outgrowth from the Fosna Tradition and that there was cultural continuity in the west Norwegian Mesolithic.

Since then, the numerous surveys and excavations of Mesolithic sites in both coastal and highland areas of western Norway have provided a more balanced data base with which to fine tune the regional chronology (Alsaker 1987; Bang Andersen 1988, 1990; Bergsvik 1991; Bjerck 1983, 1985; Bjørgo 1981, 1986; Bjørgo et al. 1992, Bostwick Bjerck and Bruen Olsen 1983; Bruen Olsen 1981; Gjerland 1985; Gustafson 1983; Indrelid 1973a,b, 1986; Johansen 1977; Kristoffersen 1990; Nærøy 1987; Nygård 1974; Randers 1988; Simpson 1992;

Ågotnes 1981). This recent work has shown that the traditional cultural classifications, based on the presence and absence of certain artifact types, are inadequate as the presence or absence of a particular type at a site may have functional, technological or social significance instead of a purely chronological one. All of these factors must be controlled for when establishing a chronological sequence. Another problem with the traditional cultures as they were previously defined was that they tended to mask regional variability. This kind of variability has been noticed more recently (Bjerck 1986:117; Bruen Olsen and Alsaker 1984; Gjerland 1985; Indrelid 1975; Madden 1983; Mikkelsen 1978).

Explanations of change are dependent on perceived similarities and differences between archaeological units through time and across space. The conventional Fosna-Nøstvet distinction emphasized differences and discontinuity through time (external causes for change) and similarities and continuity across space (regional homogeneity), whereas the revised chronology emphasizes similarities and continuities through time (internal causes for change) and differences and discontinuity across space (regional variability). These changes, indicate a fundamental shift that has had and will continue to have an impact on Mesolithic research in western Norway.

2 NATURAL AND CULTURE HISTORY

2.1 Introduction

The following provides a summary of our current understanding of the natural and cultural history of western Norway throughout the Mesolithic and part of the Neolithic. The physiography of the region is described in some detail as this forms the unchanging part of the environment. In addition, what is known of the lithic sources for stone tools is summarized, as access to these would have been an important consideration for people at that time. The location of lithic sources is also stable and would have influenced settlement patterns in a different manner than the seasonal availability of animal resources which is the emphasis in this thesis. The location of all places in western Norway mentioned in this thesis can be found on Figure 2.

Each time period is introduced with a discussion of the major environmental changes as evidenced in sea-level curves, climate changes, pollen diagrams and faunal assemblages. Three sea-level curves have been reconstructed along the coast of Hordaland and all reveal similar patterns (Krzywinski and Stabell 1979, Kaland 1984). The sea-level curve for areas farther inland would have been different as the upheaval of land in these area was much greater. A reconstructed shoreline diagram indicates that the

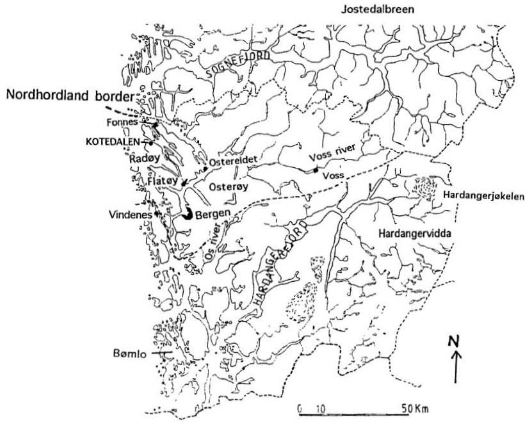

Figure 2. Places mentioned, Hordaland western Norway

transgression would have only slightly affected Ostereidet (Fig. 2) 53 km farther inland (Kaland 1984:239). The coasts of eastern Norway and Trondheimfjord (Fig. 1) have different sea-level curves and no transgressions have been documented in these areas (Hafsten 1983). In the following summary, the sea-level curve (Fig. 3) and dates corresponding to major changes in the pollen diagrams from Fonnes (Fig. 2) will be used as they relate specifically to the coast of Nordhordland (Kaland 1984:209).

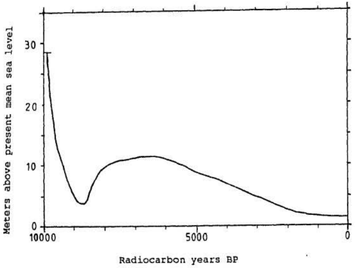

Figure 3. Sea-level curve from Fonnes, western Norway. (Adapted from Kaland 1984:227)

This environmental information is followed by an outline of our current understanding of the archaeological record for each period. Here a brief statement of the kinds of sites identified, their general location, characteristics and major typological elements is provided in addition to general interpretations of the subsistence and settlement patterns. Stone Age research in western Norway has primarily focused on the coast and the mountain plateaus, and it is the sites from these areas that form the basis of the following culture history. Though limited, the archaeological information from the fjord areas is also included. The chronological and typological divisions are based on overviews presented by Bjerck (1986), Nygård (1990) and Bruen Olsen (1992). Several different nomenclatures and dates have been used for the chronological divisions of the Mesolithic of southern Norway (Nygård 1990:235). These differences are a result of slightly different emphases on the typological criteria used to define the different periods (see Bruen Olsen 1992:90). As best expressed by the changes in blade production throughout the Mesolithic, the changes were gradual and occurred at roughly the same time along the entire west Norwegian coast (Bjerck 1986:116). The nomenclature used below is that understood by people not familiar with this specific area and the dates correspond to the Chronozones established for the natural sciences in Scandinavia (Mangerud et al. 1974). These are not meant as hard and fast divisions but only as guidelines for the discussion.

2.2 Physiography

Western Norway includes the *Fylker* (Provinces) of Møre og Romsdal, Sogn og Fjordane, Hordaland and Rogaland (Fig. 1). Although the following summary incorporates relevant data from these provinces, the emphasis is on developments within the more limited geographic area defined by the modern boundaries of Nordhordland and the adjacent mountain plateau (Fig. 2). Western Norway is situated on the western edge of the Fennoscandian Shield between 59° and 62° N latitude. In spite of this northerly location, the Gulf Stream and westerly winds strongly influence the climate of the west coast which is characterized by mild winters, cool summers and relatively heavy precipitation rates (Wallén 1968).

The following provides a description of the major physiographic features of western Norway starting at the edge of the continental shelf in the west to the central mountain range in the east, a distance of over 300 km. Off the west coast of Norway the continental shelf is less than 200 m deep and about 150 km wide. At the edge of this shelf the ocean floor drops off quickly to depths below 1000 m. The mixing of waters from the cold Norwegian Sea, the warm Atlantic Gulf Stream, and the North and Baltic Seas off the west coast of Norway results in ocean waters rich in plankton which support a variety of fish, seabird and sea mammal species. Four physiographic regions are outlined: the outer coast, inner coast, fjord and river valleys and mountain plateau (Fig. 4).

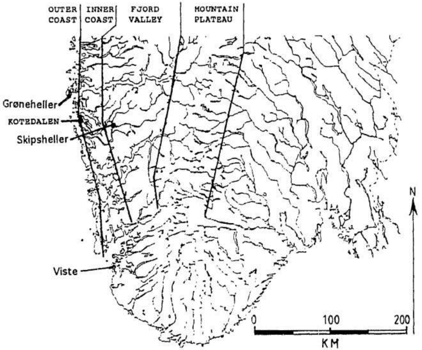

Figure 4. Physiographic regions of western Norway

The strandflat or outer coast includes the coastal islands and the lower parts of the mainland with average elevations of about 40 masl (Klemsdal 1985:275). The strandflat is about 16 km wide and stretches along the entire Norwegian coast from Jæren in the South to Finnmark in the North (Fig. 1). The islands of the strandflat have been important areas for settlements offering low-lying land close to the coast. This coastal landscape has also facilitated movement in a north-south direction, as in many places there is a protected thoroughfare for boat travel between the islands and the mainland.

A transition zone referred to as the inner coast has been defined between the strandflat and the fjord valleys with elevations generally lower than 300 masl but some as high as 700 masl. Some of this area is more similar to the strandflat whereas other parts are more similar to the fjord valleys. This area is about 30 km wide, but in some places, especially north of Sognefjord (Fig. 2), the transition between coast and fjord is much more abrupt. Residents of this area have easy access to both coastal and interior resources. In particular, the lower areas closer to the coast have been important for settlements in the past and present.

This part of western Norway is dominated by two steep-sided, deep, narrow fjords that penetrate over 180 km inland, Hardangerfjord to the south and Sognefjord to the north (Figs. 2 and 4). The slopes alongside these fjords rise from as little as 700 m to as much as 1500 masl. There are many short, steep rivers with waterfalls that flow into these fjords. Along the outer parts of the fjords, closer to the coast, there are some larger relatively level areas suitable for settlement. However, farther inland steeper slopes dominate and it is only in towards the head of the fjords and fjord arms that larger level areas for settlement were again possible. The fjords provide an easy means of travel between the coast and the mountains by boat. Between these two larger fjords is a shorter fjord system with medium relief (Klemsdal 1985:274) that forms the inner island of Osterøy (Fig. 2). The Voss river drains the mountainous region between Hardangerfjord and Sognefjord and flows into this smaller fjord system. The region around the Voss river valley is somewhat unique for western Norway and in many ways is more similar to the long, gentler river valleys of eastern Norway. This area would have been suitable for settlement in the past, and the Voss River valley and shorter fjords would provide another route connecting the mountains and the coast. The watershed of the Voss River forms the inland part of Nordhordland and it is this area more so than the large fjords that is the focus of the resource reconstruction in Chapter 3.

The mountainous regions at the head of each of fjord are somewhat different. The mountains around Sognefjord have a sharp, steep, alpine relief and relatively small level areas which are between 1,200-1,600 masl (Moe et al. 1978:74). In comparison the region at the head of Hardangerfjord has one large plateau 8,000 km^2 between 1,100-1,300 masl (Johansen 1973:60). The mountainous region is roughly 100 km wide. Small ice caps exist in restricted parts of the mountains today; to the north of Sognefjord is Jøstedalsbreen and at the head of Hardangerfjord is Hardangerjøkelen (Fig. 2). There are many small rivers and elongated lakes on the mountain plateaus and moving throughout the entire region is relatively easy. There are also many places appropriate for at least seasonal settlement. The central position of the mountain plateaus within southern Noway may have made them appropriate meeting grounds for groups from southern, eastern, western and even northwestern Norway.

The physiography of western Norway provides a myriad of strikingly different environmental situations over relatively short distances. Althcugh there is a certain degree of variability within each of the four physiographic regions, the general characteristics of each are different from one another and people would have used the outer coast, inner coast, fjord and river valleys and mountain plateaus coast, fjord and river valleys and mountain plateaus differently in the past as they do today.

2.3 Lithic sources

The most predominant types of stone found in Stone Age sites in western Norway include flint, quartzite, quartz, crystal quartz, rhyolite, mylonite, greenstone, diabase, soapstone and slate. Other types were used, but are not as prevalent. The terms used for the materials are those commonly used by archaeologists and are not geologically specific. As stone tools and flakes are the most common artifact class in west Norwegian Stone Age sites, the location of specific sources, the distribution of these materials, the technological steps in quarrying and producing tools and the changes in resource use through time all provide significant data concerning settlement and communication during the Stone Age. Although no systematic study of all the lithic resources has been completed, some initial comments can be made. The sources for rhyolite (Alsaker 1984) and slate (Søberg 1988) have been reviewed and studied, but these are primarily associated with the Neolithic in Nordhordland and will not be elaborated here.

Materials used for making flaked stone tools of various kinds are flint, quartzite, quartz, crystal quartz, and some types of mylonite. Flint does not occur in natural bedrock formations in Norway but is found along former shorelines and derives from glacially deposited cobbles from sources in Denmark and southern Sweden (E. Johansen 1957). These loose cobbles are found along the coast of southern, western and northern Norway (Bjerck 1983:100). The distribution of quartzite is variable and although several quarries have been identified on the mountain plateaus (Johansen 1977, Indrelid 1986:287), quartzite is also found in bedrock of lower lying areas of western Norway (Skjerlie; in Bjørgo 1981-Appendix 8). Some sources of crystal quartz have been located on Hardanger plateau (Indrelid 1986:288) and just to the southeast of the plateau (Martens and Hagen 1961:66). The quality of quartz varies greatly and it occurs in a large variety of places throughout western Norway. The sources for the different kinds of mylonite, particularly a green-yellow and a mottled grey mylonite which occur in Mesolithic contexts in western Norway, have not been located.

The sources for some of the materials used to make ground stone axes/adzes are known (Bruen Olsen 1981, Alsaker 1987, Gjerland 1990) and two major quarry sites have been documented and studied in detail. On a smaller island off the coast of Bømlo, Hordaland (Fig. 2), a large greenstone quarry has been located and the distribution of adze and axes from this quarry has been analyzed (Alsaker 1982, 1987). Likewise, a quarry of a distinctive diabase was found in Flora, Sogn og Fjordane (Fig. 1). The distribution of axes of this material has also been studied (Bruen Olsen 1981). Bruen Olsen and Alsaker (1984:79) suggest that these two quarries were actively worked from about 9,500 BP to 4,000 BP. The distributions of axes/adzes indicate they supplied two more or less distinct regions which overlap in the northern part of Nordhordland. These regions have been interpreted as representing two similar social territories (ibid.:97).

Some sources of soapstone are known locally in coastal areas (Bjørgo 1981, Simpson 1992:5). Soapstone was used in the Mesolithic for making fishing weights and some of the perforated stones. It was also extensively used in later periods for making vessels and as a building material and it is likely that the quarries used in the Stone Age have been extensively altered in more recent times.

The few detailed studies of specific materials and their distribution in western Norway have contributed greatly to our understanding of the settlement patterns and social networks (Bjørgo 1981, Alsaker and Bruen Olsen 1984) and additional studies of this type should be equally fruitful.

2.4 Earliest occupation

There is some evidence that people reached the south and west coasts of Norway before 10,000 BP and occupied ice-free areas during the Allerød (11,800-11,000 BP) and Bølling (13,000-12,000 BP) interstadials of the last glaciation. The finds from Blomvåg, situated on one of the west coast islands (Fig. 2), present some intriguing evidence that hints at such an early occupation. Here, the faunal remains of whales, seals, seabirds, fish, shellfish and reindeer were found beneath glacial moraine deposits and radiocarbon dated to the Bølling interstadial (Mangerud 1970, Indrelid 1975:12). No unequivocal tools were found in association with this deposit and they may be the result of a catastrophic event, but an equally viable explanation for such a faunal assemblage, which includes reindeer, would be the presence of people at that time (Hagen 1983:13-14). The exact timing of the final glacial retreat along the west coast of Norway varies; it retreated from the island of Bømlo in southwestern Hordaland (Fig. 2) by ca.12,800 BP (Sindre 1980) and from Fonnes in northwestern Hordaland by about 10,000 BP (Kaland 1984:236). All coastal areas of Norway were ice-free by about 10,000 BP and this is generally considered to mark the first sustained occupation of Norway (Hagen 1983:15).

2.5 Early Mesolithic (Preboreal: 10000 - 9000 BP)

Compared to the Atlantic Period, the environment of the Preboreal and Boreal are characterized by more instability and change and this must have influenced the way people organized themselves across the landscape. Between 10,000 and 8,700 BP more and more land was being exposed along the coast as the sea-level regressed rapidly (Fig. 3) by up to 24 m at Fonnes (Kaland 1984:211). This was later followed by a transgression which would have affected shore-bound sites dating between ca. 9500-8000 BP. Concurrently, on the mountain plateaus the glacial retreat began around 9,800 BP (Anundsen and Simonsen 1968) and after a brief period of glacial regrowth around 9600 BP the plateaus became ice-free by 9,000 BP (Andersen 1980).

The coastal vegetation was characterized by a relatively open landscape and included various grasses, sedges, shrubs like willow and juniper and one tree species: birch (Kaland 1984:211). Vegetation on the mountain plateaus did not become well established until after the area was deglaciated. Throughout the Preboreal the vegetation became more and more dense in all areas.

Exactly when and how moose, red deer, otter and possibly beaver came to occupy areas of western Norway has not been determined but it was probably during the late Preboreal (Lie

1988:231). In addition to these land animals, there was surely a variety of marine animals present including various species of whale, seal, seabird and fish. Species associated with more arctic climates today, such as the harp and ringed seals, may have been present but as there are no faunal remains from this time period, this remains unknown. It is known that the ocean at this time was colder and the salt content lower because of the addition of glacial meltwaters and the circulation of polar and subpolar waters (Jansen and Bjørkland 1985:256). Fish species not as tolerant of cold water and low salt content must have been affected and were either not present or not as common as they were during the Atlantic Optimum.

Early Mesolithic sites are characterized by a predominance of large, roughly flaked flint debitage and irregular blades. The few tools found include flake and core axes, tanged points, single edged points, microliths (primarily lancet microliths), burins, scrapers, retouched blades and flakes. The predominant raw material is flint, although some fine-grained quartzites have been found on some sites (Ågotnes 1981:25, Bruen Olsen 1992:190). Crude cores with acute platform angles are also typical (Bjerck 1986:107, Nygård 1990:229, Bruen Olsen 1992:123). Only recently have radiocarbon dates been obtained from Early Mesolithic sites in southern Norway (Bang Andersen 1990, Bruen Olsen 1992) and these suggest an age of at least 9600 - 9000 BP for such assemblages.

Typologically similar Early Mesolithic sites are found in eastern Norway, along the west coast from Rogaland to North Trondelag and related assemblages are found in Troms and Finnmark (Fig. 1; Nygård 1989:78). The absence of sites along the southern coast is probably because the Early Mesolithic shoreline lies underwater today (Nummedal 1933:239-244; Andersen 1980). The economy during the Early Mesolithic is not well understood as no faunal remains have been found from this period and other organic remains are rare. Most of the sites are associated with the coast, though a few have been found in the interior to the south of Hordaland (Bang Andersen 1990). Reindeer is assumed to have been the major land animal hunted, though it is possible that red deer and moose were available at least in the later part of the preboreal. The concentration of sites near the coast suggests a strong marine orientation (Indrelid 1978:151, Nygård 1989:76). The relatively small sites are seen as the remains of single occupations by small groups of highly mobile opportunistic foragers (Nygård 1990:232). Others find more variation in the material and interpret sites in the Early Mesolithic as the remains of more logistically

Early Mesolithic as the remains of more logistically organized groups (Bang Andersen 1990:224, Bergsvik 1991:256).

2.6 Middle Mesolithic (Boreal: 9000 - 8000 BP)

The sea-level curve at Fonnes reached a low of about 4 m above today's sea-level at 8,700 BP (Fig. 3). Two hundred years later marked the beginning of the transgression in this area and the rate of sea-level rise was most rapid between 8500 - 8000 BP. All shore-bound sites from this period would have been affected by this transgression. On the mountain plateau the plants that colonize recently deglaciated areas, such as lichens, moss and other arctic plants, began to take hold after 9000 BP (Elven 1975; Elven and Ryvarden 1975). By 8,500 BP, birch and pine were introduced to the highland plateaus and soon after the treeline reached an elevation of 1,250 masl, about 300 m higher than today's (Moe et al. 1978:76-78).

Concurrent with the rise in the sea-level at 8,700 BP was a rise in the hazel pollen curve in western Norway (Kaland 1984:209), which suggests a continued amelioration of the climate. The vegetation on the coast and the lower elevations of the fjords was dominated by birch, pine, and hazel (Fægri 1944, Hagebø 1967, Kaland 1970, Moe et al. 1978:76). Pine was more prevalent in inner fjord areas than out on the coast. The trend during this entire period was towards a more heavily forested landscape. The climate became more stable around 8500 BP and it was slightly warmer than today (Nesje and Kvamme 1991).

During the early part of the Boreal, the ameliorating climate and the direct land connection between the Scandinavian Peninsula and continental Europe resulted in the major migration of land mammals into Norway (Lie 1990:68). Those species that had not migrated in the Preboreal, like wild boar and other small mammals moved into Norway at this time (ibid.:69). Sometime after 9000 BP, when vegetation had become established, it is thought that reindeer moved onto the mountain plateaus (Moe et al. 1978:73). Between 8500 and 8000 BP the treeline was higher than today and winter forage for reindeer was greatly reduced and it is possible that moose occupied forested parts of the Hardanger plateau (Moe et al. 1978:80). Exactly what species comprised the marine fauna is not known although the ocean waters were warmer (Karpuz and Jansen 1992, Jansen and Bjørklund 1985:256) and this certainly influenced the variety and abundance of marine animals present.

Sites from this time period in Nordhordland are not well known. The shore-bound sites have been affected by sea-level changes, and the few surveys in areas at slightly higher elevations have not revealed sites that could be dated to this period. The only radiocarbon dated sites between ca, 8900 - 8000 BP have been obtained from the adjacent mountain plateaus, where the oldest dated component on Hardangervidda is ca. 8200 BP (Indrelid 1986:186). In spite of this lack of data, it is clear that assemblages pre-dating this period are different from those that post-date it and these changes occur sometime between ca. 9000-8000 BP (Bjerck 1986, Nygård 1987, 1989, 1990, Bruen Olsen 1992). The major changes noted are that flint axe/adzes go out of use and are eventually replaced by ground stone axes/adzes; tanged and single-edged points are replaced by composite blade tools; blades become narrower, more regular and even; multifacial cores with one platform are found and a few geometric microliths occur. Grinding slabs, drills, microblades and microblade cores are additional elements found that post-date this period.

The subsistence and settlement patterns reconstructed for this time period are based on a minimal number of poorly dated sites and must be considered tentative at best. The sites appear to be slightly larger than the Early Mesolithic sites and are therefore interpreted as representing occupations of longer duration (Nygård 1990:232). Otherwise, site location seems to be similar to that of the Early Mesolithic. The high mountain plateaus become inhabitable and evidence that people used them occurs toward the end of this period. The greater variety of land mammals present must have affected subsistence and settlement choices.

2.7 Middle Mesolithic (Early Atlantic: 8000 - 7000 BP)

The rate of the transgression slows down considerably after 8000 BP and it reached a maximum height of 11 masl at Fonnes by 7200 BP, after which it stabilized for the next 1000 years (Fig. 3). Around 7800-7700 BP alder increased in abundance and associated with this was a marked decrease in the shrubs and herbs indicating a generally closed forest environment with birch, alder and hazel being the predominant species in the coastal area (Kaland 1984:209). Pine was more prevalent farther inland. Arcund 8,000 BP the pine curve began to decline from the mountain plateau indicating a slight climatic cooling (Moe 1977) and by 7500 BP the treeline approximated that of today´s (Indrelid 1986:263). The ocean water temperature stabilized after 8000 BP and remained the same until 5000 BP (Karpuz and Jansen 1992). Both land and marine environments were warmer and remained relatively stable over a long period of time.

Evidence has recently been gathered indicating that sometime between 7500 and 7000 BP a tsunami which was triggered by a submarine landslide impacted the coast of

Norway. Initial projections indicate that within a matter of hours the sea-level rose between 5 to 10 meters (Svendsen and Mangerud 1990, and personal communication). This must have had an impact on the coastal population at that time, and should be taken into consideration when evaluating site formation processes, as it would have eroded and disturbed some site locations and deposited fine sands on others.

Several faunal collections can be dated to the Atlantic period and a variety of land and marine animals are present. These are discussed in detail in Chapter 3.

Many of the typological changes that began in the Boreal were completed by this time. Ground stone axes/adzes are common except on mountain plateau sites, drills and engraving tools are common as are microblades and conical cores. Tanged and single edged points are not present, and there is now evidence of slotted bone tools (Bjerck 1986, Nygård 1990). Other bone tools such as fish hooks, gorges and harpoons are first found preserved from this period, but it is likely that these were also present earlier. Flint is still the dominant material used on coastal sites in western Norway, though this changes towards the end of this period (ibid.). Some occupations containing perforated stones have been dated to this period (Bruen Olsen 1992:124, Krøger 1992).

Only a few coastal sites can be securely dated to this time period as many shore-bound sites have been affected by the transgression. Several sites on Hardangervidda have been dated to this time period (Indrelid 1986:185-186). The coastal sites seem to be similar in size to those from the Boreal, but they are now located near good fishing locations (Nygård 1990:233). The occupations from Kotedalen, which form the basis of this thesis, are from the latter part of this time period and will be discussed in detail later.

2.8 Late Mesolithic (Middle & Late Atlantic: 7000 - 5200 BP)

This represents the first time during the post-glacial period that no major changes in sea-level occurred and it was not until about 6,000 BP that the sea-level curve gradually started to decline again (Fig. 3).

The closed forest dominated by birch, alder and hazel which had been in existence since the early Atlantic Period continued to dominate. Other species were present and the exact composition of the forest in specific areas depended on elevation, slope, drainage and underlying soils. Alder began to expand onto the highland plateau around 7000 BP and reached its maximum at 6000 BP, suggesting a more humid climate (Moe et al.1978:81). Both ocean (Simmons et al. 1981:117, Karpuz and Jansen 1992) and land (Selsing and

Wishman 1984:127, Nesje et al. 1991, Nesje and Kvamme 1991) temperatures were slightly warmer than they are today. The westerly winds and weather patterns that exist today were present during the Atlantic Period (Selsing and Wishman 1984:132). The climate and vegetation of the region changed slightly after ca. 6000 BP when the average air temperature fell by 1°C (Nesje and Kvamme 1991), and a mixed oak forest developed on the coast sometime after 5700-5500 BP (Fægri 1940:82, Kaland 1984:209).

Several faunal assemblages dating to this time period in Nordhordland have been recovered and these form the basis for the reconstruction of animal resources as presented in Chapter 3.

The assemblages for the Late Mesolithic of the west coast of Norway are dominated by narrow microblades. Both bipolar cores and conical microblade cores are present. Whether these are temporal markers, with one occurring earlier than the other as suggested by Bruen Olsen (1992:91) remains to be tested. There is an increase in the variety of materials used for flaked stone tools in this part of western Norway. The assemblages are also comprised of ground stone axe/adzes, blade bores, scrapers, grinding slabs and various bone tools. Transverse arrows, though rare, appear sometime after 6000 BP (Nygård 1990:230). There are two apparently unique characteristics of Late Mesolithic assemblages from coastal western Norway. One is the presence of small, soapstone weights (Bjerck 1986:110; Bjørgo 1981), and the other is a marked increase in the variety of materials used for flaked tools (Bruen Olsen 1992:84). This indicates some regional differentiation between eastern and western Norway which becomes more distinct in the Neolithic (Nygård 1989, Bruen Olsen 1992:157). Some large sites with thick deposits are noted at this time and hint at a change in subsistence and settlement practices which has been interpreted as sedentary or semi-sedentary occupation along the coast (Nygård 1990). This will be discussed in more detail in Chapter 4.

2.9 Neolithic (5200 - 3500 BP)

The sea-level curve reveals a continued gradual decline to its present elevation (Fig. 3). The vegetational changes that occurred since the beginning of the Neolithic will not be described in detail. Two important changes occurred and these are related to the adoption of agriculture in the region. Around 4,000-3,500 BP the increase in nonarboreal pollen in the pollen diagrams has been interpreted as the establishment of cereal farming in the region and marked the beginning of the deforestation process (Kaland 1974:35). The next major change on the coast of Nordhordland occurred around 1,900-1,800 BP when the curves for nonarboreal pollen and heather rise abruptly, indicating the introduction of the present open heath vegetation (Kaland 1974). The remains of domesticated animals are first found in assemblages dating to ca 4000 BP (Hufthammer 1992a:61). Some changes in the composition of animals present in the region also occur but these have not been studied in detail.

To summarize, the environments of the Preboreal and Boreal periods are characterized by some amount of change. The understanding we have of the archaeological sites along the coast has been affected by the transgression and the limited amount of research in the areas between the coast and the mountain plateaus. The environment of the Atlantic period was much more stable and we have a better understanding of the sites and the fauna present at that time. It is this period that will be the focus of the remainder of the thesis. The Mesolithic economy of western Norway remained predominantly that of hunter-fishers. It was not until about 4700 BP that agriculture became a limited part of the economy (Bakka and Kaland 1971, Nygård 1990, Bruen Olsen 1992) and not until ca. 4000 BP that it became so significant that it may have resulted in major settlement changes (ibid., Bergsvik 1991:271).

3 RESOURCES

3.1 Introduction

In contrast to the summary provided in the previous chapter which noted changes through time, this chapter focuses on a relatively short time span and provides a synchronic sketch of environmental variability across space. The purpose is to reconstruct the spatial and seasonal distribution of animal resources for the Atlantic Period and determine how they might have influenced settlement and subsistence at that time. This evaluates one set of constraints. Although beyond the scope of this thesis, the constraints imposed by non-food resources, contact with other groups, technology, population dynamics, social structures and ideology should also be evaluated to determine the influence they may have had on settlement patterns. The following discussion concentrates on the spatial and temporal distribution of the larger and more abundant animal resources with the assumption that these were important factors in structuring subsistence and settlement.

The baseline for establishing the mammals, fish, and birds present in western Norway in the Atlantic Period was obtained from a systematic overview of all animals present in Norway today (Christiansen 1982). The other volumes in the same series, edited by Frislid and Semb-Johansson (1982), provided more detailed information about the behavior of specific species. Supplementary information concerning the modern distribution of mammals was obtained from Semb-Johansson (1990), of birds from Bentz (1988) and Heinzel et al. (1972), and of fish from Pethon (1989) and Muus (1974). Animals were excluded if they were known to be only recently available in western Norway (e.g. mink), if they were rare, if they were not likely to have been actively pursued (e.g. larger whales), or if they were not considered important food resources (e.g. fish and birds <20 cm). This list was augmented with species known to be present in western Norway in the Atlantic Period, but that are now extinct or not present (e.g. wild boar). The basis for these alterations was an overview of the animals in western Norway in the early 1900s (Helland 1921) and throughout the Boreal and Atlantic Periods (Lie 1990 a,b) and the identified remains from three cave sites in western Norway, and some sites on the mountain plateau. In addition, regional summaries of fauna found at Boreal and Atlantic archaeological sites in northwestern Europe were consulted to determine the kinds of animals identified in archaeological sites from that time (Andersen et al. 1990, Clark 1975). Appendix 1 lists all animals mentioned in the text and includes their scientific and Norwegian names.

Considered together, the faunal remains from the archaeologica. sites provide some insight, biased as it may be, into the species present in the different physiographic regions of Nordhordland: Grøneheller representing the outer coast, Viste the inner coast or mainland, Skipsheller the transition between the inner coast and the fjord valleys and the Mesolithic sites on Hardangervidda the mountain plateau (Fig. 4). The identified mammal, fish, bird, and shellfish remains associated with Mesolithic occupations of the three west Norwegian cave sites are presented in Tables 1, 2, 3 and 4 respectively. All of these are multicomponent and some degree of mixing from reoccupations in the past and from recovery procedures and interpretations in the present is unavoidable. The soil was not screened at any of these sites and the bones of smaller animals, in particular fish, are underrepresented.

The finds from Grøneheller indicate occupations from the late Mesolithic through the Iron Age (Jansen 1972). Only the Phase I faunal material is presented as the artifacts associated with this Phase are primarily Mesolithic. This is not true of the artifacts associated with Phase II which contains both Mesolithic and Neolithic elements (Bruen Olsen 1992:167). Phase I, it is typologically placed somewhere between 7000 to 5500 BP (ibid:168).

Table 1

Mammal remains from some Atlantic period sites in western Norway

		Total number of fragments			
		Skip 1		Grøn 2	Viste 3
English	*Scientific*	layer 7	layer 6	Phase 1	total
white-sided dolphin	*Lagernorhynchus acutus*		1		
harbor porpoise	*Phocoena phocoena*				3
grey seal	*Halichoerus grypus*				158+
harp seal	*Pagophilus groenlandicus*				5
harbor seal	*Phoca vitulina*	14	472	31*	
moose	*Alces alces*		73		106+
red deer	*Cervus elaphus*	27	1931	29	32+
wild boar	*Sus scrofa*	6	235	18	601+
brown bear	*Ursus arctos*	1	109		33
wolf	*Canis lupus*		6		
lynx	*Lynx lynx*				2
beaver	*Castor fiber*				2
otter	*Lutra lutra*		75	11	94
badger	*Meles meles*				1
wildcat	*Felis sylvestris*				7
red fox	*Vulpes vulpes*		1		14
arctic fox	*Canis logopus*				1
hare	*Lepus timidus*		5		
weasel	*Mustela erminea*		2		1
pine marten	*Martes martes*		64		52
European polecat	*Mustela putorius*				3
hedgehog	*Erinaceus europaeus*				1
squirrel	*Sciurus vulgaris*		12		27
small rodents	*Cricetidae, Muridae*		3		1
cow	*Bos taurus*		1		2
sheep/goat	*Ovis aries/Chircus*		8		
horse	*Equus caballus*				2
dog	*Canis familiaris*		8		62+
	identified mammal	48	3006	89	1213+
	unidentified mammal	3381	13694	582	?
	Total mammal	3429	16700	671	?

* species not certain; + approx.

Sources:

1 Skipsheller - Olsen (1976:43-44)

2 Groneheller - Jansen (1972:52)

3 Viste - Olsen (1976:126)

Table 2

Fish remains from some Atlantic period sites in western Norway

English	Scientific	Total number of fragments: Skip 1 total	Skip 2 lyr 6/7	Gron 3 Phase 1	Vist 4 total
blue ling	*Molva dypterygia*	1	?	-	-
ling	*Molva molva*	722	128	4	X
grenadier	*Coryphaeonides rupestris*	1	?	-	-
hake	*Merluccius merluccius*	10	?	1	X
pollack	*Pollachius pollachius*	1171	367	28	X
haddock	*Melanogrammus aeglefinus*	238	131	-	X
cusk	*Brosme brosme*	58	?	1	X
coalfish	*Pollachius virens*	5235	519	76	X
cod	*Gadus morhua*	2796	1223	41	X
whiting	*Merlangius merlangus*	1	?	-	-
tadpole-fish	*Raniceps raninus*	1	?	-	-
halibut	*Hippoglossus hippoglossus*	1	?	-	-
plaice	*Pleuronectes platessa*	5	?	-	-
megrim	*Lepidorhombus whiffiagonis*	1	?	-	-
flounder	*Platichthys flesus*	3	?	-	-
conger eel	*Conger conger*	-	-	-	X
wolf-fish	*Anarhichas lupus*	1	?	-	X
ballan wrasse	*Labrus berggylta*	-	-	1	X
cuckoo wrasse	*Labrus bimaculatus*	4	?	-	X
tunny	*Thunnus thynnus*	6	?	-	-
spiny dogfish	*Squalus acanthias*	50	?	1	-
mackerel	*Scomber scombrus*	31	?	-	-
common eel	*Anguilla anguilla*	1	?	-	-
salmon	*Salmo salar*	296*	?	-	-
trout	*Salmo trutta*	*	?	-	-
	identified fish	10633		153	
	unidentified fish			216	
	total			369	

* - both salmon and trout; X - present

Sources:

1 Skipsheller - Olsen (1976:112)
2 Skipsheller - Olsen (1976:113)
3 Grøneheller - Jansen (1972:53)
4 Vistehule - Degerbøl (1951:55-56)

Table 3

Bird remains from some Atlantic period sites in western Norway

		Total number of fragments		
		Skip 1	Grøn 2	Vist 3
English	Scientific	Total	Total	Total
gannet	*Sula bassana*	-	-	X
fulmar petrel	*Fulmarus glacialis*	-	-	X
cormorant	*Phalacrocorax carbo*	6	3	X
shag	*Phalacrocorax aristotelis*	1	4	X
great black-backed gull	*Larus marinus*	1	-	-
herring gull	*Larus argentatus*	2	1?	X
common gull	*Larus canus*	1	-	X
Icelandic gull	*Larus glaucoides*	1	-	-
kittiwake	*Rissa tridactyla*	-	-	X
great auk	*Alca impennis*	1	5	X
common guillemot	*Uria aalge*	2	3	X
razorbill	*Alca torda*	1	1	X
black guillemot	*Cepphus grylle*	1	-	-
puffin	*Fratercula arctica*	-	1	X
whooper swan	*Cygnus cygnus*	1	1?	X
bean goose	*Anser fabalis*	1	-	X
greylag goose	*Anser anser*	3	-	-
eider duck	*Somateria mollissima*	-	1	X
long-tailed duck	*Clangula hyemalis*	5	-	X
velvet scoter	*Melanitta fusca*	3	-	X
common scoter	*Melanitta nigra*	11	-	X
scaup	*Aythya marila*	1	-	-
gossander	*Mergus merganser*	6	-	-
goldeneye	*Bucephala clangula*	6	-	-
red-breasted merganser	*Mergus serrator*	34	-	X
shelduck	*Tadorna tadorna*	1	-	-
mallard	*Anas platyrhynchos*	6	-	X
shoveler	*Anas clypeata*	1	-	-
merganser (smew)	*Mergus albellus*	1	-	-
teal	*Anas crecca*	7	-	X
red-throated diver	*Gavia stellata*	2	-	X
black-throated diver	*Gavia artica*	2	-	-
great-crested grebe	*Podiceps cristatus*	-	-	X
red-necked grebe	*Podiceps griseigena*	-	-	X
black-necked grebe	*Podiceps nigricollis*	-	-	X

Continued on next page

English	Scientific	Total number of fragments Skip 1 Total	Gron 2 Total	Vist 3 Total
sea eagle	*Haliaeetus albicilla*	2	1	X
golden eagle	*Aquila chrysaetus*	-	-	X
snowy owl	*Nyctea scandiaca*	-	-	X
rough-legged buzzard	*Buteo lagopus*	1	-	X
common buzzard	*Buteo buteo*	-	-	X
tawny owl	*Strix aluco*	1	-	X
sparrow hawk	*Accipiter nisus*	1	-	-
goshawk	*Accipter gentilis*	-	-	X
merlin	*Falco columbarius*	3	-	-
common curlew	*Numenius arquata*	1	-	-
golden plover	*Pluvialis apricaria*	1	-	-
corn crake	*Crex crex*	1	-	-
crow	*Corvus corone*	1	-	X
raven	*Corvus corax*	-	-	X
ring dove	*Columba palumbus*	6	-	-
cuckoo	*Cuculus canorus*	2	-	-
ring ouzel	*Turdis torquatus*	-	-	?
white-backed woodpecker	*Dendrocopus leucotos*	1	-	-
fieldfare	*Turdis pilaris*	5	-	-
blackbird	*Turdus merula*	5	-	?
greater spotted woodpecke	*Dendrocopus major*	1	-	-
starling	*Sturnus vulgaris*	-	-	?
song thrush	*Turdus philomelos*	4	-	-
redwing	*Turdus iliacus*	3	-	-
capercaillie	*Tetrao urogallus*	27	-	X
black grouse	*Tetrao tetrix*	17	-	-
willow grouse	*Lagopus lagopus*	6	-	-
ptarmigan	*Lagopus mutus*	14	-	-
	identified birds	211	21	
	unidentified birds		41	
	total		62	

X - Present

Sources:

1 Skipsheller - Olsen (1976:102)

2 Grøneheller - Jansen (1972:54)

3 Vistehule - Degerbøl (1951:54-55)

Table 4
Shellfish remains from some Atlantic period sites in western Norway

English	Scientific	Skip 1	Grøn 2	Vist 3
oyster	*Ostrea edulis*	X	X	X
mussel	*Mytilus edulis*	X	X	X
periwinkle	*Littorina sp.*	X	X	X
limpet	*Patella vulgata*	X	X	X
cockleshell	*Cardium edulis*	-	-	X

X - Present

Sources:
1 Skipsheller - Bøe (1934)
2 Grøneheller - Jansen (1972:64)
3 Vistehule - Lund (1951:15,50)

Viste cave was excavated first in the early 1900s (Brøgger 1908,1910). Later excavations were undertaken and reported by Lund (1951), and Degerbøl (1951) completed the faunal analysis. The artifacts from Viste indicate that occupations at the site occur as early as the Early Mesolithic and up through the Iron Age (Mikkelsen 1971). Three cultural layers were identified. Layers I and II are Mesolithic and most of the bone material was associated with these two layers. Layer II is a shell midden probably dating 6500-6000 BP (Indrelid 1978:161,175). Layer I is older, and two radiocarbon dates from this layer have a median age of 7818±88 BP (Indrelid 1978:175). The faunal remains from the entire site are presented as it was not possible to separate those associated with specific layers.

Skipsheller was excavated in the 1930s (Bøe 1934) and the faunal analysis is presented in Olsen (1976). Seven stratigraphic layers were identified dating from the Late Mesolithic to the Iron Age. The mammal remains from Layers 6 and 7 are shown in Table 1. The published data for most of the fish and all of the birds are only presented for the site as a whole. Three radiocarbon dates from Layer 6 give a median age for this layer of 6097±60 BP (Indrelid 1978:159).

On Hardangervidda a total of 2419 burned bone fragments were recovered from 12 different Mesolithic occupations on seven sites (Indrelid 1986:268). These occupations are radiocarbon dated and are from between 8400 to 5000 BP (ibid.). Of these, 5 were identified as reindeer, 3 as moose, 16 as reindeer/red deer, 1 as ptarmigan, 1 as duck, 8 as trout, 18 as unspecified bird and the remainder as unspecified mammal or unspecified bird/mammal (ibid.).

It is assumed that those species represented with large fragment counts were actively sought and regularly exploited by people at that time. It is more difficult to determine what the absence or limited occurrence of a certain species from this list means. It is therefore important, at least initially, to also consider some of the less archaeologically visible species. A description of the distribution, habits, hunting methods and probable season of capture for each species or family thought to be important to people living in Nordhordland during the Atlantic Period is presented in the following.

3.2 Mammals

Important characteristics of all mammals thought to have been available in Nordhordland or the adjacent mountain plateau are summarized in Table 5 and discussed in more detail below.

Sea Mammals. Whales and seals provide a variety of raw materials: flesh and blubber provided meat and oil for light and warmth, skins could be used for clothing, shelters or boats (Clark 1947:99), and bones could provide tools, fuel or building materials. Wood was readily available and was more likely used for fuel and building materials than sea mammals were. Whales may have been hunted with harpoons from boats, or they may have been used when found stranded (Clark 1947). Another method of whale hunting was to herd them into coves and inlets with narrow openings. Reports of such surrounds, particularly of smaller whales are found from the late 1800s in Nordhordland (Helland 1921:331). Seals are easier to capture than whales as they are forced on land or ice-floes

Table 5
Mammals available during the Atlantic period, western Norway.

English name	Size Kg	Region Available* oc	ic	f	m	Comments
white-beaked dolphin	200	x				occasionally hunted, special sites
white-sided dolphin	200	x				occasionally hunted, special sites
harbor porpoise	60	x	x			occasionally hunted, special sites
gray seal	300	x				available? hunted
harp seal	150	x				occasionally hunted, sporadic
harbor seal	130	x	x	x		hunted
moose	600		x	x		hunted
reindeer	270				x	hunted
red deer	240	x	x	x		hunted
wild boar	150	x	x			hunted
brown bear	350		x	x		occasionally hunted
wolf	50			x	x	occasionally hunted
lynx	30			x	x	occasionally hunted
beaver	20		x	x		available ? hunted
otter	15	x	x			hunted
badger	15	x	x			available? occasionally hunted
wolverine	15			x	x	occasionally hunted, seldom
wildcat	10		x	x		available? occasionally hunted
red fox	10	x	x			occasionally hunted
mountain fox	8				x	occasionally hunted
hare	5	x	x	x	x	occasionally hunted
weasel	3	x	x	x	x	occasionally hunted
pine marten	2		x	x		hunted
European polecat	2		x			available? occasionally hunted
snow weasel	<1		x	x	x	seldom hunted
squirrel	<1	x	x	x		seldom hunted
small rodents	<1	x	x	x	x	seldom hunted

* oc-outer coast ic-inner coast f-fjord and river valleys m-mountain plateaus

during birthing or when molting. Hunting methods for seals include everything from clubbing to harpooning from land or boats, to trapping or netting or a combination of these techniques.

It is assumed that the medium sized whales like the minke, killer and pilot whales, although depicted on rock carvings from northern Norway (Hagen 1976:86), were not regularly hunted. The three species of whale most likely to have been hunted in Atlantic times in Nordhordland are the white-nosed dolphin, white-sided dolphin and harbor porpoise. In Nordhordland today, the harbor porpoise is the most common followed by the white-sided dolphin and then the white-nosed dolphin. The dolphins are social animals and often found around boats. They usually live in groups of 15-20 individuals but group size has been known to reach 1000 individuals. Harbor porpoises are smaller and they are found alone or in small groups. Although relatively stationary more are found farther inland along the fjords in the fall and winter and along the outer coast in the summer.

The small, toothed whales are considered year-round resources. Only the harbor porpoise is likely to have been found in the inner fjord, otherwise all three were available in the outer and inner coastal areas. The white-nosed dolphin was not identified at any of the three cave sites (Table 1). One fragment of white-sided dolphin was identified from Layer 6 at Skipsheller and three fragments of harbor porpoise were found at Viste. Faunal remains from Frebergsvik, a Late Mesolithic site in southeastern Norway

(Fig. 1), indicate that at least two of these species were hunted there during the Atlantic Period (Mikkelsen 1975:136).

Compared to some of the other mammals, the number of whale bone fragments identified is negligible. They may not have been regularly captured because they were difficult, they were not abundant, larger organized hunts were required, or the timing of the hunt conflicted with more accessible resources. It is also possible that they were exploited, as the few remains found suggest, but that their bones were not deposited at the few sites known with faunal remains. Most of the carcass may have been left near where the animal was caught. The site of Frebergsvik, might represent such a special purpose site (Mikkelsen 1975:138; Indrelid 1978:164).

Seals were an important resource in the past and ownership of skerries and shorelines frequented by seals, was regulated by law in the 900s (Olsen 1976:83). In the 1600s harbor seals and grey seals were referred to as "spring" and "winter" seals as grey seals give birth in the fall/early winter and harbor seals do so in the spring (Olsen 1976:84). Harp seals may also have been hunted. Although it is considered an arctic species, large groups are observed sporadically on the west coast of Norway in the late fall/early winter. The prehistoric distribution of harp seal is poorly understood and although five bone fragments were identified at Viste, its importance as a resource in Nordhordland during the Atlantic Period is unclear.

Grey seals are seen in small flocks along the outer coast and are relatively stationary. They remain on land for 3-4 weeks when molting sometime between February and April and would have been easier to capture. They were also easily hunted when gathered in breeding colonies in the fall. They do not presently breed along the coast of Nordhordland. Harbor seals are more common in Nordhordland. They too are relatively stationary but are more often seen on the outer coast in the spring and summer and in the fjords during the fall and winter. They would have been easiest to catch in the spring and early summer when gathered in larger flocks on exposed rocks. One offspring is born in June or July and they molt on land for two weeks in late July.

Remains of grey seal have been found in Viste (Table 1). Young and newborn individuals are represented, suggesting both that there was a breeding colony in the vicinity and that young seal were a sought after resource. Grey seals are the most common seal represented in archaeological sites from the Atlantic Period in Denmark (Mohl 1971:304). At least half of 1300 fragments of harbor seal found in all layers of Skipsheller are of young individuals (Olsen 1976:82). Most of these were captured in August, some in October and

November and a few in January (Olsen 1976:83). How many of these are associated with Layers 6 and 7 is not given, but these data suggest that young harbor seals were caught in the fjords from August to January. The 486 bone fragments of harbor seal found in Layers 6 and 7 of Skipsheller and 31 seal bone fragments, at least some of them harbor seal, from Phase I in Grøneheller, indicate the importance of harbor seal as a resource in the Atlantic Period in Nordhordland. No harbor seals were identified at Viste.

Hoofed mammals. Hoofed mammals were hunted primarily for their meat and hides, although bones, antlers and tusks could also be used. A variety of hunting methods was possible including stalking with bow and arrows, and using traps, snares, pitfalls, drive-fences, etc. They could be driven into water or hunted in deep snow where they were easier to capture. Some of these methods were more appropriate for hunting herds in open landscapes, whereas others are aimed at hunting individuals in a forested environment. Some involve groups of hunters whereas others were best accomplished by individuals.

Of the hoofed mammals, moose, reindeer, red deer and wild boar were hunted in western Norway in the Atlantic Period. Roe deer are present in western Norway today (Wildhagen 1961:195) and they are found in Atlantic Period faunal assemblages in Denmark (Clark 1975:245,253), but they have only been found at one Stone Age site in Norway, and that was in eastern Norway (Lie 1990b:214). Because of their absence from west Norwegian sites, it is assumed that they were not present in western Norway at this time (Hufthammer 1993).

Moose are currently found in the large coniferous forests of eastern Norway and the Trondelag region. Moose was unknown in Nordhordland in historic times although a small group has recently moved into the Voss region (Fig. 2; Olsen 1976:95). It appears that populations of moose also existed in western Norway during the Atlantic Period (Lie 1990b:214). Though relatively stationary, some groups of moose migrate into the valleys in the late fall and return to higher elevations towards the end of April. They are more solitary than the other species of hoofed mammals.

Reindeer occur in large herds on the mountain plateaus of southern Norway. They generally calve in the western part of the plateau and overwinter in the eastern part. Reindeer seek higher snow covered areas in the summer and are found at lower elevations in the winter. These reindeer do not migrate over long distances and would have been available throughout the year within the plateau area (Indrelid 1986:298). It is uncertain the extent to which coastal populations would have hunted reindeer in the Atlantic Period.

Red deer occur in small herds primarily in the mixed deciduous forests and uneven terrain of western Norway. At the beginning of the 1900s the distribution of red deer in Nordhordland corresponded to the area defined as the inner coast and river valleys (Langvatn 1990:88). Red deer gather in larger groups in the lowlands in the winter, and move to higher elevations in spring and summer. Many that overwinter together have different, more dispersed summering places. Red deer were available on the larger islands of the outer coast as they can swim, but they were surely most numerous in the inner coast and fjord valleys.

Wild boar is no longer found in Norway, but it was an important resource in Nordhordland in the Atlantic Period. Knowledge about its habits come from other European areas where they still exist. There is great variability in wild boar habitats and the size of an adult male varies between 35-350 kg. A comparison of wild boar fragments from Viste and those of Mesolithic sites in Denmark indicate that the wild boar of western Norway were smaller (Degerbøl 1951:76). Wild boar are generally associated with mixed deciduous forests (Mathiasson and Dalhov 1988:160). In Nordhordland they probably occupied the outer and inner coastal areas

(Hufthammer, personal communication 1993). They can swim and could have populated coastal islands. They avoid higher elevations and have difficulty moving in deep snow. Depending on the amount of forage, wild boar can be quite sedentary and browsing areas of less than 50 km^2 have been noted (ibid:159). The males are more solitary, seeking the rest of the family group during the mating season between November and January.

All of these hoofed mammals were available year-round but they were most attractive in the fall and easiest to hunt in the winter. The males of all of these species have the greatest weight and fully developed antlers just prior to the rut in September/October. The females are also heaviest at this time but they maintain more of their weight and fat into the winter. Reindeer hides are best for making clothing if captured in September or October, and for bedding and warmth if caught in the winter (Spiess 1979:29-30). Moose, red deer and wild boar were easiest to capture in the winter when gathered in larger groups and hindered by snow and ice conditions. Moose, reindeer and red deer were least attractive and most dispersed between March and July. The summer hide of reindeer is not attractive as this is when they molt (ibid.). It is likely that piglets, born between February and May (Jochim 1976:166), would be sought in summer. Evidence from Viste indicates that young boars were captured.

Red deer and wild boar were identified at all three cave sites (Table 1). Moose was identified at Skipsheller, Viste and one of the Mesolithic sites on Hardangervidda (Indrelid 1986:268-269). A few fragments of reindeer were identified among the remains from three of the sites on Hardangervidda (ibid.). The reason for the absence of reindeer bones at Viste, Grøneheller and Skipsheller in the Atlantic Period is ambiguous. It is possible that reindeer were not sought by coastally oriented people as the variety of other resources available, particularly other ungulates, mitigated the importance of reindeer (see Spiess 1979:133). It is also possible that reindeer were hunted as part of a seasonal round and that few remains of reindeer were deposited at these sites. Of 200 burned bone fragments found from sites on Flatøy (Fig. 2), only 2 could be identified as either red deer or reindeer (Bjørgo 1981:105).

Large fur bearing mammals. The brown bear, wolf and lynx were the three large fur-bearing mammals present in western Norway in the Atlantic Period. Wolf is absent from western Norway today and bear and lynx are rare. Both bear and wolf were more abundant here in the recent past. Lynx never seems to have been abundant in Nordhordland (Kvam

1990:204). All of them are associated with forests at higher elevations and both the wolf and lynx can be seen in the mountains. The economic reasons for hunting these is assumed to be for their winter fur, although the amount of meat provided by bear in particular should not be overlooked. Perhaps more importantly, a good deal of prestige and mystique must have been attached to hunting these mammals. They could be hunted at any time of the year, but the winter was perhaps the easiest and the best if hunted for their furs. Bears are particularly vulnerable when hibernating between October and April (Gjessing 1969:26), but might also be hunted in the spring when they emerge from hibernation, or in the late summer when feeding on berries (Jochim 1976:99). Wolves have difficulty moving in deep snow and are more vulnerable at this time and they can also be hunted in the summer at their dens. Lynx often travel along the same tracks where they can be trapped. Brown bear has been identified at both Skipsheller and Viste, wolf at Skipsheller and lynx at Viste (Table 1). The number of wolf and lynx fragments are minimal, but bear is well represented, particularly at Skipsheller.

Small mammals. A variety of smaller mammals may have been present during the Atlantic Period in western Norway including beaver, wolverine, badger, otter, wildcat, red fox, arctic fox, hare, weasel, pine marten, European polecat, snow weasel, squirrels and various small rodents. The small rodents were not likely hunted and will not be considered further. All of the other small mammals were most likely hunted for their furs; beaver, otter and hare were probably also hunted for food. Hunting methods varied but must have centered around the use of snares, traps and dead falls. Not all of these species are present in the three cave sites (Table 1). Wolverine is not represented at all. Only a few fragments of beaver, badger, wild cat, mountain fox, European polecat and hedgehog were identified and they were only present at Viste. The number of identified fragments of red fox, hare, weasel and squirrel are so small that these are not considered important resources. Only otter and pine marten are well represented, otter at all three of the sites and pine marten at Viste and Skipsheller.

Otters live near saltwater on the coast or along rivers from the outer coast to the fjord valleys. Unlike other fur-bearing mammals the quality of its fur is similar throughout the year and no special hunting season is suggested. The meat of otter can also be eaten. Otters are stationary and often use regular paths, making them easy to capture. In the more recent past, ownership of places frequented by otter was regulated (Heggberget 1990:174). Pine marten live in the forests of the inner coast and fjord valleys and are not present on some of the coastal islands. They change to a winter fur in October. Like otter, they are creatures of habit and relatively easy to capture.

3.3 Fish

Fish are primarily caught for food and perhaps in some cases for their liver/oil. They are captured in a wide variety of ways. Bow and arrows, spears, leisters, hook and line, traps, fish weirs and nets are examples of some of the tools used. Of the artifacts recovered from Atlantic Period sites in western Norway only bone hooks, gorges and soapstone weights are specifically related to fishing. Although nets and traps from other parts of Scandinavia are known from this time Period, and these were likely used in western Norway, none have been found preserved in this region.

Fish have been divided into the following groups: codfish, pelagic fish, anadromous fish, other fish, and shellfish and crustaceans. The only lake fish likely to have been important was freshwater trout. Fragments of freshwater trout have been identified at two sites on Hardangervidda and are associated with occupations dating between 6250-4920 BP (Indrelid 1986:272). Table 6 lists all fish species thought to have been available in the Atlantic Period in western

Table 6

Fish available during the Atlantic period, western Norway

English name	Size cm.	region available* oc	ic	f	m	depth	comments
blue ling	150	x	x	x		deep	fished, like ling
ling	130	x	x	x		deep	fished
grenadier	100	x	x	x		deep	few available
hake	100	x	x	x		deep	fished
pollack	100	x	x			shallow	fished
haddock	90	x	x	x		shallow	fished
cusk	90	x	x	x		deep	fished
coalfish	90	x	x	x		shallow	fished
cod	80	x	x	x		shallow	fished
greater forkbeard	60	x	x			deep	few
whiting	50	x	x	x		shallow	fished
three bearded rockling	50	x	x	x		shallow	few available
blue whiting	50	x	x	x		deep	few available
tadpole-fish	30	x	x			shallow	few
skate	150	x	x			deep	few fished
long-nosed skate	150	x	x			shallow	few available
shagreen ray	100	x	x			deep	few fished
thornback ray	70	x	x			shallow	fished? not preserved
starry ray	60	x	x			shallow	fished? not preserved
halibut	250	x	x	x		deep	fished
turbot	80	x	x	x?		shallow	few
plaice	50	x	x	x		shallow	fished, brackish water
brill	50	x	x	x?		shallow	more to south & east
lemon sole	50	x	x			shallow	fished
witch	50	x	x	x		both	fished, brackish water
megrim	45	x	x			shallow	more to south
sole	40	x	x			shallow	more to south
flounder	40	x	x	x		shallow	fished, brackish water
long rough dab	35	x	x	x		both	few
dab	30	x	x	x		shallow	fished
spotted catfish	200	x	x			deep	few, more to north
tope	170	x	x			shallow	few, fall/winter
conger eel	150	x	x			shallow	few available
rabbitfish	120	x	x	x		both	few available, liver
wolffish	120	x	x	x		shallow	fished
l. spotted dogfish	80	x	x			shallow	few
black-mouthed dogfish	70	x	x	x		deep	few
angler	60	x	x			both	few available

Continued on next page

English name	Size cm.	region available* oc	ic	f	m	depth	Comments
ballan wrasse	50	x	x			shallow	fished
lumpsucker	50	x	x			shallow	fished Jan.-Sept.
tub gurnard	50	x	x			shallow	few summer from south
eelpout	45	x	x			shallow	few
grey gurnard	40	x	x			shallow	few
redfish	40	x	x			both	fished
bluemouth	40	x	x			both	few
hagfish	40	x	x	x		both	few, not preserved
red mullet	40	x	x			shallow	few, from south
velvet belly shark	40	x	x	x		shallow	few
cuckoo wrasse	35	x	x			shallow	few
greater sand-eel	35	x	x			shallow	available Apr-Nov.
father lasher	30	x	x			shallow	few
norway haddock	30	x	x	x		shallow	few
greater weever	30	x	x			shallow	few, poisonous stinger
snake blenny	30	x	x			shallow	few
five-bearded rockling	30	x	x			shallow	few
dragonet	30	x	x			shallow	few
basking shark	1000	x	x			both	few, summer,liver
swordfish	300	x	x			both	few, solitary, sum-fall
porbeagle	280	x	x			shallow	few, sum-fall
tunny	250	x	x	x		shallow	few, summer
sunfish	250	x	x			shallow	few, fall from south
opah	150	x	x			shallow	few, summer
spiny dogfish	100	x	x	x		both	fished, Nov.-Jan.
garfish	90	x	x	x		shallow	fished, sum-fall
pelamid	90	x	x			shallow	few, summer from south
bass	60	x	x	x		shallow	few, summer from south
thick-lipped mullet	60	x	x	x		shallow	fished, sum-fall from S
larger argentine	50	x	x	x		deep	few, fall/winter
John Dory	50	x	x			shallow	few, summer from south
thin-lipped mullet	50	x	x	x		shallow	few
mackerel	45	x	x	x		shallow	fished, sum, yearly fjords
herring	40	x	x	x		shallow	fished
scad	40	x	x	x		shallow	few, sum-fall from south
skipper or saury	40	x	x			shallow	few, summer irregular
lesser argentine	35	x	x	x		both	few, fall/winter
red sea bream	30	x	x			shallow	few, summer from south
sprat or brisling	20	x	x	x		shallow	fished, sum-fall
sardine	20	x	x			shallow	few, summer from south

Continued on next page

Table 6 - Continued

English name	Size cm.	region available* oc	ic	f	m	depth	Comments
salmon	150	x	x	x		shallow	fished, summer
sea lamprey	100	x	x	x		shallow	few, spring-sum
trout	100	x	x	x	x	shallow	fished
common eel	100	x	x	x		shallow	fished, fall
allis shad	60	x	x	x		shallow	few, summer from south
twaite shad	50	x	x	x		shallow	few, summer from south
river lamprey	40	x	x	x		shallow	few, sum-fall

* oc-outer coast ic-inner coast f-fjord and river valleys m-mountain plateaus

Norway and summarizes their important characteristics. Only the more important species are discussed in detail below.

Codfish. Ling, pollack, haddock, cusk, coalfish and cod are the best represented codfish in the faunal remains (Table 2). Of these, ling and cusk are considered deep water fish and the others are found primarily in shallow waters. Some of the other codfish species are represented in the faunal remains, but the number of identified fragments is small and it is often not clear if they can be associated with the Mesolithic layers.

Ling and cusk are usually found between 100-400 m deep, although younger fish do go shallower. They are found along the outer coast and in the fjords. Ling spawn between March and April and cusk sometime between April and July. Both species are present at all three cave sites. Some of the remains indicate that larger individuals were caught, suggesting that deep water fishing from boats was practiced. Although this was possible it should also be noted that ling is caught more often than presumed in shallower water (Tambs-Lyche 1954:11).

Most of the codfish are bottom feeding fish found shallower in the summer and in deeper in the winter. Haddock is found along the entire coast and is relatively stationary. Coalfish, or saithe, is common off the coast of Hordaland. Until 3-4 years of age, they remain in the coastal area after which they move to the deeper banks of the North Sea. As is true for pollack, they prefer warmer temperatures and higher salt content than do cod. The smaller coalfish known as *pale* (2-3 years old, 30-40 cm long) were the most important species in the local year-round fisheries in the recent past (Bergsvik 1991:23). Small coalfish are also present in the inner fjords in the fall (Tambs-Lyche 1954:10). Pollack are similar to coalfish and their remains are sometimes difficult to distinguish (Olsen 1976:117). Pollack is often found deeper and in smaller groups than coalfish (Hufthammer 1992a:50). The number of pollack present in one area can vary from year to year. There are two different kinds of cod in the region. One is a coastal cod that does not migrate long distances and was present year-round, and the other is known as *skrei*. It migrates south from the coast of Finnmark to spawn in the winter. It is most likely the stationary coastal cod that was caught in Nordhordland as *skrei* remain north of Stad (Fig. 1). Cod tolerate relatively low salt content and temperatures and were present in the inner fjords (Olsen 1976:116).

All six of these most common codfish have been identified at the three cave sites, except haddock which was not present at Grøneheller (Table 2). Whereas cod is the most numerous in the Atlantic layers at Skipsheller, coalfish is more numerous at Grøneheller. Pollack has the third greatest number of bones at both of these sites.

Pelagic fish. Pelagic fish are usually only seasonally available. Spiny dogfish, mackerel and herring are thought to be the more important species present in the Atlantic Period in Nordhordland. Spiny dogfish is the most common shark in southern Norway. It lives in schools at varying depths from 0-600 mbsl and is generally found along the coast and in the fjords in the winter. Schools of mackerel (35-40 cm long) arrive on the coast in the middle of April and remain through the fall. They are found in the inner fjord areas in the fall. Some mackerel can be relatively stationary and overwinter in the deep water of the fjords. Some herring can also be stationary and found year-round in the fjords and on the coast, but large schools of herring come to the area in January. In the early 1900s they spawned between Bergen and Stavanger but their spawning area has shifted gradually north of Stad (Fig. 1). The herring fisheries have varied greatly over the past centuries with decades of good fishing followed by decades of poor fishing. It is uncertain how important herring and the even smaller pelagic fish like brisling and sardine were before commercial fisheries were established. Characteristics of other pelagic fish that might have been present are summarized in Table 6.

Fragments of spiny dogfish and mackerel were found in Skipsheller but it is uncertain which layers these belong to (Table 2). One fragment of spiny dogfish was also identified from phase 1 at Grøneheller. Herring was not identified at any of the three cave sites, but recovery techniques did not involve screening or floating of the soil and small bone fragments of these and other small fish were not likely recovered. The only other pelagic fish identified at these three sites was tunny at Skipsheller. It is uncertain which layer these are associated with.

Anadromous fish. The two most important anadromous fish are salmon and trout. Eel would also have been available.

Salmon begins to ascend some rivers of southern and western Norway as early as the end of March. Salmon fishing starts as early as the middle of April in the Os river near Bergen (Fig. 2). The larger individuals ascend the rivers first, and towards the end of June the salmon that have been in the ocean for one year ascend the rivers in large numbers. Ocean trout live in freshwater for the first 2-5 years. When about 12-18 cm long they move to saltwater where they remain in the shallow parts of the fjords and along the coast. Between July and September trout ascend rivers to spawn. Some overwinter in the ocean. Common eel is present in western Norway along the coast and in freshwater. They are catadromous, spawning in the ocean, in the Sargasso Sea. They are available from May to October at which time they begin their spawning migration.

Salmon and sea trout are very similar osteologically and are often not identified to species. They were present in the remains from Skipsheller as was one fragment of eel (Table 2). It is uncertain which layer these are associated with. No anadromous fish remains were identified at Grøneheller or Viste.

Other fish. Other fish that may have been exploited or are represented in the faunal remains from that period include: rays or skates, flounders, rabbitfish, wolffish, angler, conger eel, wrasses, lumpsucker, gurnards, and father lasher. Characteristics of these species are summarized in Table 6. None of these are well represented in the faunal remains from these sites and suggest that they did not play the same role as did codfish (Table 2). A few fragments of some species of flounder, four fragments of cuckoo wrasse and one wolffish fragment were identified at Skipsheller, although it is uncertain if these are associated with the Mesolithic layers. Conger eel, wolffish, ballan wrasse and cuckoo wrasse are present at Viste. Only one fragment of ballan wrasse was identified from phase 1 at Grøneheller. It is possible that some of the cartilaginous fish like sharks, skates and rabbitfish are underrepresented as cartilage does not preserve as well as bone (Olsen 1976:123). Likewise, some of the smaller fish are underrepresented because of the recovery techniques used.

Shellfish and crustaceans. Characteristics of the major species identified at sites or thought to have been present are presented in Table 7. None of these are considered primary resources, although they were certainly exploited on occasion. Crabs, lobsters, squid and octopus all could have contributed to the diet. Although none of these have been identified at the sites in western Norway, it is not likely that their remains would have survived.

Table 7
Shellfish, crustaceans and cephalopods available during the Atlantic period, western Norway

English name	Size kg.	Region available* oc	ic	f	m	comments
squid	100	x	x			pelagic, common fall/winter
northern squid	100	x	x			pelagic, summer and fall
lobster	30	x				demersal, shallow
edible crab	20	x	x			demersal, shallow, fall
octopus sp.	15	x	x			demersal, several species
dublin bay prawn	15	x	x	x		demersal, shallow
deep-sea prawn		x				common, shallow and deep
	cm.					
horse mussel	20	x	x	x		shallow
scallop	17	x				shallow
oyster	15	x				shallow
freshwater mussels	15	x	x			rivers pearls found
black quahog	12	x	x			shallow
mussel	12	x	x	x		shallow
cockleshell	6	x	x			shallow
periwinkle	<1	x	x	x		shallow
dog whelk	4	x	x			shallow
limpet	6	x	x			shallow

* oc-outer coast ic-inner coast f-fjord and river valleys m-mountain plateaus

By far the most numerous of all shellfish present in the three cave sites were mussels (Table 4). These would have been of greatest food value if harvested between September and April. In Norway, oysters are at the northern end of their distribution, and their populations were probably greater during the warmer Atlantic Period. They were found at all three of the cave sites. Three other shellfish identified include periwinkle, limpets and cockleshell. The last of these was only present at Viste.

3.4 Birds

Birds and their eggs were primarily sought as a source of food. Some birds also provided warm down feathers and the feathers of others, might be used to fletch arrows. A variety of methods existed for hunting the different kinds of birds, including bow and arrows, slings, snares, nooses, nets, wooden throwing sticks, clubs, hooks, bait, and dogs (Clark 1945:120). Birds were most vulnerable while nesting or molting. The number of bird bones recovered from all sites is minimal compared to that for fish and mammals and they are assumed to have had less of an influence on subsistence and settlement patterns. A great variety of birds were found in this area and their characteristics are presented in Table 8. Included is the season they were most likely hunted, the physiographic region they occur in, and other special characteristics. Only the more important species are discussed below and they have been grouped as seabirds, water birds, game birds, birds of prey and land birds.

Seabirds. Seabirds available in this region include petrels, gannets, cormorants, shags, skuas, gulls, terns and

Table 8
Birds available during the Atlantic period, western Norway

English name	Size cm.	Region* oc	ic	f	m	Season available	Comments
gannet	100	x				winter	nests to north
fulmar petrel	46	x				fall, winter	nects to north
cormorant	91	x	x	x		spring, fall +	nests to north&coast
shag	75	x				all year	nests to north&coast
long-tailed skua	55				x	May-Oct	nests in mountains
Arctic skua	50	x	x			Apr-Nov	lays eggs May/Jun
great black-backed gull	70	x	x			all year	lays eggs Apr/May
herring gull	63	x	x			all year	lays eggs May
common gull	45	x	x	x		all year	lays eggs May/Jun
kittiwake	44	x				fall, winter+	nests to north
common tern	42	x	x			Apr-Sep	lays eggs May/Jun
Arctic tern	37	x	x		(x)	May-Sep	at southern limits
great auk	70?	x				May-July	lays eggs Jun
common guillemot	46	x	x			fall, winter	nests to north
razorbill	44	x	x	x		all year(-)	nests to north&coast
black guillemot	36	x	x			all year	lays eggs May/Jun
puffin	35	x				all year(-)	nests to north&coast
whooper swan	152	x	x			Oct-Apr	nests to north
bean goose	85					spring, fall	nests to north
greylag goose	83	x	x			Mar-Oct +	lays eggs Apr/May
pink-footed goose	76	x	x			spring, fall	nests to north
barnacle goose	72	x	x			spring, fall	nests to north
brent goose	64	x	x			spring, fall	nests to north
eider duck	67	x	x	x		all year	lays eggs end of May
long-tailed duck	60	x	x	(x)	x	all year	nests-mtns wntrs-cst
velvet scoter	59	x	x	(x)	x	all year	nests-mtns wntrs-cst
common scoter	54	x	x	(x)	x	all year	nests-mtns wntrs-cst
scaup	51	x	x	(x)	x	Mar-Nov+	nests-mtns wntrs-cst
goldeneye	49	x	x		x	Sep-Apr +	nests to north & east
tufted duck	46	x	x			Sep-Apr +	nests to north
gossander	72	x	x	x		all year	nests-inlnd wntrs-cst
red-breasted merganser	62	x	x	x		all year	nests-inlnd wntrs-cst
merganser (smew)	46	x	x			Oct-Apr	nests to north
shelduck	71	x	x			Mar-Oct	lays eggs Apr/May
pintail	76	x	x	x	x	Mar-Oct +	nests to north
mallard	63	x	x	x	x	Mar-Nov+	lays eggs in Apr
wigeon	51	x	x	x	x	Mar-Nov+	nests inland
shoveler	50	x	x			Apr-Oct	nests north & south

Continued on next page

English name	Size cm.	Region* oc	ic	f	m	Season available	Comments
teal	39	x	x	x	x	Mar-Nov+	nests-inlnd mig-cst
black-throated diver	68	x	x?	x?	x	Mar-Oct +	nests-mtns wntrs-cst
red-throated diver	61	x	x	x	x	Oct-Feb.	nests to north
great-crested grebe	50	x	x			fall, winter	nests to south
red-necked grebe	48	x	x			Aug-Apr	nests to south
heron	106	x	x			Mar-Oct +	lays eggs Mar/May
bald coot	44	x	x			Oct-Apr +	nests to north
moor hen	33	x	x			Mar-Dec +	lays eggs Apr/May
corn crake	28	x	x			May-Oct	lays eggs May/Jun
common curlew	64	x	x	x		Mar-Sep+	lays eggs Apr/May
whimbrel	49	x	x			Apr-Sep	nests to north
oyster catcher	46	x	x			Feb-Aug +	lays eggs May/Jun
bar-tailed godwit	43	x	x			Aug-Oct	seen when migrating
lapwing, peewit	35	x	x	x		Mar-Nov+	lays eggs Apr/May
reeve	33	x			x	May-Oct	nests-mtns mig-cst
grey plover	30	x	x			Aug-Sep+	seen when migrating
great snipe	30				x	Apr-Oct	nests to north & mtns
golden plover	29	(x)	x	x	x	Apr-Oct	nests-mtns few on cst
common snipe	29	(x)	x	x	x	Apr-Oct	lays eggs May/Jun
dotterel	25			x	x	May-Sep	nests in mountains
redshank	25	x	x	x	x	Apr-Sep	lays eggs May/Jun
sea dotterel	25	x	x			Mar-Sep+	lays eggs Jun
purple sandpiper	23	x			x	all year	nests-mtns wntrs-cst
red-backed sandpiper	21	x			x	Apr-Oct	nests-mtns mig-cst
woodcock	21	x	x	x		Mar-Nov+	nests in woodlands
common sandpiper	21	x	x	x	x	May-Sep	lays eggs May/Jun
capercaillie	98		x	x		all year	mating game Mar/Apr
black grouse	59	x	x	x		all year	mating game Apr/May
willow grouse	44		x	x	x	all year	flocks in winter
ptarmigan	41			x	x	all year	flocks in winter
sea eagle	103	x	x			all year	stationary coastal
golden eagle	97	x	x	x	x	all year	mountains
eagle owl (horned)	73	x	x	x		Apr-Nov+	lays eggs Apr/May
goshawk	66	x	x	x		all year	forests
snowy owl	60	(x)	(x)	(x)	x	all year	wander to cst in wntr
rough-legged buzzard	56			x	x	Apr-Oct+	nests in mountains
common buzzard	56	x	x			Mar-Oct	nests east,south,north
tawny owl	45	x	x	x		all year	lays eggs Mar/Apr
sparrow hawk	40	x	x	x		Mar-Oct+	mixed forests

Continued on next page

Table 8 - Continued

English name	Size cm.	Region* oc	ic	f	m	Season available	Comments
kestrel	38	x	x	x		Apr-Oct+	lays eggs May/Jun
short-eared owl	38	(x)	x		x	Mar-Oct+	nests to north & mtns
merlin	32	(x)	(x)	x	x	Apr-Oct+	nests-mtns wntrs-cst
raven	71	x		x	x	all year	in mtns, rocky csts
crow	52	x	x	x	x	all year	winter flocks on cst
magpie	50	x	x	x	x	all year	winter flocks on cst
ring dove	43	x	x	x		Mar-Oct	more to east and north
green woodpecker	37	x	x	x		all year	mixed deciduous
nutcracker	37		x	x		all year	coniferous, hazel
cuckoo	36	x	x	x	x	May-Sep	lays eggs in Jun
grey-headed woodpecker	34	(x)	x	x		all year	higher lying forests
ring ouzel	29	x	x	x	x	Apr-Nov	open landscape
white-backed woodpecker	28	x	x			all year	mixed deciduous
blackbird	28	x	x	x		Mar-Nov+	open deciduous
fieldfare	28	x	x	x	x	Mar-Nov+	deciduous, fall flocks
gtr spotted woodpecker	27	x	x	x		all year	coniferous woods
starling	25	x	x	x	(x)	Feb-Oct+	flocks when not nesting
song thrush	23	x	x	x		Apr-Oct+	coniferous woods
waxwing	22	x	x	x	x	Oct-Apr	nests to north
dipper, water ouzel	22	x	x	x	x	all year	waterfalls & rapids
skylark	21	x	x			Feb-Oct+	lays egg Apr/May,Jul
redwing	21	x	x	x		Mar-Nov+	few overwinter

* oc-outer coast, ic-inner coast, f-fjord and river valleys, m-mountains

auks. Petrels, gannets, skuas, and auks spend most of their time at sea coming on land only to nest or occasionally during winter storms. The other seabirds remain near the coast throughout the year and do not roost at sea. Cormorants, shags and auks are the best represented seabirds in the faunal remains. It is possible that only the eggs of other seabirds were sought. Some seabirds were easy prey while nesting, though they were also probably pursued from boats while foraging on the ocean surface in the fall as was boats while foraging on the ocean surface in the fall as was common in the recent past (Lilleheim 1961:143).

Today, shags are seen throughout the year whereas cormorants are only seen occasionally in the fall and winter. Both species were more numerous in the recent past and small nesting colonies were observed on the outer coast of western Norway (Helland 1921). Cormorants can be found farther inland along the fjords whereas shags are more restricted to the coast.

The great auk, which is now extinct, remained on land in breeding colonies for about 50 days in June and July (Harris and Birkhead 1985:197) when they were particulary vulnerable. It does not seem likely that the great auk bred in Hordaland in the past, however a breeding colony is postulated farther south, near Viste cave (Fig. 4) where over 25 % of the identified bird bones were of great auk (Hufthammer 1982:49). The puffin is the most common auk in Norway and some smaller breeding colonies occur on the outer coast of Hordaland, though larger breeding colonies are more common both to the north and south of Nordhordland. The common guillemot, black guillemot and razorbill nest in colonies farther north. They can overwinter in flocks on the islands and inner coast of Hordaland and are present in the area from about August to March. All of these have been noted nesting in Hordaland in the recent past (Helland 1921). This is particularly true of the black guillemot which generally nests in smaller colonies. The dovekie is only an occasional winter visitor.

Shags, cormorants, great auk, common guillemot and razorbill were identified at all three cave sites (Table 3). Black guillemot was identified only at Skipsheller which is located farther inland and puffin was identified at the two coastal cave sites Grøneheller and Viste. Of the other seabirds, petrel, gannet and kittiwake were only identified at Viste which is the most southerly of the three sites. The skeletal remains of gannet and fulmar petrel found on archaeological sites in Norway is fully discussed by Montevecchi and Hufthammer (1990). Surprisingly few bones of gulls have been recovered from these three sites. It is suggested that gulls were sought for their eggs. No species of skua or tern were identified at any of the sites.

Water birds. There is a great variety of these kinds of birds present in the area. More specific information concerning each species is provided in Table 8.

Although the following birds nest in different physiographic regions, they all can be found somewhere in the Nordhordland region (including the adjacent mountain plateau) throughout the year. Eider duck is in the area year-round along the outer and inner coasts and they nest in the early summer. A variety of birds nest on the coast and although some migrate in the winter others are known to overwinter in this area. Included in this category are the heron, greylag goose, shelduck, red-breasted merganser, gossander, the rails and some of the shorebirds (oyster catcher, lapwing, wimberel, redshank, common sandpiper, sea dotterel, woodcock, common snipe). Of these, the gossander can be found farther inland along the fjords. Another group of birds nest farther inland near lakes or ponds and some of these migrate in the winter whereas others overwinter in the area. Included in this category are the mallard, shoveler, teal, wigeon and black-throated diver. Yet another group of birds nest in the mountains (some farther north) and overwinter on the coast. After nesting, the males leave for the coast in June or July at which time they molt and the females arrive on the coast around September. This group is comprised of the long-tailed duck, velvet scoter, common scoter, goldeneye and some of the shorebirds (great snipe, dotterel, purple sandpiper, red-backed sandpiper, golden plover).

The whooper swan, tufted duck, merganser and great-northern diver, red-throated diver all nest farther north and are present in this area in the winter from about September to March. The bean goose, brent goose, scaup and some of the shorebirds (grey plover, knot, reeve, bar-tailed godwit) are primarily seen in this area during their fall and spring migrations although some may overwinter in this area. Some scaup nest in the mountains of southern Norway, and the bean goose is only rarely seen today. There are also a number of species that nest farther south or east and overwinter in this area. Included here are the great-crested, red-necked and black-necked grebes and the shoveler.

Whooper swan is the only one of the water birds that was identified at all three cave sites (Table 3) although the identification at Grøneheller is tentative. Eider duck was identified only at the two coastal cave sites Grøneheller and Viste. Grebes were only identified at Viste. Some of the ducks and divers were identified at both Skipsheller and Viste including the common scooter, velvet scoter, red-breasted merganser, mallard, teal, and red-throated diver. A variety of other water birds were identified only at Skipsheller but it is uncertain which layer these are associated with.

Game birds. Four game bird species were probably present in Nordhordland during the Atlantic Period (Table 8). Black grouse is the most common in Hordaland today and it is associated with the coast. Capercaillie is more common farther inland and willow grouse and ptarmigan are associated with the mountains. They all tend to flock in the late fall/winter. The black grouse and capercaillie have mating games in the same place year after year. Capercaillie mates in March and April and black grouse slightly later. Both would have been more vulnerable at this time or in the winter when they gather in larger flocks. Ptarmigan is found at slightly higher elevations than the willow grouse. Both willow grouse and ptarmigan are more dispersed during the mating season from about March through May, and they both have white winter feathers from November to March. Today, mountain game birds are hunted from September to February. All four of these game birds are represented in the remains from Skipsheller (Table 3). Capercaillie was also identified at Viste.

Birds of Prey. There must have been a certain amount of prestige associated with capturing some of the birds of prey. The characteristics of birds of prey thought have been present are shown on Table 8. The sea eagle is a relatively stationary coastal bird and is seldom seen in the fjords. The golden eagle is seen farther inland particularly in the mountains of southern Norway, though it may have overwintered on the coast. Goshawk is present in Hordaland and is found dispersed in wooded areas. The rough-legged buzzard, sparrow hawk, kestrel, and merlin are usually present in this area from about April to October although some do overwinter. The rough-legged buzzard prefers open landscapes, sparrowhawks mixed forests and uneven terrain, kestrels are not found in the mountains and merlins are associated with the birch/willow zones of the mountains. Today, the common buzzard is more closely associated with eastern Norway. Four owl species are present in the area. The eagle owl and tawny owl are common in the forests of Hordaland. The snowy owl and short-eared owl nests in the mountains and can overwinter along the coast. The short-eared owl often migrates for the winter.

Sea eagle was the only bird of prey identified at all three sites (Table 3). The tawny owl was present at both Skipsheller and Viste. Those species found only at Viste were the golden eagle, goshawk, rough-legged buzzard, common buzzard and snowy owl and those species identified only at Skipsheller were the sparrow hawk and merlin.

Land birds. The other land birds will not be considered but their characteristics are presented in Table 8. Crow was identified at both Shipsheller and Viste (Table 3). Raven, starling and one of the thrusts were identified only at Viste. The ring dove, cuckoo, two species of woodpecker, and four species of thrust were identified only at Skipsheller. It is unclear if these belong to the Mesolithic layers. Thrusts gather in large flocks in the fall and in the recent past gather in large flocks in the fall and in the recent past were trapped and sold for food.

3.5 Plants

Although plants would have been important, not much weight has been given them in this reconstruction as the emphasis has been placed on obtaining detailed information about the faunal resources. In the future more effort is needed to determine the plant resources available and to identify and quantify those present at archaeological sites in western Norway. A starting point might be the detailed information concerning some of the species from Finland (Nunez 1990). The previous chapter described some tree species thought to have been available in the different regions. Especially along the coast and in the mountains there appears to have been more forest cover than is the case today. A variety of wood for fires, construction, and tools was available and plentiful in the Atlantic Period and it is assumed that wood was not as critical a resource as it might have been in the pre-Boreal Period or after deforestation.

Of the edible plant resources the more obvious ones include nuts, particularly hazelnuts, and berries. Charred hazelnut shells are often found in sites from Nordhordland. Hazelnuts are harvested in the fall and can be stored. Hazel trees were associated with the coastal and outer fjord areas and there were fewer farther inland (Kaland and Krzywinski 1978:12). Berries, of which there are a wide variety today, would have been picked in the summer and fall and they must have been an important component of the diet.

3.6 Seasonal and spatial distribution of resources

The above discussion of the available resources provides the basis for determining the underlying spatial and seasonal structure of the food resources in Nordhordland during the Atlantic Period. The composition of the more important resources in each region for each season is outlined and the implications that this distribution has for subsistence patterns is discussed (Fig. 5). Important to bear in mind is that several species of codfish were available year-round from the outer coast to the inner fjords. Otter must also be considered a year-round resource.

Spring. Spring includes the end of March, April and May. The temperature is warmer, snow and ice has melted and ground vegetation has begun to sprout, somewhat later in the mountains than on the coast. In mild winters the ponds on the coast do not freeze and the snow accumulation is minimal. Many of the birds that nest in this area return from their wintering grounds and those that have overwintered here have

Figure 5
Spatial and seasonal distribution of major resources

	OUTER COAST	INNER COAST	FJORD VALLEY	MOUNTAINS
SPRING March April May	seals seabirds game birds codfish small mammals	seals anadromous fish seabirds game birds codfish small mammals	lg. fur mammal anadromous fish game birds	lg. fur mammal small mammals game birds
SUMMER June July August	seals seabirds codfish small mammals	seals anadromous fish seabirds codfish small mammals	anadromous fish berries	small mammals game birds berries
FALL September October	seals deer/boar codfish small mammals nuts berries	deer/boar anadromous fish lg. fur mammals codfish small mammals seabirds nuts berries	deer/boar anadromous fish game birds lg. fur mammals small mammals berries	reindeer game birds small mammals
WINTER November December January February	deer/boar small mammals codfish seabirds	deer/boar small mammals game birds lg. fur mammals codfish	deer/boar lg. fur mammals game birds small mammals	game birds lg. fur mammals small mammals

begun to move north or farther inland to nest. Along the outer and inner coast, seabird eggs are available during the late spring and early summer. The game birds like capercaillie, farther inland, and black grouse, nearer the coast, gather in larger groups for mating games. Harbor seals are found on the skerries. Anadromous fish runs, particularly of larger salmon, begin as early as April and salmon can be captured near the mouths of rivers at the inner coast and in the rivers of the fjord valleys. During the spring, harbor seal is probably the most important resource of the outer coast whereas salmon becomes more important in the inner coast and fjord valleys where it is easier to catch and more concentrated than on the outer coast.

Summer. Summer encompasses the months of June, July and August. This is the warmest part of the year. The resources exploited during the summer months change slightly from those available in the spring, especially towards the end of the summer when fewer species are available on the outer and inner coasts and perhaps a few more are available in the inner fjords and mountains. Game birds are more dispersed and not as easy to capture. Seabird eggs have hatched and young fledglings are available at this time. Harbor seals are still in the area along the coast. They are most vulnerable in June and July when on land to give birth. The anadromous fish runs continue but larger concentrations of smaller salmon ascend the rivers now. Small coalfish are the most likely codfish to be caught at this time. Deer and wild boar are available, especially in the inner coast, but they are more dispersed at this time. The piglets were probably sought now and into the fall. Some berries were probably gathered in the summer as they ripened. Seasonal fish from the south are only available now and flounder and many of the other fish are found in shallower waters. During the summer the resources in the fjord valleys and the mountains consists of anadromous fish in some of the fjord valleys, some game birds and lake fish (trout). In addition, the mountains are the nesting grounds for several duck species. Although reindeer are available in the mountains at this time, they are more valuable in terms of weight and hides in the fall. On the coast, the late summer seems to be the time of year with the least to offer.

Fall. The temperature begins to drop in the month of September and continues to be cool in October. Along the outer coast grey seal may be sought as they are on land to give birth in October and November. However, the extent to which grey seals were available off the Nordhordland coast in Atlantic times is uncertain. In the rivers of the inner coast and fjords the salmon is replaced by sea trout and common eel. Red deer and wild boar are sought in the inner coast and fjord valleys. Wild boar may also have been sought. Some migratory birds are available. They are most valuable in terms of weight at this time, though they may have been easier to catch later after the first snowfall. Evidence from the remains at Skipsheller indicates that young harbor seals were a sought after resource of the inner fjords at this time. Willow grouse and ptarmigan are available in the fjord valleys and mountains, though they may have been hunted later. Reindeer and large fur mammals are more attractive now. Many of the nuts and berries are harvestable. This is the season when there is the greatest variety of fjord valley and mountain resources available.

Winter. Winter is defined as the time of snow cover and includes the months of November, December, January, February and the first part of March. This covers a long time and is better divided into an early and late period. The early period would be a continuing focus on deer and wild boar, but by the end of January, red deer would be less attractive as they have lost weight. Along the coast in the later period there is an influx of herring, but how much this resource was used in the Mesolithic is not known. Fur bearing mammals are most likely to have been sought throughout the winter for their furs. Game birds would be easier to catch in the winter and they could be found from the inner coast and up into the mountains. The late winter months of February and March seem to be the most difficult in the mountains and fjord valleys, whereas the most limiting time on the coast is in the late summer.

3.7 Discussion

It is assumed that the seasonal and physiographic distribution of available food resources structures or constrains, but does not determine, past settlement patterns. It is apparent that Nordhordland during the Atlantic Period was relatively rich in resources, especially on the outer coast, inner coast and lower part of the fjord valleys where a variety of resources were available at all seasons of the year. This allows for much choice and both year-round sedentary settlements and other more transient settlement patterns were possible. Several different physiographic regions were accessible over short distances and these would be easy to use on a logistical basis from year-round base camps. Moving north-south along the coast of Nordhordland would not provide access to any new resources whereas moving from the coast to the mountain plateaus would provide access to a variety of resources. During the spring and early summer the emphasis would be on maritime resources, particularly harbor seals and nesting seabirds, whereas during the fall and early winter the emphasis would be on land resources, especially nuts, berries, wild boar, red deer and possibly reindeer. The various species of codfish and otter offer secure resources throughout the year both on the outer coast and in the inner fjords. Codfish may have been especially important in the late winter which was the most limiting time of the year. From the perspective of a coastal group, reindeer on the mountain plateau appear to have little to offer. Its primary advantage is that it is more predictable and occurs in larger herds than the other ungulates nearer the coast. It is possible that coastal groups from western Norway hunted reindeer in the fall, although this would have conflicted with the best time for hunting wild boar and red deer which were closer at hand. The sites on the mountain plateau may also have been left by groups oriented to the river valleys of eastern Norway or possibly the fjord valleys of western Norway (Indrelid 1986:320).

It should be pointed out that regions to the north, south and east of Nordhordland do have different resources to offer and the reconstruction would be different for these areas. Today, seabird and particularly grey seal colonies are larger to the north in the provinces of Sogn og Fjordane and Trondelag (Fig. 1). Also, to the south in Rogaland, where Viste cave is located, the resources available were different. Evidence from the faunal remains at Viste indicate local bird and grey seal colonies and perhaps more moose were present, at least in the early Atlantic Period. Farther east, on the other side of the mountain plateau, the composition of the resources and the physiography is quite different. Here, long river valleys and lakes make the transition from the coast to the mountains much more gradual. Moose, roe deer, beaver and a variety of lake fish are some of the other kinds of resources available here. The sites in these areas probably represent neighboring bands with whom contact was maintained and it is likely that some of these areas were visited by individuals or groups from Nordhordland.

In conclusion, the resources in Nordhordland were varied and rich and would have allowed for a variety of settlement patterns including both year-round sedentary occupations along the outer and inner coasts, or a more seasonally mobile one. The differences between these settlement systems and the implications they have for site formation processes will be discussed in Chapter 6. Specific implications will be developed to evaluate the faunal, artifactual and feature data from the Atlantic Period components at Kotedalen, a site located in the inner coastal region, to determine the roles it played in the regional settlement system of Nordhordland during the Atlantic Period.

4 SUBSISTENCE AND SETTLEMENT PATTERNS

4.1 Introduction

While inferring the function of small single component sites in regional subsistence and settlement systems can be accomplished with some degree of confidence, based on location, content, size and internal structure, the same is not so true of large multicomponent sites where more complex site formation processes are in operation (Lyman 1982:367). Is it the size of the group using the site, the length of occupation, the repetitive use of the site, the kinds of activities, or some combination of the above that result in its size and complexity? This does not mean that these types of sites should be ignored. On the contrary, an understanding of their role in the regional subsistence and settlement system, no matter how tentative, is essential.

The following discussion will integrate recent trends in modelling hunter-gatherer subsistence systems and interpreting site-specific data to arrive at more specific implications for determining length of site occupation, the degree of repetitive use, site activities and function, and group size. The goal will be to arrive at implications that can more confidently distinguish a residential camp occupied on a year-round basis from one occupied seasonally.

4.2 Models

Previous models for the Late Mesolithic of western Norway. Previous reconstructions of the economy during the Late Mesolithic of western Norway are not all similar. Considering that alternative strategies for resource procurement were possible, and the Late Mesolithic spans over 2000 years, it is perhaps not surprising that some differences of opinion exist. Despite these differences, all seem to agree that some degree of semi-sedentary or sedentary settlement existed in some coastal areas of western Norway sometime during the Late Mesolithic.

In the 1970s the large coastal sites and cave sites in western Norway were interpreted as representing year-round sedentary or semi-sedentary base camps, and settlements were oriented to the coast (Jansen 197., Indrelid 1978, Mikkelsen 1978). The smaller sites in the region were interpreted as the remains of short-term occupation by smaller groups accomplishing specific tasks, or obtaining access to more distant resources (Indrelid 1978:170; Mikkelsen 1978:110-111). These interpretations were based on the coastal orientation of Mesolithic sites, the variety of faunal remains from the cave sites, the kinds of fauna depicted on rock carvings (Indrelid 1978), ethnographic analogy (Mikkelsen 1978) and the seasonal availability of resources (Mikkelsen 1978).

Indrelid suggests that red deer was the predominant land mammal taken and as it was a relatively stationary species, base camps would not need to be relocated on a yearly basis (1978:169). Mikkelsen reconstructs a seasonal availability chart of resources based on the faunal remains from Viste (Mikkelsen 1978:91) and both conclude that the mixture of land and marine resources located in the coastal areas was sufficient to support year-round occupation with no need to travel farther inland during any season (Indrelid 1978:169, Mikkelsen 1978:115). Most of the Late Mesolithic sites on the mountain plateau are thought to be associated with groups from southeastern Norway (Indrelid 1978:170, 1986:373). He also suggests that some of the Middle Mesolithic (ca. 8500-7000 BP) sites in the northern part of the mountain plateau might be the remains of groups with an interior adaptation (ibid.). However, there is also evidence based on raw material distributions for contact or movement between the west coast and the mountains (Mikkelsen 1978:115; Bjørgo 1981:153).

Research in the early 1980s continued to focus on interpreting the large coastal sites (Bjørgo 1981, Ågotnes 1981, Bostwick Bjerck 1987), but more emphasis was placed on the evidence from the fjord valleys that indicated this area was used more intensively than previously assumed (Bjørgo was used more intensively than previously assumed (Bjørgo 1981, Bruen Olsen 1981, Alsaker 1987, Gjerland 1985).

A number of large Late Mesolithic sites with thick layers and a variety of artifacts were excavated in the inner coastal area (Bjørgo 1981, Ågotnes 1981). Bjørgo suggests that the sites on Flatøy (Fig. 2) may have been used both in the summer and in the winter and although there is no clear evidence for winter occupation, he argues that the coastal resources would have been the most predictable in the winter (1981:161). Ågotnes suggests that the sites at Vindenes (Fig. 2) had been used for a long time, but not necessarily by a sedentary group (1981:39-41). Palynological evidence from two of the Vindenes sites and a nearby bog support this interpretation and suggest that for the latter part of the Late Mesolithic there was either frequent, regular or long-term permanent occupation at these coastal sites (Bostwick Bjerck 1987:145).

Stray finds and limited site surveys indicate that Mesolithic sites are also found along the fjords (Bjørgo 1981:155, Bruen Olsen 1981:187, Alsaker 1987, Gjerland 1985). A more seasonally mobile settlement pattern between the inner fjord and mountains and between mid-fjord and coast was proposed (Bruen Olsen 1981:157, 1988:155, Alsaker 1987:98). Others propose a model in which the remains in the inner fjord and mountains are left by groups whose primary base is at the coast (Gjerland 1985:76, Bjerck 1987:7). Based on the small number of stone artifacts and its location in the inner fjord area, the remains from Skipsheller are reinterpreted to represent a short-term camp used repeatedly during moves between the coast and inland, or perhaps as a meeting place or for some other special activity and not as a residential camp (Bjørgo 1981:141).

As more sites were identified, excavated and radiocarbon dated the ability to be more specific both spatially and temporally increased. From the late 1980s to the present, the emphasis has been on evaluating settlement pattern changes throughout the Mesolithic and into the Neolithic (Bruen Olsen 1988, 1992; Nygård 1987, 1989, 1990; Bergsvik 1991). Nygård interprets the scanty site data available for western Norway between 8000 and 7000 BP as a continuation of the more mobile settlement pattern she sees from the Early Mesolithic (Nygård 1987:153). The only difference is that the sites are slightly larger. The stray finds and few sites known from the interior, when compared to the those found on the coast, suggest only limited use of the fjords at this time (Nygård 1989:85, 1990:233).

After about 6500 BP, the number of sites increases, large sites with thick cultural layers are common on the coast (i.e. Flatøy, Vindenes), single occupation sites are found on the outer coast, inner coast and mainland, the number of stray finds along the fjords increases and there is evidence that some of the sites in the mountains are connected with the west coast (Mikkelsen 1978:110, Bjørgo 1981:146, Nygård 1991:233). This distribution of sites continues into the Early Neolithic (Nygård 1989:85). She provides three alternative settlement patterns that would explain this distribution. The large coastal sites are evidence of permanent or semi-permanent groups who are also responsible for the smaller sites throughout the entire region. Alternatively, some groups of people remained on the coast year-round and others were more seasonally mobile using both the coast and inland areas. The third alternative is that some groups had a coastal orientation and were responsible for the large and small sites near the coast and others had primarily an inland adaptation using the fjords, river valleys and mountains (ibid:234).

Bergsvik has recently proposed two alternative models for the subsistence and settlement systems for the Late Mesolithic in western Norway (1991:260). Both are flexible and would leave a variety of sites in the landscape. One model is referred to as "logistical settlement mobility" (my translation) which combines aspects of both foraging and collecting strategies where the residential camp is relocated at least once a year to locations favorable for acquiring an important resource, but at the same time logistical task groups from these base camps acquire other resources (ibid:40). The other model is called the "diffuse sedentary model", the major difference being that a group lives year-round at the residential camp. He concludes that either one of these models is possible and they both could have been in operation at the same time (ibid:261). These models were evaluated with data acquired from an intensive testpit survey of the area in the immediate vicinity of Kotedalen and included an analysis of the geographical criteria for site location from the Early Mesolithic through the Neolithic in this area (Bergsvik 1991). The results from this study for the Late Mesolithic have a direct bearing on interpreting settlement patterns in Nordhordland during the Atlantic Period and will be discussed more fully in Chapter 7.

All of these suggest some degree of sedentary or semi-sedentary settlement in coastal areas during the Late Mesolithic and that several alternative subsistence and settlement models are not only possible but probable. As of yet, no sites occupied in the winter have been definitely identified, although many suggest that the inner coast is a likely area to find such sites. Three scenarios, based on the models outlined above and the regional reconstruction of the resources (Chapter 3) are presented.

Sedentary year-round occupation. Sedentary year-round occupation was possible near good fishing locations in the inner coastal regions. Task group forays to inland areas in the fall and early winter to hunt deer and wild boar were possible, though not necessary, as these species were available near the coast. Such forays may have been more necessary as the length of stay (in number of years) at a sedentary settlement increased and the non-migratory resources in the immediate area were depleted. A residential move to another good fishing location in the inner coastal area would solve the same problem. Nuts, primarily hazelnuts, and berries were harvested in the late summer and fall and probably stored for the winter. The main part of the winter diet was fish and possibly otter captured locally, together with stored nuts and berries. During the winter months, smaller groups may have taken trips farther inland to hunt fur mammals and possibly replenish meat supplies. During spring and early summer the orientation shifted to the outer coasts to hunt seal and perhaps collect eggs and, depending on the distance from the residential camp, temporary camps may have been used. Given the variety of fish available at the coastal residential camp, it seems less likely that trips to the rivers to fish salmon were undertaken at this time. During the summer, people fished near the residential camp and wild boar piglets may have added variety to the diet at this time. Year-round base camps might also have been established at the heads of the fjords where the resources emphasized at each season would have been slightly different from a coastal residential camp. Salmon would be more important in the late spring and summer, harbor seal in the fall, and game birds in the winter and possibly spring. Fish would have been the stabilizing year-round resource at these camps and just as groups at the coast might have used the inner fjords in a logistical fashion, the coastal resources would have been available to year-round base camps in the inner fjords.

Repetitive seasonal occupation. A somewhat similar pattern would be centered around seasonal habitation at a winter residential camp at the inner coast. A residential move in the spring/early summer to either the outer coast to hunt seal and seabirds or to the mouths of salmon fishing rivers was possible. Another residential move was possible in the fall/early winter. This might have involved a move to hunting grounds farther inland, possibly into the mountains or perhaps a return to the winter residential camp. This pattern, if repeated over a number of years would result in more permanent use of a region. In many ways such a semi-sedentary pattern approaches y· r-round sedentism, especially when the number of residential moves per year is limited. The only difference is that the entire group instead of just a part of the group is involved in moving. The implications for social organization and complexity that both of these patterns have is not significantly different and perhaps what is important in both is the attachment to a specific region and the repetitive use of specific places (Engelstad 1990).

Seasonal occupation. Alternatively, seasonal mobility may have been less redundant and the length of stay at each residential camp reduced. For the spring and early summer, base camps would most likely be found at the outer coast, possibly at river mouths. In the summer base camps would probably be located in the inner coast near food fishing places. In the fall and early winter, base camps would be located farther inland and possibly in the mountains, and in the late winter a move back to a good fishing location would be reasonable. Other combinations are possible including a yearly round oriented towards coastal areas or between the inner fjords and mountainous areas.

4.3 Intrasite implications

A number of different implications for identifying base camps occupied by a sedentary group have been suggested in the literature (Rafferty 1985, Chatters 1987, Rowley-Conwy 1983). These have varying degrees of applicability to this particular region at this particular time. I will concentrate on those applicable to the data available for the Late Mesolithic components at Kotedalen and discuss a few that may be useful in a regional synthesis of the Late Mesolithic in Nordhordland.

The base camps described above can be thought of along a continuum from permanent year-round occupation to repetitive seasonal occupation to seasonal occupation. Although it is difficult to distinguish between base camps occupied year-round and those occupied repeatedly for most of the year, it should be possible to distinguish between these kinds of sites and sites occupied primarily during one season of the year, especially if there are good faunal collections from the sites. Likewise, it should also be possible to compare the evidence from two base camps and conclude where along the continuum they should be placed relative to one another. The following discussion is oriented towards determining the data classes useful for answering the following questions. Do the occupations dated to the Atlantic Period from Kotedalen represent base camps occupied on a year-round permanent basis, base camps occupied repeatedly for several specific seasons, base camps occupied occasionally for only one seas(, or do they perhaps represent some other special purpose camp?

The kind of data available to evaluate these questions include various characteristics of site location, stratigraphy, age, features, artifacts, fauna assemblage and on-site pollen diagrams. Evidence from all these categories will be combined to get an overall understanding of the cultural and natural site formation processes. None of the indications summarized below are sufficient for establishing year-round occupation. However, when several lines of evidence point in the same direction a much stronger argument can be made (Rafferty 1985:136).

Location. An evaluation of the site location on both a regional and a local level can, in some cases, assist in distinguishing year-round residential camps from seasonal ones. In the former the camp should be situated with access to either a year-round resource or easy access to a variety of resources available at different seasons. Its location should take into account a number of geographical considerations and represent a good compromise. In contrast, a seasonal camp should be located to acquire one or two seasonally available resources and fewer geographical factors will be considered important in its location (Bergsvik 1991:227). As noted in the scenarios above good fishing locations in the inner coastal region would be a likely place for either a seasonal or a year-round residential camp. In contrast, a location along the outer coast or on the mountain plateau would be less desirable as a year-round residential camp, but appropriate for seasonal base camps. Site location is an important consideration for regional studies, but is not elaborated in this thesis because the location remains constant for the different occupations at Kotedalen.

Size and thickness. Generally, the longer the stay at one location the greater the amount of trash produced (thicker), and the wider the range of activities represented (larger) (Yellen 1972, Schiffer 1978:233, Chatters 1987:345). However, there are other factors that have a bearing on site size and thickness. One of these is the size of the group using the site. Another is the position a site has within subsequent seasonal rounds. A site visited during different seasons can leave an archaeological record similar to one occupied throughout the year (Binford 1982:15). It is also possible that a site used as a year-round residential camp over a number of years can subsequently be used as a seasonal camp. There are a number of complex factors that affect site size and thickness and considered alone they are not adequate measurements for distinguishing between base camps of varying duration, though they may be helpful in distinguishing base camps from other special purpose camps (Bergsvik 1991:67). Small sites or ones without cultural layers are easier to interpret. However, as site size and layer thickness increases, interpretations become more speculative as there are more factors involved in the cultural site formation processes. Site size is primarily influenced by the number of people present, the kinds of activities undertaken and the degree of repetitive use, whereas site thickness is more a reflection of the duration of occupation and the degree of repetitive use. Large sites with thick occupation layers are often interpreted as base camps representing at least more than seasonal and usually sedentary occupations (Ågotnes 1981; Bostwick Bjerck 1987; Bjørgo 1981, Nygård 1990, Rowley-Conwy 1983:120, Rafferty 1985:135). Although large size and thick layers provide indications of longer duration, it is not always clear whether the time span represented is the result of continuous or repeated occupations and implicit in these interpretations is also an evaluation of the variety of artifacts, the kinds of features found, the faunal remains present and the nature of the soil matrix. Although site size and thickness can contribute to an understanding of site duration, they need to be evaluated critically and certainly not used without the support of other lines of evidence.

Features. The presence of certain features such as indoor and outdoor hearths, substantial dwellings, storage facilities, formal dumps and middens all provide additional clues to sedentary year-round occupation. Not only the presence of these features can be helpful but their discreetness and degree of preservation can be useful in interpreting the duration of occupations. A feature created and used once or twice should be more discrete (easier to identify) than one used longer or repeatedly (Chatters 1987:346). It seems reasonable to assume that repeated occupation may be more disruptive to feature distinctiveness than year-round occupation because of the greater probability for spatial non-conformity. This is especially true for more ephemeral features. Although the presence of these features and their non-discreetness can be indicative of year-round or repeated occupations, the absence of these may not be as significant. This absence may just reflect our inability to identify such features or that such features are not preserved in the archaeological record. A lot depends on the kind of feature being evaluated and site formation processes.

Hearths are ubiquitous and would be expected at all types of base camps and at other sites where warmth, light or cooking were required. In a year-round residential camp one would expect to find a variety of both indoor and outdoor hearths whereas a seasonal residential camp would more likely have one or the other depending on the season of occupation (see Binford 1983:157). Outdoor hearths at a year-round base camp are likely to be less discrete than those at seasonal base camps, but this depends on the degree of reuse, and the situations surrounding site abandonment.

More substantial dwellings would be expected at a year-round residential camp, as has been observed both ethnographically and archaeologically (Rafferty 1985:129). Such dwellings are not as likely at a seasonal camp unless the camp was to be regularly reoccupied by the same people or it was occupied primarily during the winter months in an area with a cold winter climate. The absence of dwelling structures may not be significant. For example, dwelling structures related to Mesolithic sites in this part of Norway have been difficult to identify. This is partially because of excavation methods, but it must also have to do with the kinds of construction materials used and how well these or evidence of these are preserved.

Although the presence of storage facilities may be indicative of a year-round residential camp (Rafferty 1985:135), they may also be present at seasonal base camps, particulary ones used repeatedly within a yearly round. The reason for the absence of such features from a site is not as clear. The variety of resources available year-round along the coast of western Norway and the close proximity of other resource regions would mitigate the need for storage facilities. It should also be noted that there are many different methods for storing that may not leave preservable traces in the archaeological record such as organic containers, platforms in trees, or social methods of storage (Weisner 1982).

More formal dumps or middens are expected at year-round camps and would be more likely found at these than at seasonal base camps. However, these too can be present at seasonal camps, especially if such camps were repeatedly used. It is possible that the characteristics of the size, content, and integrity of the middens/dumps might add important supporting evidence. Once again, the absence of such dumps must be interpreted with caution. For example, many of the Stone Age sites in western Norway are along the shoreline and the ocean would have been an appropriate dumping area (Bergsvik 1991:235).

Features at year-round camps are expected to be more diverse, more substantial, and in some cases less discrete than those found at seasonal base camps. However, the absence of features from a particular site may not be significant and must be evaluated in terms of the natural and cultural site formation processes.

Artifacts. Many suggest that the artifacts found at year-round base camps will be varied, dense and numerous (Rafferty 1985:135; Chatters 1987:340), implying that those found at seasonal base camps are less so. This is generally valid, but there are exceptions. For example, a seasonal residential camp near a quarry might produce varied, dense, and numerous artifacts. It is also argued here that the artifacts left at a year-round residential camp should reflect both generalized and specialized activities but with an emphasis on the generalized activities, whereas those left at a seasonal residential camp would more likely be dominated by one or the other of these categories. This argument is based on the idea that in a system with seasonal camps and greater residential mobility, it is more likely that a special purpose camp is also used as a residential base.

Chatters found that although tool diversity was different between spring residence camps (seasonal camps) and hunting camps (special camps), his prediction that the seasonal camp with its longer duration would have greater tool diversity than the hunting camp proved to be invalid (Chatters 1987:341). Instead, he found that the artifacts found at the seasonal camp were less diverse than those at the short-term hunting camp. Torrence (1983) also noted that generalized tasks like those expected at a residential camp can be accomplished with a small number of versatile tools whereas specialized tasks, like those required at a hunting camp require special sets of specifically designed tools (Torrence 1983). Based on these two arguments, and the proposition that seasonal residential camps may incorporate "special purposes", it follows that the ratio of generalized, expedient tools like retouched blades and flakes compared to formal scrapers would be greater at year-round residential camps than at seasonal residential camps.

The presence of large, heavy or breakable artifacts might indicate a year-round camp as a more seasonally mobile group would be less likely to transport and move these (Rafferty 1985:132,134). However, such objects may well be used and left at a seasonal camp especially if the group plans to reoccupy the site. Such items are referred to as "site furniture" (Binford 1979:264), or "appliances" (Gould 1980:71-72). Although year-round occupation may facilitate the accumulation of these kinds of artifacts, their absence does not directly indicate a seasonal camp (Rafferty 1985:132).

The problem with all of these implications is that there are many complex factors that determine what kinds of tools, in what condition get left at a particular location. Considerations concerning the function of stone tools, the meaning of their diversity, their degree of curation, the technological processes and the manner in which they enter the archaeological record need to be taken into account. As was true in evaluating site size and thickness, the best way to evaluate these aspects is to have a better understanding of the variability of artifacts from different site types on a regional level and to develop specific operational definitions for quantity, diversity and density.

Although the artifacts alone may be difficult to use to distinguish different kinds of base camps, considered together with their distributions and the features present, they can provide information concerning site activities, degree of repetitive use and duration of occupation.

Fauna. Characteristics of the faunal remains can be treated in much the same way as the artifacts. The arguments above for artifact quantity, density, diversity, evenness and distribution relative to each other, and the features, all apply to the faunal remains also. The faunal assemblage at a year-round residential camp should be more numerous, more dense, more varied and the different species more evenly represented than those at seasonal camps. The same is true, however for sites reoccupied in different seasons.

Faunal remains are perhaps the singularly most important site specific evidence for establishing the seasonality of occupation, though interpreting this evidence can be more problematic (Monks 1981, Lyman 1982). The seasonality of occupation for the well known site of Star Carr in England is a case in point (Rowley Conwy 1987:76). It has been interpreted as being occupied primarily in the winter and spring (Fraser and King 1954), or as occupied throughout the entire year (Pitts 1979), or as occupied more sporadically throughout the year (Andersen et al. 1981) or primarily occupied in the late spring/early summer (Legge and Rowley-Conwy 1988). In order to interpret seasonality based on the composition of the faunal remains, an understanding of the spatial and seasonal availability of resources is essential. In addition, more specific seasonal evidence as outlined below should be evaluated against the composition of the faunal remains as a whole. The presence of a seasonal indicator at a site does not specifically measure the season of site occupation but the season the animal was killed. There is a good possibility that certain animals or parts of them were transported, exchanged and stored.

The presence of certain migratory species, of specific age groups based on size (Olsen 1976:83) and bone and tooth development (Rowley-Conwy 1987), of fish otoliths (Mellars 1978, Mellars and Wilkinson 1980) and of shell growth-lines (Deith 1983) are all examples of faunal evidence for establishing the season of site occupation. Establishing that a site remained unoccupied during part of the year is much more difficult, and the absence of seasonal indicators has to be critically evaluated. Even with all seasons represented in the faunal remains, one is still left with determining if this represents the remains from groups returning to the site at various times throughout the year or year-round settlement.

An evaluation of the anatomical part frequency (Binford 1978b, Rowley-Conwy 1987:76) and of bone fragment size (Binford 1978b, Chatters 1987:344) for specific species can assist in determining whether the site represents primarily a butchering site or whether the animal was butchered elsewhere. These in turn have implications for whether the site is interpreted as a year-round or seasonal camp.

At present, only the number of fragments identified for specific species is available for the different occupations at Kotedalen and the analysis in Chapter 5 will be based on interpreting the species represented in the faunal remains against the seasonal and spatial availability as reconstructed in Chapter 3. Eventually the fragment size, the anatomical part distribution of certain species and the distribution across the site of the identified elements relative to the features and the artifacts should be used to evaluate the conclusions arrived at here.

Palynology. Pollen diagrams taken from the site and adjacent bogs contain evidence for evaluating the duration of occupation and the degree of impact people had on the immediate environment. Although it is difficult to distinguish between regular, repeated occupation and continuous year-round occupation it is possible to distinguish brief occupations and delineate periods of site abandonment (Bostwick Bjerck 1987:139). Especially when combined with the other lines of evidence, on-site pollen studies can be useful for distinguishing year-round base camps from less intense sporadic occupations.

All of the site-specific indications listed above are useful for determining the type of occupation that left such an assemblage in the archaeological record. Essential for determining the length of occupation, the degree of repetitive use and the site activities is a holistic evaluation of all of these lines of evidence in relation to one another. Once the known occupations from a limited time period have been classified and compared, and specific operational measurements established, we can arrive at a good understanding of the subsistence and settlement system on a regional level and begin to study change through time and incorporate the significance of contact with other regions. Although this will not be attempted here an initial outline of important intersite implications and a sketch at the regional level will be provided.

4.4 Intersite implications

The different types of sites, as defined from intrasite studies and their distribution in the landscape relative to each other and to the resource structure, provides the basis for evaluating the settlement system on a regional level. The following takes a closer look at the different site types expected and their distribution relative to one another based on the three general settlement patterns proposed earlier.

Site types. Several different types of sites are expected within a region no matter which subsistence and settlement system was most prevalent. Apart from the residential camp, which was the focus of the discussion above, there are a great variety of other site types expected, including observation posts, overnight stands, hunting camps, menstrual huts, quarry sites, meeting places, cemeteries, etc. The variety is only limited by the imagination and perhaps the ethnographic record. The common characteristics of these special purpose sites is that they represent short-term occupation (one season or less), though they may have been repeatedly occupied, and that they were not used by a residential group but by either a subset of that group or by several residential groups gathered together. It is possible that in some situations the "special purpose" is incorporated into a residential camp. This would be especially true for seasonally mobile groups where more frequent moves provide more opportunity to locate the residential camp in places adequate for undertaking the "special purpose". In a system with year-round sedentary occupation there should be a clearer distinction on a regional level between base camps and the various special purpose sites, whereas in a system with more residential mobility, and the possibility for the repeated occupation of the same site for different purposes, the distinction between base camps and other site types will be more blurred (Binford 1982:20-21). Likewise, assemblage similarity within each site type would be expected for sites incorporated in a sedentary system as each special purpose site is used repeatedly for the same activity. On the other hand, assemblages from the same site types in a system with more residential mobility would be expected to be less similar as they would have been used for a variety of reasons (ibid., Chatters 1987:343).

One site type often expected once sedentary year-round occupation is established is the cemetery (Rafferty 1985). Cemeteries would also be expected when more permanent use of a place became established. Such cemeteries from the Mesolithic have been found in other areas of Scandinavia (Andersen 1981, Larsson 1980). In western Norway, the only Stone Age burials found to date are a few in caves, though there is also some limited evidence that other forms of burials in or near open sites existed (Bergsvik 1988). At present there are too little data concerning burial practices during the Mesolithic in western Norway to use this criteria, but perhaps this situation will change in the future.

Evidence on the regional level might be able to clarify some of the problems encountered when interpreting the length of occupation and degree of repetitive use, especially if specific relative criteria can be developed within a regional framework to operationalize what is meant by "large" and "thick". It is suggested here that data from short-term, single occupation base camps will be important in this regard, providing the basic building blocks for interpreting some of the multicomponent sites (see Thomas 1984). Small, single component sites are appropriate for intrasite studies as they are simpler in structure and site formation processes are easier to interpret (Indrelid 1973:21). Activity areas can be identified using the features and the spatial distributions of different find categories and a reasonable picture of how the site was used can be obtained (Kristoffersen 1990, Bang Andersen 1987, Blankholm 1987). An understanding of these types of sites is essential for interpreting the multicomponent sites. However, without the comparative data from these larger, more complex multicomponent sites, which exhibit different site formation processes, we will not be able to adequately reconstruct settlement systems. They represent a specific type of site which clearly played a different role in the regional settlement system.

Some initial criteria for defining site types have been proposed for western Norway (Indrelid 1973:24, Kristoffersen 1990:16, Nygård 1990, Bergsvik 1991:185). The number of site types defined depends on the level and aim of the analysis, the number of defining characteristics used, and the type of data available. For example, whereas Bergsvik operates primarily with two site types, long-term and short-term (1991:36-7), Indrelid operates with four types: Type 1 represents a short-term locality, Type 4 a more permanent locality with dwelling structures and Types 2 and 3 lie somewhere between these two extremes (1973:16-17). Bergsvik's work is based on testpit data from the coast for Mesolithic and Neolithic sites. Important criteria for distinguishing short-term from long-term sites include layer thickness, artifact frequency, site size, raw material variation, and layer character (1991:185). Indrelid's work is based on excavated and partially excavated Mesolithic sites from the mountain plateau and the criteria he used included the quantity of flakes, the quantity of tools, the presence of hearths, charcoal, fire-altered rocks, evidence of constructions and site size. As is obvious, this initial work on establishing operational criteria for delineating different site types varies, but there are common threads. Regional criteria for more specific time periods should be developed using as many of the different data categories discussed above as possible.

Site distributions. The distribution of the different site types both in relation to the available resources, to the landscape and to each other are also important aspects of reconstructing the subsistence and settlement system. Criteria for the location of base camps was discussed previously. The location of a permanent, year-round residential camp should represent a compromise of some of the following factors: proximity to either a year-round resource, or a dependable resource available in the lean time of the year, a good water and fuel supply, located such that several different resources are available within the immediate vicinity, located on a relatively flat, well drained, sheltered surface with a good view and accessible from a number of directions. The base camps of a repetitive seasonal pattern should also take advantage of these factors but at least one other contemporary residential camp from the same group should be found in another place such as on the outer coast, or along a river, or farther inland. The locations of base camps within a seasonally mobile pattern should be even more variable, not only because different resources would be the focus at different seasons but also because in a seasonally mobile pattern it is more likely to combine considerations for special purpose activities into the residential camp location. The location of special purpose sites in any of the systems will be the most variable and dependent on the type of site it is. The more temporary the stay, the fewer factors considered for site location, and the more important only one or two specific factors will be.

In sedentary settlement patterns, special purpose camps should be located farther from the residential camp than would be the case for non-sedentary patterns, the reason being that only a small number of people move to a special purpose camp in a sedentary pattern whereas the non-sedentary pattern requires the mobilization of the entire group on at least a seasonal basis (Rice 1975:115, as cited in Rafferty 1982:136). However in an area such as that of western Norway where different physiographic regions exist over very short distances this may not have been significant.

There should be fewer large sites in a sedentary settlement system with perhaps several contemporaneous large sites next to each other. It also seems reasonable that the distance between large sites, or groups of large sites, would be greater in a sedentary system, than would be the case for base camps incorporated in a residentially mobile system. Although these seem reasonable assumptions, it is obvious that evaluating these is dependant on our ability to evaluate contemporary or almost contemporary sites and our understanding of the overall population size in the region for a specific time. Although this level of detail is not practical today, we do have the data to come much closer as many more sites are radiocarbon dated. Although appropriate in the past, it is no longer adequate to combine sites from a 2000-5000 year time span into one system. Now, we have the potential for combining sites within a 200-500 year time span.

Although this is still not adequate, it is a step closer to understanding the past.

4.5 Discussion

Although some of these distinctions seem clear, on a more theoretical level they are not so easy to operationalize and test. How do we interpret archaeologically a medium sized site in the inner fjord area with a medium amount of tools and debris? As is suggested from the outline above, problems arise when attempting to distinguish a site occupied on a year-round basis from one that was occupied throughout most of the year (semi-sedentary), from one that represents a myriad of repeated occupations of a non-sedentary population. It can be argued that it is not important to distinguish the nuances between a sedentary and a semi-sedentary site. However, distinguishing between a year-round residential camp and one that was occupied repeatedly by a seasonally mobile population is crucial because the implications that each has for understanding the organizational structure of the group are different. These two alternatives will be evaluated in the following chapter using the faunal, artifactual and structural evidence from Kotedalen. This will be a comparative study between the different Late Mesolithic phases at Kotedalen. A preliminary assessment of other known sites in the region from the same period will provide a guideline for further research at a regional level. It is only after enough sites have been found and dated to roughly the same period on a regional level that the distinction between semi-sedentary and sedentary can be made and even then the conclusion will be in degree and not kind. It is at the regional inter-site level that a distinction between these alternatives can be evaluated further.

5 KOTEDALEN - FEATURES, ARTIFACTS AND FAUNA

5.1 Site overview

Site description. Kotedalen is situated at the northern end of Radøy, an inner coastal island in Nordhordland, western Norway (Fig. 2). Adjacent to the site is a narrow strait with a strong current, Fosnstraumen, which separates Radøy from the islands of the Lindås Peninsula to the north (Fig. 6). In the recent past, this strait and the nearby parts of Lurefjorden have been known as good fishing locations, and relatively stable year round populations of coalfish in particular were available in the narrow straits (Bergsvik 1991:23-24). Because of its proximity to Fosnstraumen, it is expected that fish was also an important resource at Kotedalen in the more distant past. Other animal resources of the inner and outer coastal regions were also directly accessible from Kotedalen, whereas those associated with the inner fjord and river valleys and the mountain plateaus were not. Access to these resources would have required some degree of mobility either by the entire group or a smaller part of the group or, alternatively, by being organized within a regional exchange system.

The site at Kotedalen has been known since 1962 when a few test units were excavated (Bakka 1964:10). The area was surveyed again in 1984 and 1985 in connection with the proposed construction of a bridge between the island of Radøy

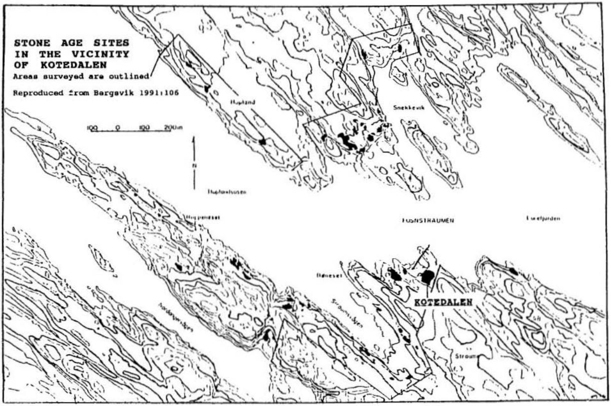

Figure 6. Stone Age sites in the vicinity of Kotedalen

and the Lindås Peninsula (Bruen Olsen 1992:14). A large stratified site was identified on two adjacent terraces with evidence of occupations from the Early Mesolithic to the Middle Neolithic. The site was considered especially important because of the relatively good preservation of faunal remains, and it was the first non-cave site with an adequate faunal sample found in western Norway. As prehistoric sites are protected by law in Norway and all of the alternative bridge alignments would impact this site, a major excavation was planned and carried out in 1986 and 1987 (ibid:15). This was an interdisciplinary project and included expertise in archaeology, botany and osteology. The overarching research problem was to obtain data relevant for identifying and explaining continuity and change in resource exploitation, subsistence strategy and settlement patterns with a special emphasis on the transition from a hunter-gatherer economy to an economy that included agriculture (ibid:20). A comprehensive two-volume project report that places the results from the excavations at Kotedalen in a both a regional and natural-historical perspective has been completed (Bruen Olsen 1992, Hjelle et al. 1992). The faunal material analyzed is presented by Hufthammer (1992a), the offsite pollen analysis by Kaland (1992), the onsite pollen analysis by Hjelle (1992) and the macrofossil analysis by

Soltvedt (1992). A related study which surveyed the area immediately surrounding Kotedalen on both sides of Fosnstraumen (Fig. 6) provides insight into the kinds of archaeological sites found in the immediate vicinity (Bergsvik 1991). This thesis looks in more detail at the Middle and Late Mesolithic occupations found on the upper terrace at Kotedalen with the intent of determining whether year round occupation occurred at this coastal site at this time.

Excavation procedures. The following description is based on the procedures as outlined in Bruen Olsen (1992:21-24) and my own experience working at the site. The excavation strategy was designed to first obtain an understanding of the stratigraphic sequences by excavating trenches and then to open up larger areas of some of the stratigraphic layers in plan in order to identify associated features and structures. One main trench was excavated across the entire site in 1986 and several perpendicular trenches provided additional stratigraphic control (Fig. 7). Two backhoe trenches which were dug (not excavated) into the adjacent valleys provided additional information on the extent of the different stratigraphic layers. In a nearby bog to the southwest of the site another backhoe trench was excavated and two monoliths for pollen analysis were

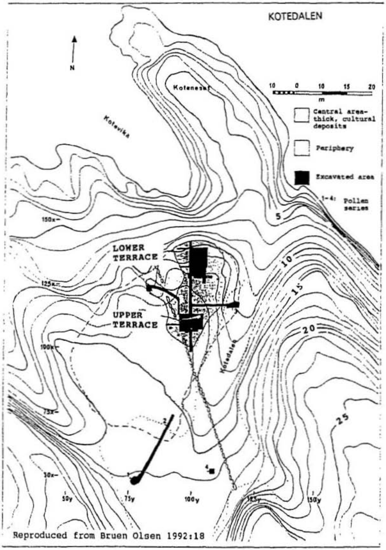

Figure 7. Kotedalen excavations

obtained (Kaland 1992:70). The oldest dated layer from these monoliths was 6350±180 BP (ibid.:77) and as this is 600 years later than the occupations that are the focus of this thesis, the results are only briefly mentioned. The grid system used at Kotedalen is common for many of the excavations in western Norway. Each square meter obtains its designation from its southwest corner. The north-south axis is labeled with increasingly higher X numbers towards the north and the east-west axis has increasingly higher Y numbers towards the east. At Kotedalen each square meter was usually divided into four 50 cm^2 quadrants labeled northeast-NE, northwest-NW, southeast-SE and southwest-SW.

The major north-south trench along 99Y was excavated in 50 cm^2 units with both stratigraphic levels (designated with letters) and 10 cm mechanical levels (designated with numbers). All artifacts and bone found after water screening each excavation unit through 4mm mesh screens were bagged and catalogued separately. Floor plans were drawn of each square meter at the top of each new stratigraphic level and the depths below surface using a line level were noted on a level form. At this time additional notes about the unit were recorded, including the number of liters of soil screened per quadrant (10 liter buckets were used), special artifacts found, samples taken, and the relative amount of charcoal, bone, and different raw material types. As each square meter was completed, wall profiles were drawn. In one corner of every square meter a 10 liter soil sample was taken for flotation. Flotation was used to acquire a better sample of macrofossils and the smaller bones present at the site. Although a number of flotation samples were acquired from the upper terrace, priority was given to analyzing the smaller fractions from the Neolithic occupations. More rigorous, and valid comparisons between the Mesolithic and Neolithic occupations at Kotedalen could be obtained if these samples were analyzed in the future. This is especially true considering the dominance of small fish remains in the faunal collection from Kotedalen. Specific features, including bone concentrations, were assigned their own number and recorded in more detail separately and most of the soil from these were floated. One on-site soil monolith for pollen analysis was removed and analyzed from the upper terrace (Hjelle 1992:97).

After acquiring a better understanding of the stratigraphy, each excavation unit was correlated and assigned a specific stratigraphic unit. Those units excavated in a transition between two stratigraphic layers and thought to be mixed were assigned both stratigraphic layers, however the first letter designates the layer presumed to be more dominant in that sample. Similar procedures were used for the perpendicular trench along 109X, and several adjacent units. Fourteen square meters were excavated in this manner (Fig. 8).

The trenches excavated on the upper terrace revealed that the accumulation of cultural sediments was over one meter thick and included seven stratigraphic layers. The stratigraphy is shown and described on two profiles, one along 100Y and the other along 109X (Fig. 9). Layer A is the plowzone and it is underlain by layers B, C, D, H, and I respectively. Layer I contains an Early Mesolithic component and the others are all dated to the Middle Atlantic Period. These sediments have accumulated on top of either bedrock or a coarse sand and gravel. The profiles reveal one of four larger more recent disturbances on the upper terrace (MS 1). A large Iron Age hearth (MS 11), an oven (MS 9) and a pit (MS 8) of unknown age were other recent disturbances noted. These disturbances affected the top three layers and only penetrated the lower layers in small, confined areas. The stratigraphy of the side trenches, particulary the western trench, show the amount of erosion indicated by the interface between the plowzone and the other layers (Fig. 10). In addition, the slope of many of these layers suggest that they most likely represent midden accumulations from occupations

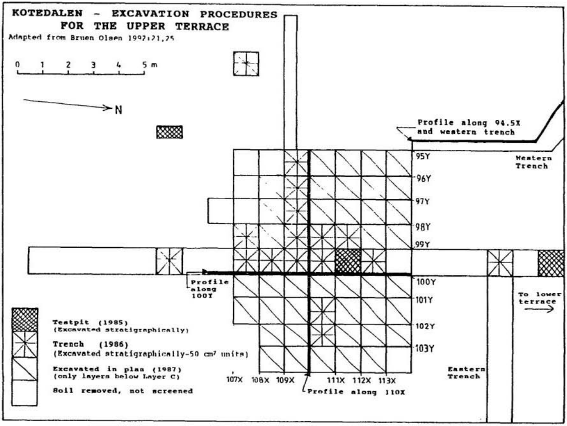

Figure 8. Excavation Strategy for the upper terrace

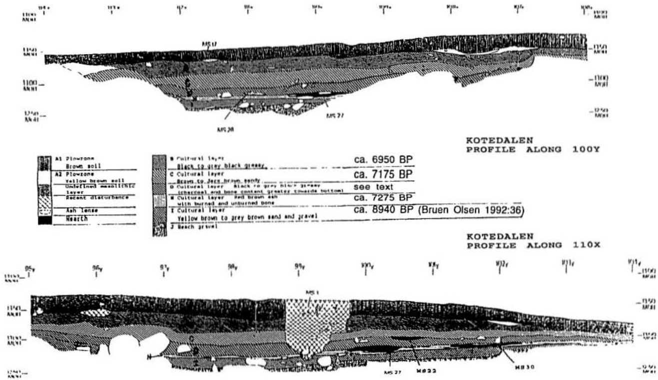

Figure 9. Stratigraphy of the upper terrace
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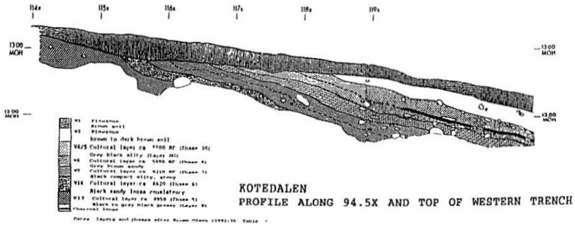


Figure 10. Stratigraphy of the western trench
Reproduced from Bruen Olsen (1992:28,29)

on the level area between these trenches and that they were partially superimposed on top of Layer B. The plowzone and erosion affected the remains of the upper layers on both terraces. The occupations from about 6900 BP (the youngest dated Mesolithic layer on the upper terrace) to 5500 BP (the oldest dated layer on the lower terrace), and those after 4400 BP (the youngest dated layer on the lower terrace) are partially disturbed and eroded and were only minimally sampled in the two side trenches.

Having acquired the necessary stratigraphic control, two larger areas were excavated in plan in 1987 (Figs.7 and 8). The plowzone and the next two layers of the upper terrace were not screened and only those artifacts seen while shoveling away the soil were collected and bagged from the entire area. Features observed while excavating in this manner were documented and soil samples taken. A good sample of these layers had been obtained in the initial 14 m^2 excavated. This allowed more time to carefully excavate and document the remaining three layers which were considered more important. They were the least disturbed Mesolithic layers and they had the greatest amount of bone. Although no faunal assemblage was associated with the Early Mesolithic layer, it was considered important as a large hearth was uncovered and the occupation could be radiocarbon dated. It is unusual to find organic remains preserved on Early Mesolithic sites along the coast of western Norway and this provided the opportunity to obtain a date for this kind of assemblage.

After the plowzone and the next two layers were removed, the grid system was reestablished and each square meter was excavated stratigraphically. Although there was fairly good stratigraphic control it was not always easy to determine the top of Layer D, the first layer excavated in plan, especially in areas away from the trenches at the edges of the excavated area. It was also difficult at times to connect the stratigraphic layers in the eastern and the western part of the site as these were separated by the 1 to 2 meter wide gap previously excavated. Within each stratigraphic layer 5 cm, occasionally 10 cm, thick mechanical layers formed the excavation unit. All units were water screened through 4 mm mesh screens. As the use of quadrants (50 cm^2 units) was inconsistent for the layers excavated in plan, the distributions discussed later are all based on 1 m^2 units. Each excavation unit was recorded on a form in a similar fashion to that used when excavating the trench. The only difference was that the depths of the area excavated were now measured with a level and recorded on large, overall floor plans of the eastern and western sections which were drawn when each new layer and its features were exposed. All features identified were assigned a number (i.e. M31) described, drawn in plan and cross-sectioned, and flotation samples were taken. Although both macrofossil and pollen samples were taken of some features and horizontally across the eastern part of the upper terrace, none of these have been analyzed (Hjelle 1992:96).

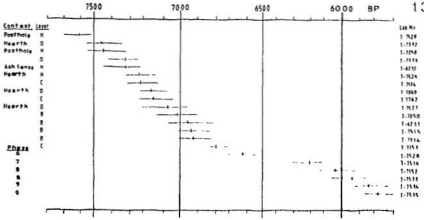
Table 9 presents a summary of the data from the Late Mesolithic occupations on the upper terrace at Kotedalen, including information on the extent of each stratigraphic layer, the number of liters excavated, the number of artifacts, and the artifact density.

Table 9
Summary of archaeological data from Kotedalen

	Layer H	Layer D	Layer C	Layer B
Date (see text)	7275±74	see text	7176±67	6958±61
Minimum extent (square meters)	20	46	95	95
Maximum extent (square meters)	30	60	120	150
Average thickness (cm)	5	15	20	25
Masl (lowest level)	12,7	12,8	12,8	12,3
Contemporary sea level elevation	10,7	10,8	11,0	11,2
Excavated area (square meters)	28	55	15	14
# of liters excavated	879	6071	3021	2932
Total number of stone artifacts	9498	20874	7646	8918
Total number of tools (nonretouched blades not included)	267	1297	313	395
Bone tools	77	117	7	2
Density of stone artifacts (#/liter)	10,8	3,4	2,5	3,0
Density of stone artifacts (#/square meter)	339	380	510	637
Density of bone tools (#/ 100 liter)	8,8	1,9	0,2	0,1

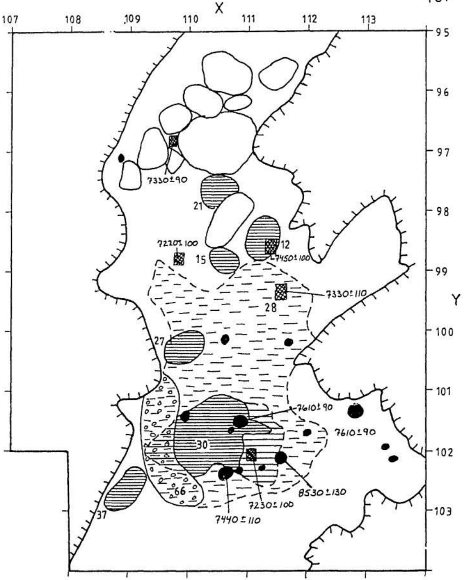
Radiocarbon dates. A total of 67 radiocarbon dates were obtained from Kotedalen and the results of 27 of these from the Mesolithic (Bruen Olsen 1992:266) are presented (Fig. 11). Five of these samples were associated with Layer I, the Early Mesolithic component and are only presented for comparison, as these are evaluated in more detail by Bruen Olsen 1992:89). In addition to these, five of the samples were from Layer H, four from Layer D, three from Layer C, three from Layer B, four from the western trench and three from the eastern trench. The overall trend is as expected with the oldest dates associated with Layer I and the youngest with the layers in the side trenches, however, there are some inconsistencies between the dates obtained and the interpreted stratigraphy. A more thorough discussion of the dates and their contexts, especially from Layers H, D, C and B, is warranted. Some of the samples are associated with specific features which are described in more detail in the following section.

Five radiocarbon dates were obtained for Layer H and the location of the samples in plan are shown on Figure 12. Three of these are samples from postholes which penetrate into the underlying Early Mesolithic layer. The age of these are suspect as all are situated partially over one of the two hearths from Layer I and may contain charcoal associated with



Lab #	Strat. Layer	Excavation Unit	Quad	Feature	Material	Date	±
Ua-890	MI	109X99Y	NV		Birch	9395	160
T-7511	MI	111X101Y		MS62-hearth	Willow	8980	70
T-6233	[illegible]	111X99Y			Willow	8880	150
T-7048	MI	109X98Y	NØ		Deciduous	8680	230
Ua-891	MH	111X102Y		MS31-posthole	Birch	8530	130
T-7512	MI	109X101Y			Oak	7890	70
T-7529	MH	110X101Y		MS48-posthole	Pine	7610	90
T-7332	MD	111X98Y	NØ	MS12-hearth	Willow	7450	100
T-7258	MH	110X102Y		MS39-posthole	Pine	7440	110
T-7333	MD	109X96Y	NØ		Pine	7330	90
T-6232	MH	111X99Y		MS28-ash layer	Pine	7330	110
T-7526	MH	111X102Y		MS30-hearth	Willow	7230	100
T-7514	MC	109X98Y			Hazel	7220	100
T-7049	MD	111X98Y	NØ	MS10-hearth	Deciduous	7150	70
T-7762	MC	110X98Y			Birch	7140	90
T-7527	MD	109X100Y		MS22-hearth	Hazel	7080	130
T-7050	MB	108X99Y	NØ		Willow	7020	110
T-6231	MB	111X99Y			Hazelnut shell	6950	130
T-7515	MB	115X94Y			Coniferous	6930	90
T-7334	MB	109X96Y	NØ		Pine	6920	90
T-7153	MC	109X98Y			Birch	6800	90
T-7528	6	115X94Y			Hazelnut shell	6620	100
T-7516	7	119X94Y			Willow	6210	100
T-7152	8	119X93Y			Pine	6030	100
T-7533	8	116X108Y			Pine	5950	100
T-7534	9	116X108Y			?	5830	100
T-7535	9	116X108Y			Oak	5780	80

Figure 11. Radiocarbon dates from the upper terrace (adapted from Bruen Olsen 1992:266)



KOTEDALEN-B14501 LOWER LAYER D AND LAYER H

Figure 12. Location of Radiocarbon samples in plan

this earlier occupation. The two remaining dates from Layer H are from features MS30-a hearth and MS28-the surrounding ash lens with burned and unburned bone. Both features cover a large horizontal area but are relatively thin and occupy the same stratigraphic position. In some places MS28 is superimposed over MS30. The weighted mean from these two features is 7275±74 BP. A statistical test, the T-test, is used here to determine if averaging more than one date is justifiable (see Aitken 1990:97, Gillespie 1984). The T value for these two dates is 0.45 and is acceptable for a sample of two at the .05 level (Aitken 1990:112).

The four radiocarbon dates from Layer D are wide spread from 7080±130 to 7450±100 BP and it is not permissible using the T test at the .05 level to accept these as dating the same event. They seem to indicate at least two separate occupations. The weighted mean for the two oldest dates from this layer is 7384±67 BP and for the two youngest dates is 7134±62 BP. Two of these samples were from the same meter square and although both were assigned to Layer D, the sample of the younger one was taken in close proximity to the hearth MS10 which is associated with Layer C. The other younger date is from a distinct hearth (MS22) which was exposed towards the top of Layer D. Note that Layer D is relatively thick (up to 20 cm) and it is likely that it represents more than one occupation. It should also be pointed out that the weighted mean for the two older dates is older than that of the two more secure dates from Layer H. As mentioned earlier, it was not always easy to correlate the stratigraphic layers in the eastern part of the site with those in the western part. An alternative interpretation is possible. If the two more secure dates from Layer H and all four dates from Layer D are considered together the weighted mean is 7256±39 BP and the T test at the .05 level is acceptable for a sample of six dates. When considered together, these samples from Layer D and H could date the same event.

Layer C had three radiocarbon dates which do not provide an acceptable weighted mean at the .05 level. One of these is rejected as it provides a younger date than Layer B above. Another sample from the same excavation unit provided a date that fits into the stratigraphic sequence. The two valid dates for this layer have a weighted mean of 7176±67 BP which is well within the acceptance limits for T at the .05 level.

Four samples were dated from Layer B, one of these was taken from the western trench. All four dates provide a weighted mean of 6949±51 BP and can be accepted as coeval. These four dates are fairly well distributed across the area excavated and their closeness in age suggests a relatively rapid accumulation over a short period of time. This is a different impression than the dates for the other three layers which are less consistent.

As can be seen from the above presentation there are several alternative interpretations of the relationship between the different layers. Layer D was most problematic as it represented two distinct periods, one closer to the age of Layer H and the other closer to the age of Layer C. The difference between the acceptable weighted means for Layers H and B is approximately 300 years. By far the largest gap is between Layers C and B where there is over 200 years difference. Based just on the radiocarbon dates, Layer B should be considered a separate, distinct occupation. It is more difficult to consider Layers C, D and H separately, although they are stratigraphically separate layers For example, if the two non-posthole dates from Layer H, the four dates from Layer D and the two more secure dates from Layer C are considered together, the weighted mean of all eight dates is 7236±33 BP and is acceptable at the .05 level. Part of the problem is that the radiocarbon dates are not exact enough to distinguish occupations that occurred within a 100 to 200 year time period. Another part of the problem is that some layers, in particular Layer D, probably represent more than one separate occupation. It is also likely that some disturbance and redeposition of the layers and charcoal occurred during these reoccupations in the past.

It is instructive at this point to return to the presentation of all the dates and ignore the stratigraphic associations. This presents a picture of either regular reoccupation of the terrace between ca. 7500 and 6900 BP, two separate occupations, one around 7330 BP (the acceptable weighted mean for T-6232, T-7258, T-7332, T-7333, T-7514, T-7526) and one around 7040 BP (the acceptable weighted mean for T-6231, T-7049, T-7050, T-7334, T-7515, T-7527, T-7762), or some combination in between. These alternatives will be evaluated in more detail once the features, artifacts and faunal remains are presented. In any future work with this site, additional radiocarbon dates should be obtained for specific features and a reevaluation of the stratigraphy in the western and eastern sections of the site should be completed. It seems most likely that it is cultural site formation processes and our tentative stratigraphic interpretations that are behind some of the inconsistent radiocarbon dates. However, another complicating issue that should also be considered is the fact that a tsunami may have flooded this terrace sometime before 7000 BP. The descriptions below are based initially on the separate stratigraphic layers as identified during excavation. However later interpretations take into account that the relationship between these layers based on the radiocarbon dates is not as clear.

5.2 Stratigraphy and features

The foregoing presentation of the radiocarbon dates suggests that a more thorough discussion of the stratigraphy is warranted, as the distinction between each layer is central to this thesis. The following discussion will highlight the differences between each stratigraphic layer. At the same time the features associated with each layer will be described (Table 10) and the relationship between the stratigraphic layers discussed. Figure 9 (p. 129) should be referred to for the following discussion as it shows the stratigraphy of the upper terrace.

Layer H - (between ca. 7350-7200 BP). Layer H is a relatively thin (5 cm) stratigraphic layer that covers an area of at least 25 m^2 and directly overlies the Early Mesolithic component at Kotedalen. Although 33 features are assigned to Layer H in Bruen Olsen (1992:194) the stratigraphic association of some of the postholes is questionable. After reconsulting the field notes only those postholes with no direct contact with Layer D were assigned to Layer H and all those that may have originated from

Table 10
Summary of features from Kotedalen

Layer	Name	Description	Length cm	Width cm	Thick cm	C-14 (Fig 11)	±
B	MS17	ash patch with burned bone frag.	60	50	5		
B	MS20	ash patch with burned bone frag.	50	45	4		
B	MS2	charcoal conc. with burned bone frag.	45	25	5		
B	MS4/5	hearth-charcoal conc. stones and burned bone	65	35	5		
B	MS18	more recent?-conc. of fire shattered rocks	50	45	7		
C	MS10	hearth-ash, flat stones on top	82	50	6	7150	70
D	MS6	ash patch with burned bone frag.	40	25	3		
D	MS23	ash patch with burned bone frag.	98	27	2		
D	MS25	ash patch with burned bone frag.	110	25	3		
D	MS26	ash patch with burned bone frag.	50	35	3		
D	MS7	hearth-ash and bone with flat stones on top	150	75	7		
D	MS12	hearth-charcoal conc. stones along the edge	50	40	10	7450	100
D	MS13/19	hearth-charcoal conc. ash and burned bone	95	60	3		
D	MS15	hearth-ash, weathered stones, bone	75	45	2		
D	MS21	hearth-charcoal conc. ash and unburned bone	80	65	3		
D	MS22	hearth-charcoal conc. with flat stones on top	90	70	10	7080	130
D	MS24	hearth-charcoal conc. with flat stones on top	165	120	5		
D/H	MS27	hearth-stone lined	115	77	8		
D	MS68	hearth-charcoal conc. with stones	55	35	5		
D	MS32	possible posthole	29		10		
D	MS44	possible posthole	22		12		
D	MS45	possible posthole	7		5		
D	MS46	possible posthole	28		1		
D	MS52	possible posthole	19		3		
D	MS53	possible posthole	6		3		
D	MS57	possible posthole	16		3		
D	MS31	posthole	30		16	8530	130
D	MS33	posthole	28		7		
D	MS39	posthole	18		3	7440	110
D	MS55	posthole	7		9		
D	MS56	posthole	11		8		
H	MS66	gravel embankment- ash, and bone frag.	250	55	7		
H	MS28	ash layer with burned and unburned bone	320	240	7	7330	110
H	MS3	ash lense with bone frag.	90	68	5		
H	MS29	ash lense associated with MS28	70	65	4		
H	MS35	charcoal conc. linear associated with MS66	90	25	5		
H	MS36	charcoal conc. linear associated with MS66	43	11	3		
H	MS38	charcoal conc. associated with MS66	45	18	3		
H	MS37	hearth-charcoal concentration with stones	75	45	3		
H	MS30	hearth-large charcoal conc. burned bone, few fla	190	120	5	7230	100
H	MS40	possible posthole	18		3		
H	MS47	possible posthole	19		8		
H	MS54	possible posthole	13		7		
H	MS59	possible posthole	13		4		
H	MS34	posthole	20		5		
H	MS41	posthole	15		8		
H	MS42	posthole	20		10		
H	MS43	posthole	10		10		
H	MS48	posthole	23		8	6610	90
H	MS49	posthole	7		5		
H	MS58	posthole	20		5		
H	MS60	posthole	8		8		
H	MS61	posthole	13		8		
	MS1	more recent-funnel shaped pit, possible grave	115	85	80		
	MS8	more recent-pit	82	50	6		
	MS9	more recent-clay-lined oven	288	150	60		
	MS11	more recent-stone lined hearth	320	270	35		

Source: Bruen Olsen (1992:Appendix 5)

Layer D were assigned to that layer. Nineteen features could more definitely be assigned to Layer H (Fig. 13). Of these, four are areas of ashy soil with unburned bone (MS3, MS28, MS29, MS66), one a hearth (MS30), one a possible hearth (MS37), three are charcoal concentrations (MS35, MS36, MS38), nine are more certain postholes (MS34, MS41, MS42, MS43, MS48, MS49, MS58, MS60, MS61) and four are uncertain postholes (MS40, MS47, MS54, MS59).

The central hearth area (MS30) is delineated by a large 3-5 cm thick charcoal concentration. There are several flat rocks associated with the central part of this feature. This hearth is surrounded on three sides by an extensive lens of ashy deposits with unburned bone defined as MS3, MS28 and MS29. To the south of the central hearth, abutting the bedrock, is MS66, a raised embankment 5-7 cm higher than the surrounding area. This feature is similar to the ash lenses and contains unburned bone but it also has a considerable amount of gravel. Together, the ash lenses and the central hearth make up a large portion of this layer. The transition between the ash lenses and the surrounding Layer H which contained less ash and unburned bone was gradual and not distinct. MS35 and MS36 are two restricted linear concentrations of charcoal up to 7 cm deep within MS66 and MS38 located on the southeastern side of MS66 is also a small

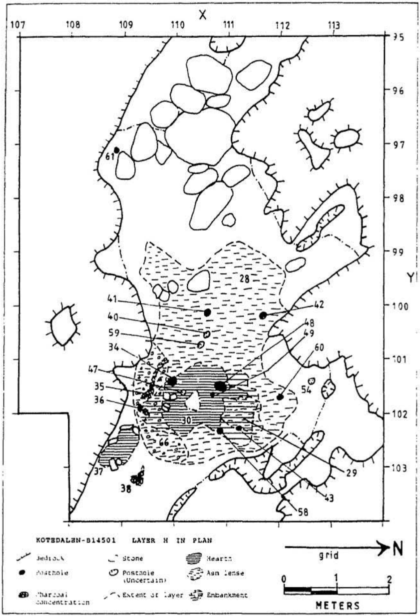


Figure 13. Layer H features

concentration of charcoal. It is not known what type of feature these represent. MS37 is interpreted as a probable hearth since it is a charcoal concentration with several stones on the perimeter, but it may also represent charcoal and stones that originated from MS30, the central hearth. The postholes were primarily visible against the lighter colored ash lenses, but some were also identified on the edge of the hearth area. The more definite postholes were about 15 cm in diameter and 5-8 cm deep. The less certain postholes were only about 3 cm deep. All occur in the eastern part of the site except for MS61.

The extent of Layer H in the western part of the site is less certain and the connections between the eastern and western sections is hampered by the gap from the initial trench. There are some specific areas in the western section where unburned bones and ashy soil were recorded but these appear to be limited in extent. Two of the radiocarbon samples from the western part of the site which were assigned to Layer D (T-7332 from MS12, T-7333) can be contemporaneous with the dates from Layer H and suggest that this part of the site was also used extensively at that time. The large rocks in the western part of the site were put in place during the Early Mesolithic, the largest of these was probably found in situ at that time. If these were used in some fashion when

Layer H was deposited is not known but they seem to partially mark the extent of Layer H (see profile along 110 X between 96 and 97Y Fig. 9).

Considered together, these features suggest a post-supported structure enclosing an area of at least 10 m^2 (as defined by the extent of the ash layer) with an internal hearth. It is possible that such a structure was larger and included the area up to the rocks in the west, but this is not clear. At least one additional hearth (MS12-assigned to Layer D) from the western part of the site is dated to roughly the same time period.

Layer D - (between ca.7450-7300; 7200-7075 BP). Layer D is a dark brown, charcoal rich soil which averages about 15 cm thick and covers an area of at least 45 m^2. It is much thicker than Layer H and contains more charcoal. In addition, the large quantities of unburned bone associated with the ash lense in Layer H are not present, although burned bone fragments are found. While excavating some sections of the site, Layer D was divided into two Layers D1 and D2. Layer D2 contained a greater concentration of charcoal and small burned bone fragments and was more closely associated with Layer H. Layer D1 was used to designate the soil excavated before the initial features in Layer D were exposed in plan.

A total of seven hearths (MS7, MS13/19, MS15, MS21, MS22, MS24, MS68) were assigned to Layer D and a ninth one (MS27) could be associated with either Layer D or Layer H (Fig. 14). In the vicinity of some of the hearths are smaller patches of ashy red brown soil with small, burned, poorly preserved, bone fragments (MS6, MS23, MS25 and MS26). The postholes were first recognized as darker, more homogenous patches in the lower part of Layer D. Five of these are more certain postholes (MS31, MS33, MS39, MS55, MS56) and seven are uncertain (MS32, MS44, MS45, MS46, MS52, MS53, MS57). Although similar to those identified in Layer H, the postholes first seen in Layer D are generally larger. All are located in the eastern part of the site.

The features in the eastern part of the site are different from those in the western part. Most of the features in the western part were excavated as part of the initial trench and were not revealed in plan simultaneously. The three hearths found in this area were generally smaller than those in the east and the stones were found on the perimeter of a thin lense of charcoal and/or ash. One of the hearths in the eastern section, MS12, was radiocarbon dated and provided the oldest date associated with Layer D. Three of the hearths in the eastern part of the site were quite distinct and exposed at a level about 7 cm above the

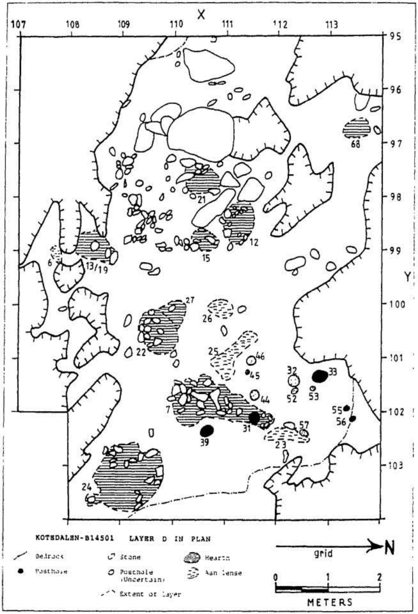


Figure 14. Layer D features

interface with Layer H. These were comprised of collections of flatter stones on top of a thin layer of charcoal with only a slight depression. One of these, MS22, was radiocarbon dated and provided the youngest date for Layer D. The three hearths in the eastern section appear to be contemporaneous, but whether they represent indoor or outdoor hearths could not be determined.

The thick accumulation of sediment, the fact that charcoal was spread throughout the soil matrix, the general absence of unburned bone fragments and the presence of hearths in different states of use suggest several repeated reoccupations of the terrace in Layer D. A post-supported structure was probably present as evidenced in the postholes, and a possible tent ring was identified in the western part of the site. This is different from Layer H, which was thinner and seemed to represent a much more temporally confined occupation centered around a post-supported structure with one central hearth and an accumulation of unburned bone fragments.

Layer C - (between ca. 7250-7100 BP). Layer C was not always easy to delineate when excavating and was referred to as both Layer C and K, based on slightly different color and texture. However, these occurred in the same stratigraphic position relative to both Layer B above and Layer D below

(Fig. 9). Layer C was sandier, lighter in color and contained less charcoal than either Layer D or B. Layer C was about 20 cm thick and covered an area of at least 90 m^2. Only 15 m^2 of Layer C was excavated and it was partially disturbed by younger features. Only one hearth, MS10, was found at this level and it was similar to the hearths from Layer D (Fig. 15). A radiocarbon sample was taken adjacent to this hearth and it provided a date within one standard deviation of that for MS22 which was assigned to the top of Layer D. Although the data acquired from Layer C is limited, the thick soil accumulation, combined with a sandier matrix and lower density of artifacts (Table 9) suggests less frequent reoccupations of the terrace than was the case for Layer D.

Layer B - (between ca. 7000-6900 BP). Layer B consisted of a dark brown soil that contained charcoal and covered an area of at least 95 m^2. It was similar in color and texture to Layer D. Layer B was about 25 cm thick, though it was probably thicker at one time and has since been truncated by the plowzone. Only 14 m^2 was excavated and parts of Layer B were disturbed by the younger features (Fig. 16). One hearth (MS 4/5), two ash lenses (MS17, MS20) and one charcoal concentration with bone fragments (MS2) were identified. One additional hearth or concentration of fire-altered rocks

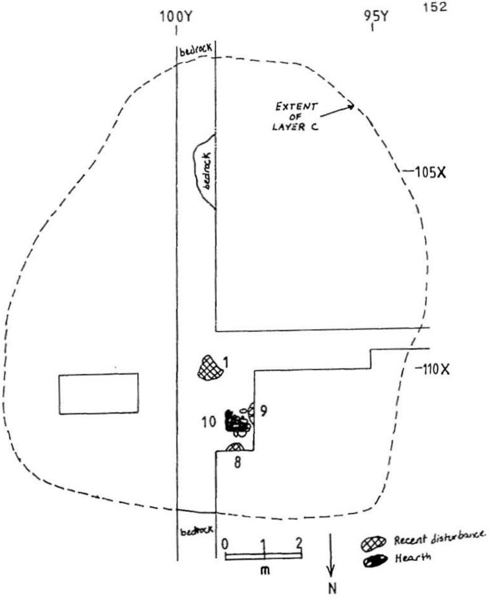


Figure 15. Layer C features
Source: Bruen Olsen 1992

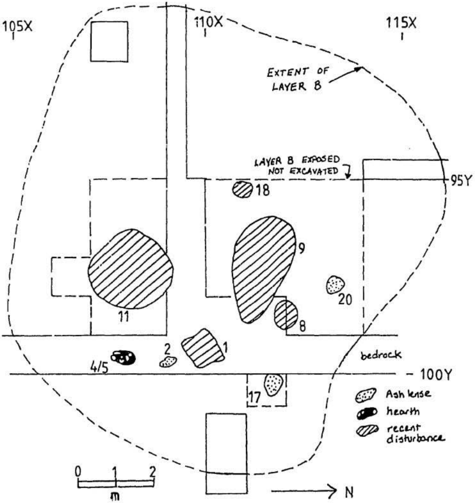


Figure 16. Layer B features and recent disturbances
Source: Bruen Olsen 1992

(MS18) was found but it was in direct contact with the plowzone and its stratigraphic association is uncertain.

Comparison. Based on information from the features, stratigraphy and radiocarbon dates it is suggested that Layer H and the lower part of Layer D (D2) are roughly contemporaneous as are the upper part of Layer D (D1) and Layer C. These appear to represent at least two separate, but somewhat similar occupations of this terrace. The similar structural organization of the reoccupation of this terrace is revealed on Figs. 17 and 18 which depict all of the features from Layers H, D and C associated with an earlier occupation and a later occupation, respectively. Note that four of the hearths from the later occupation(s) are almost directly superimposed over those of the earlier occupation(s). All hearths are shallow surface hearths and no direct associations between the upper and lower hearths were observed when the cross-sections were drawn. It may have been the presence of the proposed post-supported structure that was the reason behind this organizational similarity. The more distinct and non-overlapping hearths in the upper part of Layer D suggest that they are roughly contemporaneous and that the eastern part of the site was abandoned and not returned to for some time, long enough for vegetation to provide some protection from disturbances

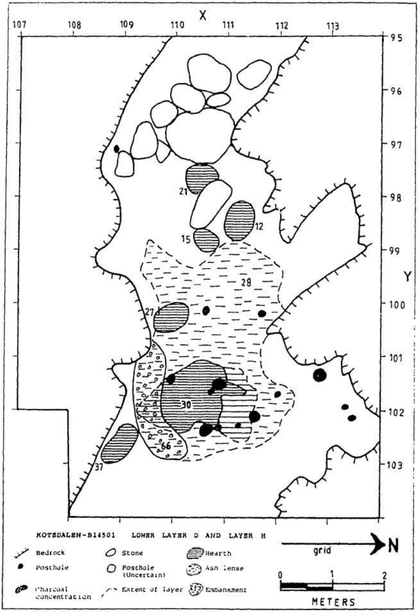


Figure 17. Lower Layer D and Layer H features

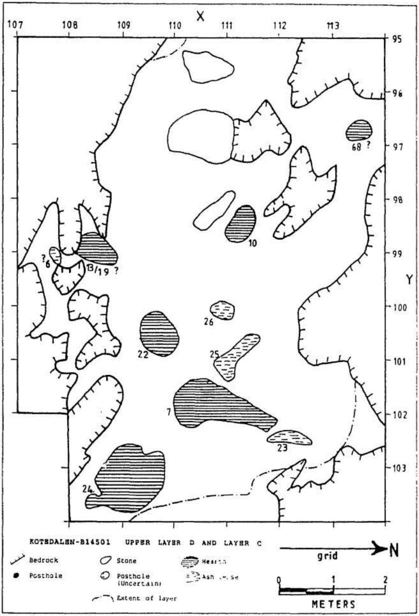


Figure 18. Upper Layer D and Layer C features

during later occupations. Layer B is interpreted as a discrete and separate occupation from those of Layers H, D and C and this is supported by the consistency of the radiocarbon dates from different areas within Layer B. From the little data available for the features from this layer, they are smaller than those of earlier occupations and not located in the same fashion. It is possible that frequent, continuous reoccupation of the terrace at this time has effectively obliterated previous features and incorporated these into the soil matrix.

5.3 Artifacts

The artifacts were catalogued, coded and entered into a database system as described by Bruen Olsen (1992:75, Appendix 6). The morphological definitions used for the flaked stone tools are presented in Helskog et al. (1976). A computer-based cataloguing system for all stone artifacts from the Stone and Bronze Ages is being developed for the Historisk Museum and this manuscript formed the basis for the Kotedalen catalogue (Indrelid 1990). This was adapted slightly to include bone tools and ceramics and to provide more detail for the slate artifacts and retouched flakes and blades (Bruen Olsen 1992:75). These morphological classifications were not difficult to convert into broad functional categories which are used in the distributions in Chapter 6. This does not imply that the specific functions of certain artifacts have been determined, but that there are some basic differences in the ways the different artifacts were used and/or discarded.

Those areas from the upper terrace that were not catalogued as part of the Kotedalen project were catalogued for this thesis as they provided a more complete horizontal distribution. Subsequently, the totals and summaries of the artifacts presented here are based on a different database than that presented in Bruen Olsen (1992). There are some additional discrepancies because all tools from the relevant stratigraphic layers were rechecked and some items were reclassified. In particular, a greater number of retouched flakes and blades were reclassified as scrapers based on the regularity and extent of the retouch. Another area where the procedures differ is that Bruen Olsen (1992) and Hufthammer (1992a) use two sets of numbers for each layer (Phase). One of these is for the remains that can more certainly be assigned to that specific layer and the other includes those items from excavation units at the transition from one layer to the next. These numbers (a small percent of the total) were combined here as it was important to maintain the horizontal integrity of the layers to evaluate artifact distributions.

This discussion of the artifacts has two objectives. One is to provide a basic description of the artifacts found in each stratigraphic layer (Table 11). However, the primary objective is to use the assemblage compositions and artifact distributions together with complementary data on features and faunal remains to evaluate some of the implications for the different models developed in Chapter 4. This evaluation is presented in Chapter 6. It should be emphasized that the databases for Layers D and H represent most of the central part of the occupations whereas those from Layers C and B are only a small sample of the site.

Flakes, blades and cores. Flakes were classified by material type and the percentages of the different material types for each Layer are presented in Fig. 19. The decrease in flint for each successive Layer from over 90% of the assemblage in Layer H to under 40 % of the assemblage in Layer B, is compensated by a corresponding increase in quartz/quartzite and crystal quartz. This corresponds to the same general trends throughout the Mesolithic noted in western Norway as described previously. This substantial change over a relatively short time period of 500-200 years can be compared to the rapid adoption of rhyolite throughout

Table 11
Summary of Artifacts found at Koledalen

	LAYER H	LAYER D	LAYER C	LAYER B	H%	D%	C%	B%
FLAKE/FRAGMENT	7780	16329	6333	7518	87	82	86	88
BLADE	1097	3130	860	801	12	16	12	9
CORE	4	126	57	100	0	1	1	1
CORE FRAGMENT	59	389	95	113	1	2	1	1
TOTAL PRIMARY REFUSE	8940	19974	7345	8532	100	100	100	100
RETOUCHED FLAKE/FRAGMENT	61	355	96	118	29	35	36	40
RETOUCHED BLADE	55	258	51	70	26	26	19	24
SCRAPER	77	320	79	69	36	32	29	23
DRILL	12	39	27	30	6	4	10	10
POINT	5	11	0	0	2	1	0	0
BURIN	0	5	0	0	0	0	0	0
ENGRAVER	3	19	15	9	1	2	6	3
TOTAL RETOUCHED TOOLS	213	1007	268	296	100	100	100	100
GROUND STONE ADZE	0	4	3	8				
GROUND STONE TOOL FRAGMENT	30	118	10	27				
FLENSING KNIFE & FRAG.	1	4	0	0				
GRINDING SLAB & FRAG.	1	8	3	7				
ANVIL	0	1	0	0				
HAMMER STONE	0	13	1	4				
ROUND STONE	6	33	14	22				
SMOOTHING STONE	0	2	1	0				
GRINDING STONE	0	1	1	0				
PERFORATED STONE	0	4	1	0				
OTHER STONE TOOL	1	0	1	0				
SOAPSTONE WEIGHTS & FRAG	0	0	0	22				
TOTAL OTHER STONE TOOLS	39	188	35	90				
BONE POINT	3	3	0	0				
HARPOON	0	2	0	0				
NEEDLE OR AWL	9	8	0	1				
FISH HOOK FRAGMENT	28	58	6	1				
OTHER WORKED BONE FRAGMENT	45	46	1	0				
TOTAL BONE TOOLS	85	117	7	2				
TOTAL ALL REFUSE	9277	21286	7655	8920				
liters excavated	879	6071	3021	2932				
DENSITY #/1 LITER	10.6	3.5	2.5	3.0				

the region during the transition from the Mesolithic to the Neolithic (Alsaker 1987, Nærøy 1988:270). A more detailed study of raw materials and their sources that come into use is an important area for future research and would add to the regional picture of mobility strategies and social organization of production.

The vertical distribution of the different materials from each meter square can assist in reinterpreting the integrity of the different layers. This is particularly important relative to Layer D which provided a wide range of radiocarbon dates. On Figure 19 the layers are organized from top (BA) to bottom (I). Transition layers are designated by two different letters (CD) whereas more certain layers are designated by double letters (DD) or as letters and numbers (D2). Each layer is typified by different signatures. The signatures of Layer D1 and DC, which represent the upper part of Layer D, is most similar to Layer C. This indicates that Layer D1 and DC should be reclassified and removed from the counts for Layer D. Although this was not done for this thesis, as they represent only 17% of the total for Layer D, this factor is taken into account in the following discussions. The remainder of the excavation units in layer D are similar to one another and

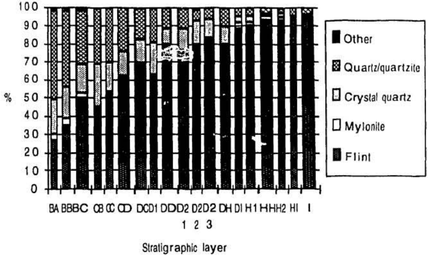


Figure 19. Vertical distribution of material types

noticeably different from Layers C and H. This supports the observations that Layer D is a separate layer.

A definition for blades which includes fragments and blade-like fragments was used (see Bjørgo 1981:65-68). They were grouped into three categories based on width: macroblades (w >12 mm), medium blades (8mm< w < 12mm) and microblades (w < 8mm). Microblades represent 50% of the blades in Layer H and up to 70% in Layer B. The regional trend from wider to narrower blades throughout the Mesolithic is reflected here (Fig. 20). A microwear analysis of

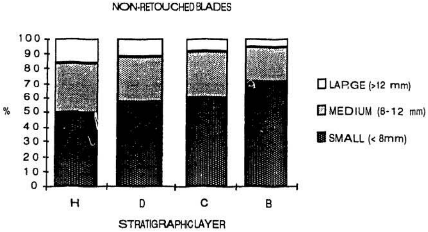


Figure 20. Percentage of blades by width in each layer

unretouched blades from four Late Mesolithic sites in southern Scandinavia indicate that at least 20% of the unretouched blades were utilized, most of them for single tasks like cutting, sawing and whittling soft to medium hard materials (Juel Jensen 1986). A complete understanding of the different ways blades, both unretouched and retouched, have been used is lacking and would require additional microwear analysis and experimental studies, but it is clear that they are a flexible tool that could be used in a variety of different situations (Clark 1976, Bjerck 1985:79).

A summary of the cores found show that bipolar cores dominate in Layer B (75%) whereas in Layers C and D they make up just over 50% of the total cores (Fig. 21). The percentage of platform cores in Layers C and D is 22% and 21% respectively, whereas Layer B had 11%. Only four cores, two of them bipolar, were found associated with Layer H which was excavated in its practical entirety. The greater percentage of bipolar cores in the younger layer is a general chronological trend noted for the region as a whole (Bjørgo

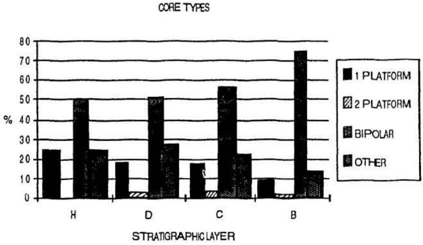


Figure 21. Percentage of core types in each layer.

1981, Bjerck 1983) and is related to the changing technology. These percentages emphasize similarity between Layers C and D and the difference between these and Layer B which is interpreted as a separate and different type of occupation.

Retouched stone tools. Retouched tools were divided into two major categories, formal retouched tools and informal retouched tools, based on the degree and regularity of the retouch. If the retouch was limited in extent, weak or irregular, the item was classified as an informal retouched tool (retouched flake, fragment or blade), otherwise it was classified as a formal retouched tool. The formal retouched tools were further classified into specific tool types including points, drills, burins (as defined in Helskog et al. 1976), engravers which have not been formally defined, and other formal retouched tools which primarily include various types of scrapers.

Figure 22 reveals that the percentage of scrapers decreases from 36% in Layer H to 23% in Layer B, whereas the reverse trend is true for drills (6% in Layer H to 10% in Layer B) and retouched flakes/fragments (29% in Layer H to 40% in Layer B. The percentage of retouched blades is more consistent between the different layers varying between 19-26%. Engravers are less frequent than the other retouched tools but note that the highest percentage was found in Layer

C (6%) whereas all other Layers had less than 3%. Only a few points were identified in Layers H and D and even fewer burins were found and these were only present in Layer D.

Without microwear analysis, and replication experiments the function of many of the retouched tools remains unknown. In spite of this, there are several general characteristics of the retouched edge that indicate that certain tools were used differently than others. Three of these include the thickness, angle, and shape of the retouch. These

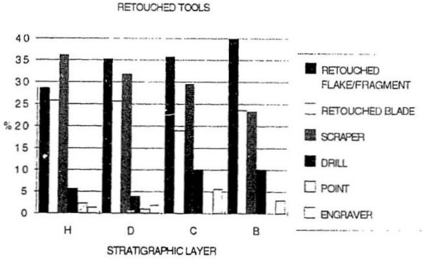


Figure 22. Percentage of retouched tool types in each layer

characteristics were evaluated for all retouched tools except points and burins (Fig. 23). In Layer H 80% of the retouch was on thin (<5 cm) edges indicating different kinds of activities from the other three layers which had only between 57-61% of the retouch on thin edges. This same trend is reflected in the percentages for the degree of retouch. Steep (60-90°) retouch comprises only 15% of all retouch in Layer H whereas for the other layers it represents more than 25%. The fact that a greater percentage of retouch in Layer H was weak and on thin blanks indicates the relatively greater discard of expedient tools which suggests that either more generalized tasks were performed during this occupation, or it may be a result of site abandonment where the more formal tools were taken from the site. The percentages for retouch shape are generally similar for the different layers all of them being dominated by straight retouch (44-53%) and convex retouch (17-27%) with concave, wavy and pointed retouch making up less than 15% of the total. The relatively high percentage of convex retouch in Layer D may indicate a specific activity.

Other stone tools. Other stone tools are represented by only a few items and their importance in the assemblage can be interpreted more directly from the number of items found. Remember that Layers C and B were only partially excavated.

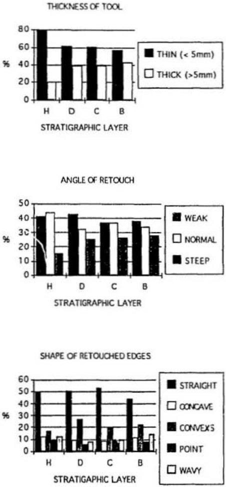


Figure 23. Percentages cf retouch edge thickness, angle and shape

Few flakes of the materials that axes and adzes are made of are found in any of the layers (see "other" Fig. 19) indicating that axes/adzes are coming to the site in finished or near finished form. This is true for other Late Mesolithic sites in the region like those on Flatøy (Bjørgo 1981:115). Although a total of 22 complete or almost complete axes/adzes were found, the provenience of seven of these is less certain as they were found while clearing away the upper layers. Of the remaining 15 recovered from excavated units, eight are from Layer B, three from Layer C and four from Layer D. None were recovered from Layer H (Table 11). Most of these are damaged or broken and are difficult to place into the classification scheme developed for this region which is based on complete axes (Bruen Olsen 1981, Alsaker 1987). There are a variety of size and shapes represented (Fig. 24) and some probably functioned as other types of wood working tools (49607, 55614), whereas others (41508, 32306) may be broken parts of perforated stone picks mentioned below. Although no complete tools were found in Layer H a number of fragments were found. Layer D had few complete axes/adzes, but a relatively large number of fragments. Layer C had a few axes and a few fragments and Layer B had a relatively large number of axes and relatively few fragments. The small fragments indicate the degree of use for these kinds of objects which in turn may be related to the season or the duration of occupation.

Another type of stone tool is made of sandstone or a slate/shale. These were originally classified as grinding slabs, but they have been reclassified as "flensing" knives based on their thinness and bifacially flaked edges (Fig. 25). Layer H has two small fragments of sandstone, one from a grinding slab and one which can be refitted to a fragment of a flensing knife recovered in the same unit and assigned to the bottom of Layer D. Both grinding slabs and flensing knives are present in Layer D whereas only grinding slab fragments were found in the excavated portions of Layers C and B, though it is possible that flensing knives are represented by some of the sandstone fragments found in these layers.

A variety of tools made from round or egg-shaped stones are found in these assemblages. Some of these are smooth and have no obvious use marks and are classified as round stones, others are more oblong in shape with flatter surfaces and are referred to as smoothing stones. Hammerstones have pecking marks at one or both ends and anvil stones have pecking marks on one or both of the flatter surfaces (Fig. 26). Of these four different types only round stones were found in Layer H, all types are present in Layer D, all types except for anvil stones are present in Layer C and only round stones and hammerstones are present in Layer B.

Four other stone tools were found and the function of these are not known. Two of these, have a groove all around and appear to have been used as weights. One was found in Layer H (61021) and one of soapstone was found in Layer C (49853). The other two have a faceted surface and are referred to as grinding stones. One was found in Layer D (61269) and one in Layer C (47805).

Four perforated stones or fragments thereof were recovered in Layer D (Fig. 27). Two of these were probably shaped like the complete specimen (50566) which was found at the interface between Layer D and the Early Mesolithic layer. The complete speciment may be associated with either of these or Layer H. One of the fragments was made of a distinctive type of stone with traces of former crystal surfaces (40503). The third perforated stone was flatter and pick shaped (37114) and the fourth one was quite small and broken in two fragments (62961/48104). One possible fragment of a perforated stone tool (39708) was found in Layer C and this had linear decorations similar to that found on other perforated stone (Østmo 1986, Solberg 1989) or bone tools. All except for one was broken at the perforation. In this region these perforated stones have been associated with the

Neolithic (Solberg 1989), but there are now a number of indications that they also belong to Mesolithic assemblages (Bruen Olsen 1992:92, Krøger 1992, Johansen 1992). The function of these is not known, but there are a variety of shapes and sizes. It has been suggested that the club-shaped perforated stones were used as digging stick weights (Vinsrygg 1979, Broadbent 1978) or weights for bow drills (Krøger 1992) or the smaller ones as jewelry (ibid.). Most of these are made of soapstone or a soapstone-like material.

Small soapstone sinkers or fishing weights, some of which are decorated, were found in Layer B (Fig. 28). From other Mesolithic sites in the region similar artifacts have been dated as far back as ca. 6600 BP (Ågotnes 1978:37, Bjørgo 1981:82), but based on the finds from Kotedalen the date for these can be pushed back to around 7000 BP (Bruen Olsen 1992:90). Their function has been disputed, but Bjørgo (1981:111) has convincingly argued for their use as weights on fishing lines for fishing in shallower waters. This was based on their weight distributions compared to those of more recent lead weights for fishing. The weight range for these artifacts from Kotedalen compare with those from other Late Mesolithic sites in the region (Bjørgo 1981:110, Nærøy 1987:145) with the majority being from 1-2 g (Fig. 29). These were used in the area until the transition to Neolithic.

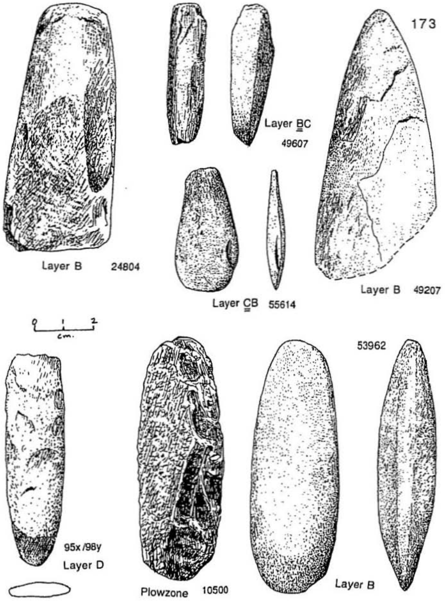


Figure 24. Groundstone tools
Source: Bruen Olsen 1992:95-97. Drawn by Ellinor Hoff

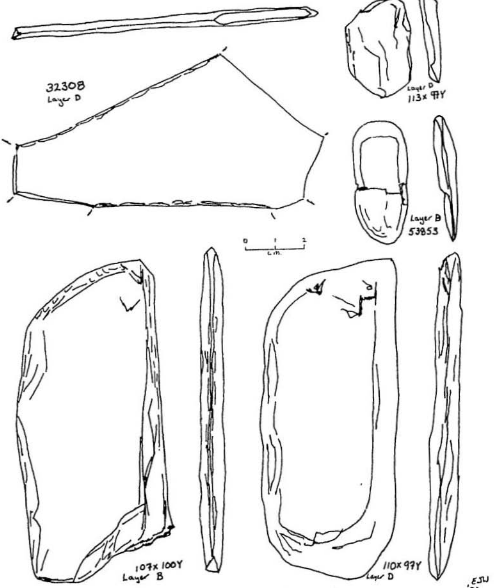


Figure 25. "Flensing" knives

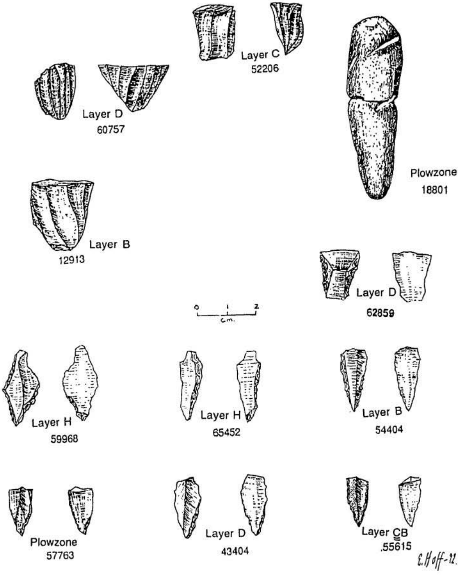


Figure 26. Other stone tools

Source: Bruen Olsen 1992:94,99 Drawn by Ellinor Hoff

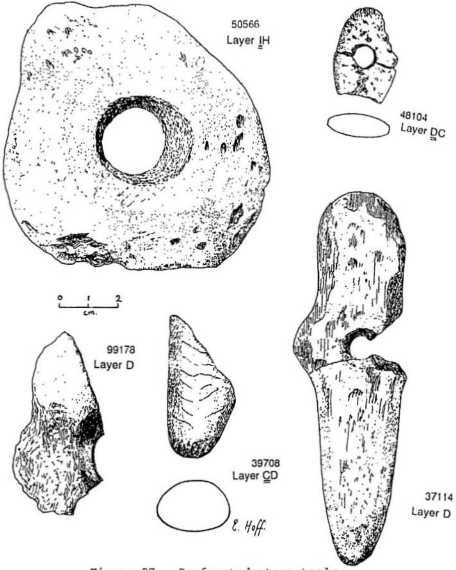


Figure 27. Perforated stone tools
Source: Bruen Olsen 1992:98. Drawn by Ellinor Hoff

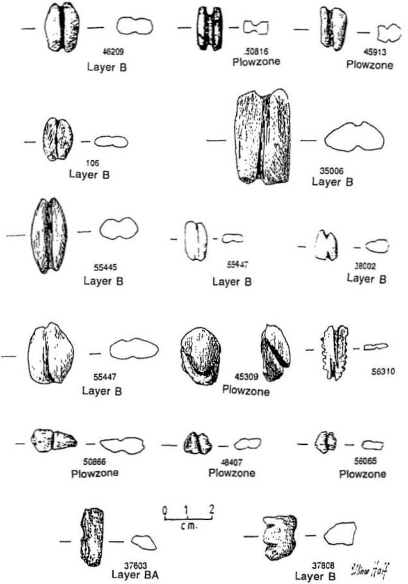


Figure 28. Soapstone weights
Source: Bruen Olsen 1992:99-100. Drawn by Ellinor Hoff

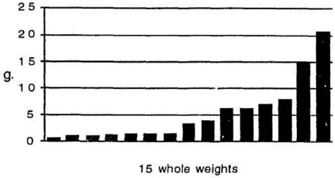


Figure 29. Weight distribution of soapstone weights

Bone tools. The bone tools were generally small, fragmented and poorly preserved and most of them were associated with Layers D and H (Fig. 30). Two bone harpoon fragments were found, both in Layer D. A number of fragments of bone points (including slotted bone tools) needles/awls, fish hooks and unidentified worked bone were found in both Layers H and D (Table 11). One needle or awl fragment and one fish hook fragment were found in Layer B. The provenience of all seven of the bone tools from Layer C are questionable. Five of them were found near MS1, a more recent disturbance, one was found at the interface with Layer D and one was found in the initial testpit excavated in 1985 which cannot be confidently correlated. Despite this, it is

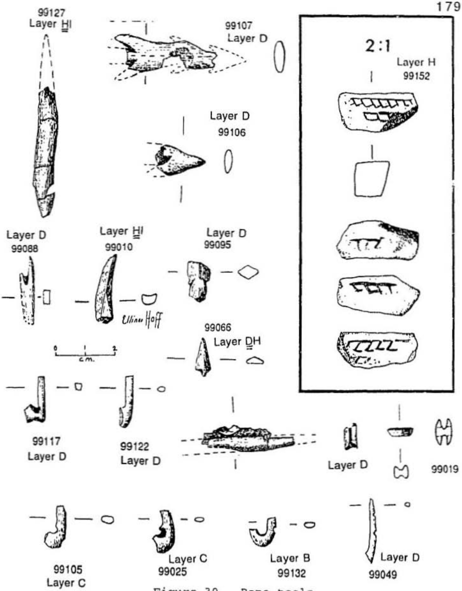


Figure 30. Bone tools
Source: Bruen Olsen 1992:162-163. Drawn by Ellinor Hoff

expected that these kind of bone tools were present in Layers B and C but they have not been preserved. It is the ash lenses that had a preservative affect for bone (Hufthammer 1992a) and only limited areas with ash were found in Layers B and C. Only one small fragment had decoration (99152) and it was found in Layer D (Fig. 30).

5.4 Faunal Assemblages

The faunal material from Kotedalen was analyzed by Hufthammer (1992a). The data presented here focuses on the Mesolithic occupations. Although the faunal collection from Kotedalen was rich for a non-cave site, the bones were difficult to identify as many had been subject to burning, shrinkage and fragmentation (Hufthammer 1992a:17). As the numbers of bone fragments per species was generally low, and the interpretive value of MNI is disputable, no attempt was made to determine the minimal number of individuals (MNI). All material recovered in 4 mm mesh screens is presented as well as a minimum number of selected samples of items found in 2 mm screens (ibid.). Many of the flotation samples have not been analyzed and are not included in the counts below (ibid.). The counts for the faunal remains for Layer H used here include those bones associated with Phase 1 in Hufthammer (1992a:20).

Before examining the composition of the faunal remains it is necessary to have an understanding of the nature of the faunal remains preserved and analyzed for each layer. The frequency (#/100 liters analyzed soil) of mammal, fish and bird fragments for each stratigraphic layer provides an indication of this (Fig. 31). A comparison of these figures with the extent of the ash lenses for all layers at Kotedalen (Bruen Olsen 1992:49-60) reveals that the degree of bone preservation is directly related to the amount of ash present (see also Hufthammer 1992a:49). The faunal remains from Layer H are by far the best preserved and it has been estimated that as much as 20% of the fragments from this layer are unburned (Hufthammer 1992a:19).

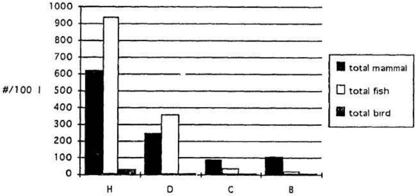


Figure 31. Frequency of faunal remains (#/100 l soil analyzed)

Composition. The faunal remains can be examined at two different levels. The first provides a more general impression of the nature of the assemblages from each layer based on the number of bones which could be classified as mammal, fish or birds (Fig. 32). Fish bones dominate the faunal remains from Layers H and D whereas mammal bones dominate in Layers C and B. Birds are minimally present in the Mesolithic layers (less than 5%) and are much more important in the Neolithic layers where they represent between 14-20% of the remains (Hufthammer 1992a).

General comparisons between mammals, fish and birds is only possible at this level. If the numbers of bones identified to genus or species is used the relationship between the different groups changes and fish dominates all of the layers (Fig. 33). This indicates that mammal bone fragments are more difficult to identify to genus/species than are fish at Kotedalen. The bones identified to genus/species are best used only as comparisons within the major groups of mammals, fish and birds. It is an evaluation of the genus/species identified that comprises the second, more specific level of the faunal composition of each layer.

Mammals. As described above, bone fragments of mammals dominate in Layers C and B. The identified mammal bones are primarily comprised of seal, red deer, wild boar and otter

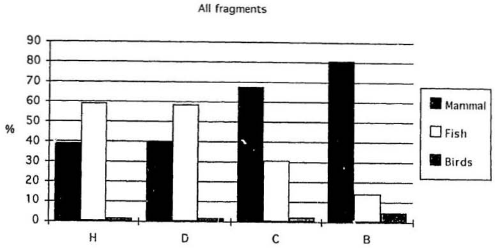


Figure 32. Percent mammal, fish and bird fragments

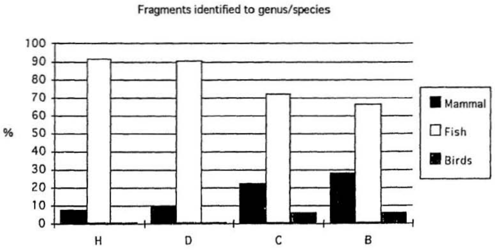


Figure 33. Percent mammal, fish and bird identified to genus/species

(Table 12). One fragment of moose, a few fragments of dog and a few fragments of various fur mammals including bear, wolf, lynx, red fox, hare, pine marten and members of the Mustelidae were also identified.

Table 12
Mammals identified at Kotedalen

	# of fragments			
liters analyzed	1013	5651	1595	1211
Layer	H	D	C	B
gray seal	1			
harbor seal	6	10		
seal (sp?)	107	113		3
moose		1		
red deer	1	7	2	
hoofed mammals(Artiodactyla)	28	37	4	2
wild boar	23	36	2	2
brown bear	2	4		
wolf	1			
lynx		1		
carnivore	2	4		
otter	72	37	7	5
red fox	1	5		
hare		2		
pine marten		1		1
Mustelidae		1		
squirrel		1		
small rodents		1		
dog	1			
Canidae dog/fox	2	4		2
identified mammal	247	265	15	15
unidentified mammal	6024	13372	1388	1245
Total mammal	6271	13637	1403	1260

Source: Hufthammer 1992a:21,22,28,30,31

Seals dominate the identified mammal bones in Layers H and D whereas cloven-hoofed mammals dominate in Layers C (Fig. 34). Layer B is quite different from the other layers being equally represented by otter, cloven-hoofed, seals and other mammals. It should be emphasized that only 15 mammal bones could be identified from Layers B and C so these should be considered critically. Otter is better represented in the Mesolithic than in the Neolithic (Hufthammer 1992a:56).

The most important cloven-hoofed mammals were red deer and wild boar. As mentioned earlier, only one fragment of moose was found at Kotedalen and it came from Layer D. Moose was somewhat better represented at the inland site of Skipsheller (Table 1). Wild boar was more frequently identified than red deer in Layers H and D and the other two layers do not have enough fragments to warrant a comparison.

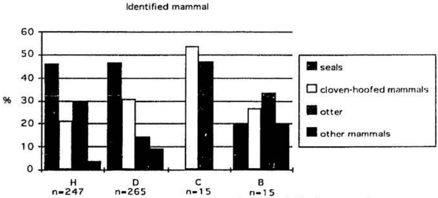


Figure 34. Percent of identified mammals

Fish. Fish was the most important group represented in Layers H and D. By far the most important fish in the faunal remains at Kotedalen are those of the Cod family in particular coalfish (saithe), cod and pollack, though ling and haddock are also present (Table 13).

Table 13
Fish identified at Kotedalen

Liters analyzed	1013	5651	1595	1211
Layer	H	D	C	B
ling	1			
pollack	13	211	1	10
haddock	58	13		
coalfish	1040	227	6	8
Pollachius sp.(coalfish/pollack)	660	625	23	8
Gadidae cod family	888	1285	18	5
cod	225	125	1	3
flounder		1		
Heterosomata (flounder sp)	8			
wolffish		1		
ballan wrasse	41	16		
cuckoo wrasse	3			
Labrus sp.	3	1		
redfish	2	1		
herring	3			
salmon	2			
salmonidae	9	3		1
identified fish	2956	2509	49	35
unidentified fish	6588	17684	581	184
total fish	9544	20193	630	219

Source: Hufthammer 1992a:21,22,28,30,31

Much less numerous but present in small quantities are members of the Labrus family (ballan and cuckoo wrasse), the

Salmon family and herring. Only a few fragments of flounder, conger eel, wolffish, redfish, mackerel and common eel were identified. Layer H was dominated by coalfish and Layer D is almost equally represented ' · coalfish and pollack (Fig. 35). The other layers have few fish bones identified to the species level.

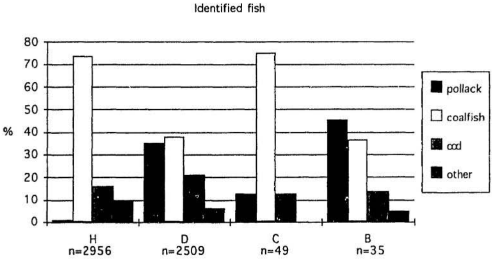


Figure 35. Percent of identified fish

Birds. The percentage of bird bone fragments relative to mammals and fish was greatest in the Neolithic layers (Hufthammer 1992a:51). Auks, cormorants and shags were the best represented birds in the Mesolithic layers. In addition to these only one gull and one duck fragment were identified (Table 14). The bird remains in the Neolithic layers are dominated by various species of Auks and there is also a greater variety of other birds identified (ibid.).

Table 14
Birds identified at Kotedalen

liters analyzed	1013	5651	1595	1211
Layer	H	D	C	B
great auk	1	1		
common guillemot				1
razorbill	1	3	3	1
puffin				1
Alcidae auks	9	3	1	
cormorant	10	5		
shag	1			
kittiwake	1			
Anatidae sp ducks		1		
identified birds	23	13	4	3
unidentified birds	260	491	36	74
Total birds	283	504	40	77

Source: Hufthammer 1992a:21,22,28,30,31

Seasonality. One way of addressing the seasonality of site occupation through the faunal remains is by identifying the presence of species known to occur in the area at only specific times of the year. This was done for the Kotedalen remains and only five of the identified species were found to be present in the region at more specific times of the year:

Salmonidae, common eel and mackerel representing the summer months and long-tailed duck and dovekie representing the winter months (Hufthammer 1992a:48). In the Mesolithic layers only 15 fragments of salmonidae represent the summer indicators and they were present in all layers except Layer C and no winter indicators were found. Both summer and winter indicators were found in the Neolithic layers (ibid.:49).

One of the drawbacks with this kind of analysis in this region is that only a very few species fit the requirement of being available during only part of the year. When these are represented by a only a few fragments the argument is less valid as other interpretations for their presence which have nothing to do with the seasonality of occupation are possible.

In addition to the presence of specific species, several quantitative measurements for seasonality based on the faunal remains are proposed (Bruen Olsen 1992:240, based on Hufthammer 1992a). For example, additional indicators of summer occupation may be a greater frequency of cormorants, coalfish, haddock and seal (ibid.). Cormorant and seal are likely to reflect summer occupation, assuming that the seal remains are primarily harbor seal, however the large amount of coalfish and haddock can be interpreted in other ways. Coalfish is present in the vicinity of Kotedalen year round

(Bergsvik 1991:23). Based on the reconstruction of the availability of resources in Chapter 3, various species of codfish would have been the most important resource in the late winter and although coalfish is more abundant in the summer and easier to catch in larger quantities, it may not have been large quantities that were important, but its availability locally during the late winter months. The abundance of some species during specific seasons may have been an important consideration for when they are acquired, but for species available year round, particulary fish, their season of abundance may not have been as important as was their availability at times when other resources were either not available or less desirable. Haddock rises closer to the surface in the summer and may be more accessible at that time, but they could have been caught at any time of the year. A local fisherman noted that haddock as well as cod and pollack were fished in the winter in deeper waters with nets (ibid.:22), so the slightly different percentages of haddock between the Mesolithic and Neolithic (Hufthammer 1992a:50) may not be significant.

A quantitative winter indicator that was proposed was a greater frequency and diversity of Auks (Bruen Olsen 1992:239, Hufthammer 1992a:54). Auks are generally more abundant in the area in the winter than at other times of the year (ibid.). First, it could be argued that most of the Auks should be summer indicators as they are easier to capture while nesting and most of the species are thought to have nested at least in some numbers in this region in the past (ibid., see discussion in Chapter 3). Second, the fact that less than 5% of all faunal remains from the Mesolithic layers was bird (for most layers less than 2%) suggests that the chances of finding a winter indicator, or any specific seasonal indicator for that matter, in the Mesolithic layers is practically none. Third, the noticeable difference between the number and variety of bird species between the Mesolithic and Neolithic layers may merely represent a more intensive use of bird resources, perhaps because of an increase in the population or a narrowing of available hunting territory. Optimal foraging models suggest that, especially for less important food species (like birds), abundance is not a key factor in foraging decisions (Winterhalder 1981:96).

Some of the year round indicators proposed were a high percentage of cod and pollack (relative to coalfish), a low percentage of haddock, a dominance of cloven-footed mammals and an extremely high frequency of fish (Hufthammer 1992a, Bruen Olsen 1992:240). A high frequency of fish may be an indicator of year round occupation, especially if the other aspects of the archaeological data do not indicate any kind of specialization on fishing. However, a high frequency of fish does not only occur in some of the Neolithic layers (Bruen Olsen 1992:240, Table 28). This is also true for Layers H and D from the Mesolithic occupations (Fig. 31).

Although cloven-hoofed mammals are available year round, there are some seasons when they are more desirable (better hide, more meat, antlers) or they are easier to catch like in the fall and winter. This is a similar argument to the one criticized above referring to coalfish, but these are two different kinds of resources. Compared to coalfish, cloven-hoofed mammals are much larger, not as easy to catch, and offer non-food as well as food resources. More planning, time and energy must have gone into acquiring these kinds of resources. Therefore, it is more likely that cloven-hoofed mammals were hunted when they had the most to offer or when people were more certain of a successful hunt.

The relative proportions of different fish species, like coalfish to cod/pollack may provide some indication for season of occupation (Hufthammer 1992a:50; Bruen Olsen 1992:239). The spring and fall fisheries provide the greatest catches of coalfish (Evjevollen 1968), indicating that coalfish is more abundant during the summer-half of the year (Hufthammer 1992a). On the other hand, pollack and cod are equally abundant year round (Hufthammer 1992a:50). The argument is that a greater frequency of coalfish relative to cod/pollack indicates occupation during the summer-half of the year (ibid.), whereas a lower frequency may indicate year round occupation. Although this may be a valid argument, one also has to consider that factors other than the timing of greatest abundance of a species may have been important in determining when a species was acquired. As argued above, a more important consideration may have been that coalfish is locally available during the winter, and considering the paucity of other available resources during the winter, it may have been an important part of the winter diet. Another problem with the argument as presented by Bruen Olsen (1992:Table 28, p.240) is that it is not acceptable to combine the assemblages from several layers. Coalfish dominates over other fish species only in Layers H and C whereas for Layers D and B cod/pollack dominate (Fig. 36). The results from the Neolithic layers are also presented on Figure 36 to indicate the degree of variability within the Neolithic that is hidden when information from several layers is combined (see also Hufthammer 1992a:51 Figure 4). More detailed descriptions for these Neolithic layers which date to ca. 5200(NF), 5000(NE2), 4900(NE1), 4690(ND) and 4400 (NC) BP are provided in Bruen Olsen (1992:36).

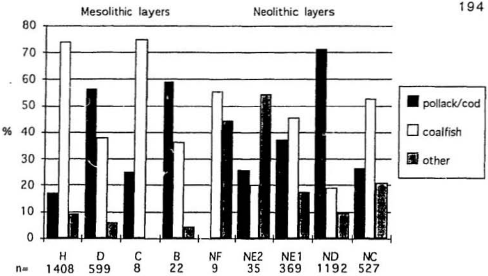


Figure 36. Percent of pollack/cod, coalfish and other fish

Another approach to determining the seasonality is based on an understanding of the spatial and seasonal distribution of important food resources and the assumed seasons that these resources were most accessible or most desirable as presented in Chapter 3. All species that wereidentifed in the faunal remains at Kotedalen were assigned to one of the following categories: spring/summer, fall, winter and year round (Table 15). Some of these assignments would be different if considering a site located on the outer coast, fjord valley or mountain plateaus. The reasoning behind these assignments is provided in Chapter 3 and based on when they were present in an inner coastal

Table 15
Assumed seasonality of identified animals

	YEAR ROUND	SPRING/SUMMER	FALL	WINTER
MAMMAL	otter	harbor seal seals (unspecified)	grey seal moose red deer wild boar cloven-hoofed	fur bearing (except otter)
FISH	pollack coalfish cod flounder conger eel herring	ling hake haddock cusk wolffish wrasses mackerel salmon	redfish common eel	spiny dogfish
BIRDS	sea eagle raven	great auk common guillemot razorbill black guillemot puffin auk (unspecified) cormorant shag herring gull kittiwake eider duck mallard wigeon ducks (unspecified)		dovekie Icelandic gull whooper swan red-breasted merganser long-tailed duck

environment and when they were most likely to have been hunted. The seal bones not identified to species are assumed to be those of harbor seal, though this is not known (Hufthammer 1992a:27).

The results for mammal, fish and bird together reveal that Layers H and D have over 90% year round resources

(Fig.37). Fish is the dominant contributor to the year round results and the importance of fish for groups that settled at Kotedalen is clear (Hufthammer 1992a:51). Fish may be over represented in the above diagram. Fish have more bones than do birds and mammals and they are easier to identify to species. On the other hand, only few flotation samples were analyzed, and certainly a high percentage of the bones in the flotation samples were fish. It is also not known how resistent the different types of bone were. In order to adjust for such discrepencies when comparing across major

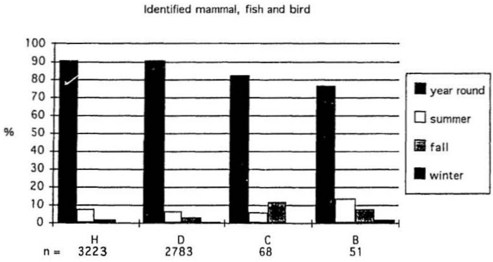


Figure 37. Seasonality based on mammals, fish and birds

groups, the seasonality of the faunal remains based on just the identified mammal bones is presented (Fig. 38).

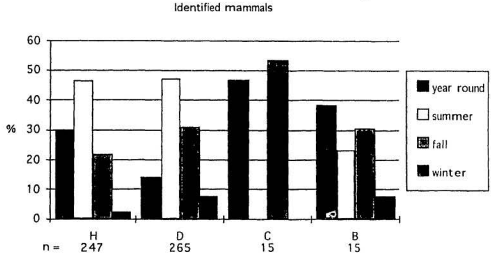


Figure 38. Seasonality based on mammals alone

Summer resources represent over 40% of the the total in Layers H and D, they are not present in C and only represent 20% of Layer B. Seal is the primary contributor to the summer percentage. Fall resources (cloven-hoofed mammals) are better represented in Layers B and C than they are in Layers D and H. Otter is the only species contributing to the year round percentages. Winter is poorly represented in all layers, but is the greatest in Layers D and B. Note that the number of identified mammal bones for Layers C and B is too low and they are only presented for comparative purposes.

There are various drawbacks to this approach which are highlighted by examining the mammals. Otter bones (year round mammal) are probably over represented as their bones are more compact and therefore better preserved and easier to identify than other mammals (Hufthammer 1992a:27). Deer and wild boar (fall mammals) can be caught during other seasons, and as age determinations were difficult (ibid.), and the number of bones identified few, this could not be evaluated. The seal bones were assumed to be of harbor seal but it is possible that they also represent grey seal, which would be considered a fall mammal. Some of the fur mammals (winter mammals) are only represented by a few bones and these may not be indicative of the season of occupation (Monks 1981), as it is possible that they represent prestige items which were curated. In addition, the transitions between the seasons are not clear cut and there is much more overlap than suggested here.

Although these results cannot be directly interpreted to indicate the season(s) of site occupation, they do provide a means for summarizing the characteristics of the resources present in each layer and provide a basis for comparing them.

As the percentages of identified fragments of mammal, fish and bird do not reflect the total number of the bones found for each major animal group, an adjustment was made.

This adjustment was based on the relative frequency of identified species within each animal group that assumes that the ratio of the number of identified fragments within each group (mammal, fish, bird) is valid and allows a comparison of the seasonality based on all faunal remains (Fig. 39).

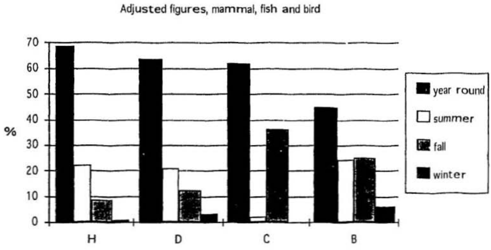


Figure 39. Adjusted seasonality for mammals, fish and birds

No effort was made to account for the effects of differential preservation, and recovery techniques. Layers H and D are similar and are dominated by year round resources (over 50%) with approximately 20% summer resources. Layer D has a slightly higher percentage of fall and winter resources than does Layer H. Layers C and B were represented by fewer identified elements and the results are not reliable, but Layer C had a high percentage of year round resources and was well represented by fall resources. Layer B had the most even distribution and all seasons were fairly well represented.

The following provides a summary of the important characteristics of the faunal remains of each Layer. Layer H is dominated by year round resources (68%), primarily coalfish, but otter is also well represented. Summer resources are the next best represented (22%) and the animal contributing most to the summer figure is seal, although some fish and birds (cormorants) are also part of this count. Fall resources (9%), represented by the cloven-hoofed mammals, in particular wild boar, are the third most represented. And, as is true for all layers, the winter resources are poorly represented (1%). One fragment of grey seal from this layer may indicate that some of the unidentified seal fragments which were classified as summer resources may not be valid, and instead indicate a greateer emphasis on fall resources. One interpretation of this assemblage is that it primarily represents a spring/summer occupation, however the variety of species present indicates more than one season of occupation. If fish is the most important resource of the late winter, then the faunal remains from Layer H may indicate occupation from the late winter through the summer Wild boar could well have been caught in the late winter and only one fragment of red deer and grey seal was identified. It is also possible that the remains represent year-round occupation and the species found reflect the resources predicted in the previous chapter for a site on the inner coast with year-round occupation.

The faunal remains from Layer D are very similar to those of Layer H. There are however, three major distinctions. The percentage of year-round resources is slightly less in Layer D (64%) as a result of the fewer number of otter bones. In turn, fall (12%) and winter (3%) resources are better represented in Layer D. More fragments of red deer contribute to the quantities of fall resources, but wild boar still dominates and one fragment of moose was found. Another difference is the higher percentage of pollack and cod relative to coalfish. This may also indicate less emphasis on resources from the summer-half of the year as suggested by Hufthmmer (1992a:50). Summer was represented by 21% of the adjusted figures and this was dominated by seal with some fish and bird also contributing. Like Layer H, the faunal remains indicate that Layer D was occupied at least in the spring and summer. However, there is more indication for Layer D that it was also occupied in the fall and winter and possibly year-round. This does not necessarily imply that it was occupied year round, as it may also have been reoccupied during subsequent seasons. As mentioned in the section on radiocarbon dates and stratigraphy, Layer D appears to have an earlier and a later occupation. This distinction has not been taken into account in this analysis but should be in future work with the faunal remains from this site.

Only a total of 68 fragments were identified for Layer C and the results described below are tentative. They are perhaps most valid when compared to Layer B, both of which were only sampled. Year-round resources (62%) are only slightly lower than for Layers H and D; however, the summer indicators (2%) are poorly represented, the winter indicators non-existent and the percentage of fall resources is as high as 36%. The year-round resources are almost equally divided by fish (coalfish) and mammals (otter). The fall remains are equally represented by red deer and wild boar. The lack of seal bones is perhaps the greatest distinction between Layer C and the other Mesolithic layers. Whether this is a sampling problem is not known. Based on the sample recovered, the faunal remains indicate occupation in the fall.

The same precautions apply for Layer B as only a small portion of the layer was sampled and only 53 bone fragments could be identified to genus/species. Year round resources only represent 45% of the total adjusted figures followed by summer and fall with 24% and 25% respectively. Although Layer B has the greatest percentage of winter (6%) indicators, this figure is based on the presence of only one fragment of pine marten and is not valid. The low percentage of year-round resources is a result of the smaller number of fish bones present and this is surely a reflection of differential preservation and recovery procedures. Summer is indicated by the presence of seal, although minimal fish and bird fragments associated with summer occupation were also present. Cloven-hoofed mammals, mostly wild boar, are the only contribution to the fall results. The tentative conclusion based on the limited sample is that Layer B represents an occupation during at least the summer and fall.

The following chapter will evaluate the interpretations arrived at above concerning site seasonality and occupation duration based on a more detailed study of the spatial distribution of specific artifact classes across the site relative to the features.

6 KOTEDALEN - INTERPRETATIONS

6.1 Introduction

The general pattern of refuse discard forms the basis against which the distribution of specific tool types assumed to have different functions will be assessed. The aim is not to arrive at small, detailed activity areas, but instead to achieve a more general understanding of how different areas of the site were used during the different occupations. Although it is not expected that this will provide direct evidence concerning season(s) or duration of occupation, it should provide a better basis to evaluate the results arrived at in the previous chapter and to present a more complete understanding of how the archaeological remains from each occupation are interpreted.

An assumption made throughout the following is that non-retouched artifacts, like flakes, blades and cores (primary refuse) are used and discarded in a different manner than is true for more formal tools (Binford 1978a). Such artifacts are primarily related to stone tool production and concentrations can be used to identify such areas, or areas of secondary discard. Retouched flakes and blades will reflect working areas where they were used, or areas of secondary discard. More formal tools like scrapers, knives and points, that are hafted or curated in some fashion will be found disposed of in a variety of ways. Some are used and discarded away from the site and will not be found, others may be discarded during retooling when they are no longer useful. They may also be left in a particular working area or stored to be returned to later. The manner in which these three different data classes, primary refuse, the refuse of expedient tools and the refuse of more formal tools, are patterned across the site can assist in interpreting the behavior that resulted in their deposition.

In the discussion below, more detail is provided for Layers H and D as these were almost completely excavated. Only partial samples were taken of Layers C and B. Appendix 3 provides the distribution per m^2 for all artifacts, number of liters excavated, density (number of artifacts/liter), other material types, flint, quartz/quartzite, crystal quartz and mylonite for each layer. Based on the distribution of the total number of stone artifacts per m^2, isobase maps were drafted for each layer which together with the features form the basis for dividing each layer into several areas. A map overlay with this information is provided inside the back cover and it can be used for the distribution maps. The information from 111X99Y was excluded from all of these isobase maps as the excavation units in this initial test pit were difficult to correlate and it stood out as an anomaly in most of the distributions.

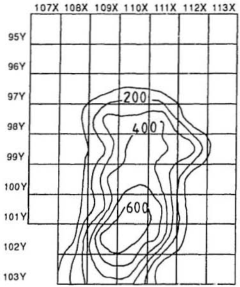
Although the faunal analysis was not presented such that the horizontal distribution of the different species across the site or the distribution of the identified elements for a specific species could be discerned, the identified species from some features were presented and provide limited insight into how specific features were used and how the remains within the features compare to the layer as a whole. Only a few fragments could be identified from each feature, but they correspond to a specifically defined context and are valuable in that sense.

The characteristics of the different areas defined, together with an evaluation of the artifact distribution, and a summary of the results from Chapter 5 form the basis for interpreting the function, seasonality and nature of the occupation that the remains from each layer represent.

6.2 Layer H - (between ca. 7350-7200 BP)

Distributions. The center of the artifact concentration in Layer H is defined by the 600 find isobase and is directly associated with the hearth MS30 (Fig. 40). The 400 find isobase corresponds fairly well with the ash layer MS28, except along the eastern edge of the site where no ash feature was observed. The 200 isobase falls just short of the area defined as Layer H. To the north and south of the hearth (MS30) the slope of the contours is steeper. This is a result of two different factors: a low bedrock rise is present along the southern edge and Layer H is absent to the north where Layer D and the Early Mesolithic layer are in direct contact. The slope is less distinct to the east of the hearth and there is a broad plateau to the west. The upper edge of the slope corresponds to the ash layer and represents the edge of dwelling structure. Most of the finds are distributed within an area of about 18 m^2.

Based on the features which suggested a post-supported structure with an indoor hearth (see p.142-147) and the general artifact distributions outlined above, Layer H can be divided into 5 different areas (Areas 1-5) which are expected to have different characteristics (Fig. 41). Area 1 covers the central area of the site around the hearth (MS30, use map overlay). The units to the south and east of Area 1 where there is no ash lense but some finds were defined as Area 2. To the west of Area 1 is most of the ash lense (MS28) which forms Area 3. Area 4 is situated along the western edge of Area 3 and is not as closely associated with the ash lense, but still within the area with a substantial amount of the finds. It is not certain whether this area is inside or outside the proposed dwelling. Area 5 lies outside the 200 find isobase on the western edge of the site.



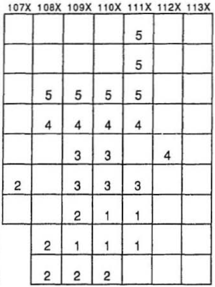


Figure 40.
Layer H-Artifact distribution.
100 find isobase lines

Figure 41.
Layer H-Areas defined.

Table 16 shows the relative number of different artifact types/100 liters for each of these areas. The same results were acquired when the percentage was calculated as the volumes excavated in each of the areas, except for Area 5, were roughly equivalent. The distributions indicate that most of the stone artifacts are concentrated in Area 1. This includes flakes, core fragments and blades as well as retouched flakes, scrapers, drills, engravers, groundstone tool fragments and round stones. Areas 2 and 3 are almost

Table 16
Layer H - Artifact distribution by Area

		#/100 liters					
		Area 1	Area 2	Area 3	Area 4	Area 5	Entire
	n	Hearth	SE	Ash	W	Edge	Layer
Flakes/fragments	7012	1433	744	866	777	258	870
Cores	4	1	1	1	0	0	0
Core fragments	55	12	2	7	5	9	7
Blades	955	170	122	137	84	48	118
Retouched flakes/frg.	59	13	8	5	4	8	7
Retouched blades	49	7	8	6	5	4	6
Scraper	68	19	6	7	4	5	8
Drill	11	3	1	1	1	0	1
Engraver	2	1	0	0	0	0	0
Stone points	4	1	1	1	1	0	0
Frg. of ground stone	29	8	5	1	1	2	4
Flensing knife	1	1	0	0	0	0	0
Grinding slab	1	1	0	0	0	0	0
Round stone	7	2	1	1	0	0	1
Steatite artifact	1	0	1	0	0	0	0
Bone tools/tool frg.	77	10	4	21	2	10	10
Total	8335	1682	903	1052	883	342	1034
Liters excavated		181	171	181	169	105	806

Note: 111X99Y not included

equally represented by scrapers, drills and round stones. The difference between these two areas is that formal tools or fragments of them (retouched flakes, retouched blades and groundstone tools) are more prevalent in Area 2 and primary refuse (flakes, blades and core fragments) are more prevalent in Area 3. In addition, Area 3 has the greatest concentration of bone tools which is probably a reflection of the better bone preservation within the ash lense. Flakes are fairly frequent in Area 4, and blades and to a certain extent core fragments are also present. Only a few retouched stone tools or bone tools were found in Area 4. Area 5 had relatively few artifacts. Despite this, some artifact categories were better represented here than in some of the other areas. Core fragments were more frequent here than in Areas 2, 3 and 4. Retouched flakes and fragments of groundstone tools were also more frequent in Area 5 than in Areas 3 and 4 and some scrapers were present. Bone tools were just as frequent in Area 5 as they were in Area 1.

To summarize, the hearth (Area 1) was used as a central disposal area for all types of refuse including both primary refuse as well as that from, expedient and curated tools. Also the areas immediately surrounding the hearth contained refuse of all types, but not of the same magnitude as in the hearth. Formal tools or their fragments were more prevalent to the south and east of the hearth (Area 2), whereas primary refuse and bone tools were associated with the ash lense to the west of the hearth (Area 3). Farther west, the finds are dominated by primary stone refuse (Area 4). Outside the proposed dwelling (Area 5) there were fewer artifacts, but these represented all three types of refuse. The types of refuse within the hearth and outside the proposed dwelling are mixed whereas the other areas are typified by either primary refuse, expedient refuse or refuse from more formal tools. With this overall picture, it is instructive to examine the distribution of each artifact type (Figs. 42-47).

The four cores were recovered spread in Areas 1, 2 and 3, and core fragments were concentrated in Area 1 in the units along the southwestern edge of the hearth (MS30, Fig. 42). Microblades (w < 8mm) had the greatest concentration in 110X101Y in Area 1, and macroblades (w > 12mm) were concentrated in Area 3 to the west of the core fragments mentioned above (Fig. 42). The greatest concentration of medium blades was in the area between the macroblades and the microblades. They were also well represented in Area 2. Although the relationship is tentative, there appears to be a trend with the microblades concentrated in the hearth (MS30), surrounded by the medium blades and finally the large blades. This indicates that some cultural process is sorting the blades by size with the largest items occurring farther away from the hearth and the smallest in the hearth. This may represent "tossing" activity as described by Binford (1978a), but is more likely a reflection of the process of blade production, or the selection process for blade use. No study of flake size distribution was completed, but if the trend

CORES SUM 4

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y			1				
100Y							
101Y				1			
102Y							
103Y			1	1			

CORE FRAGMENTS SUM 1097

	107X	108X	109X	110X	111X	112X	113X
95Y					12		
96Y					3		
97Y		4	5	11	15		
98Y		1	20	11	42		
99Y			29	71	142	68	
100Y	4		59	51	37		
101Y			52	71	44		
102Y		5	63	88	42		
103Y		22	69	56			

MACROBLADES SUM 561

	107X	108X	109X	110X	111X	112X	113X
95Y					6		
96Y					2		
97Y		1	3	7	7		
98Y		1	11	7	24		
99Y			9	36	59	40	
100Y	2		36	22	27		
101Y			35	43	23		
102Y		5	34	31	19		
103Y		10	35	26			

MICROBLADES SUM 536

	107X	108X	109X	110X	111X	112X	113X
95Y					6		
96Y					1		
97Y		3	2	4	8		
98Y			9	4	18		
99Y			20	35	83	28	
100Y	2		23	29	10		
101Y			17	28	21		
102Y			29	57	23		
103Y		12	34	30			

Shaded area initial testpit

Figure 42. Layer H-distribution of cores, core fragments, macroblades and microblades

RETOUCHED FLAKES SUM 61

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y			1	3	4		
98Y			2	3			
99Y			3		2	1	
100Y	1			1	5		
101Y			2	6	8		
102Y		1	3	1	5		
103Y			5	4			

RETOUCHED BLADES SUM 55

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y		1	1	2			
98Y			3	2	3		
99Y			3	3	6	1	
100Y			2	1	2		
101Y			4	4	1		
102Y			5	1	1		
103Y		2	7				

"SCRAPERS" SUM 77

	107X	108X	109X	110X	111X	112X	113X
95Y					1		
96Y							
97Y			2	2			
38Y			1		2		
99Y				1	9	3	
100Y			2	8	1		
101Y			3	9	4		
102Y		1	5	11	6		
103Y			4	2			

ENGRAVERS SUM 3

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y					1		
100Y							
101Y							
102Y				2			
103Y							

Shaded area initial testpit

Figure 43. Layer H - distribution of retouched flakes, retouched blades, scrapers and engravers

DRILLS SUM 12

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y					1	1	
100Y				1	1		
101Y			1		2		
102Y			2	1	1		
103Y				1			

WEAK RETOUCH SUM 85

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y		1	1	3	3		
98Y			3	4	2		
99Y			5	3	6	2	
100Y	1		2	2	4		
101Y			3	9	6		
102Y			7	1	3		
103Y		1	9	4			

NORMAL RETOUCH SUM 91

	107X	108X	109X	110X	111X	112X	113X
95Y					1		
96Y							
97Y			3	2	1		
98Y			3	1	3		
99Y			1	1	9	2	
100Y				5	2		
101Y			6	8	9		
102Y		2	5	11	5		
103Y		1	7	3			

STEEP RETOUCH SUM 32

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y				2			
98Y							
99Y					4	2	
100Y			2	3	3		
101Y			1	3			
102Y			3	4	5		
103Y							

Shaded area initial testpit

Figure 44. Layer H-distribution of drills, weak retouch, normal retouch and steep retouch

CONVEX SUM 58

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y			2	3	1		
98Y			2	2	2		
99Y				1	2	3	
100Y			1	2	1		
101Y			4	2	2		
102Y		1	5	8	10		
103Y			2	2			

CONCAVE SUM 44

	107X	108X	109X	110X	111X	112X	113X
95Y					1		
96Y							
97Y					1		
98Y			1	1			
99Y			2	3	5	1	
100Y	1		1	2			
101Y			3	4	4		
102Y			6	2	2		
103Y			4				

STRAIGHT SUM 171

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y		2	2	3	2		
98Y			5	2	3		
99Y			5	1	17	3	
100Y	2		3	10	10		
101Y			9	13	14		
102Y		1	8	22	12		
103Y		2	12	8			

WAVY SUM 43

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y			1	3			
98Y			1		1		
99Y			2	1	6	2	
100Y	1			1	2		
101Y			3	7	1		
102Y			6	1			
103Y			4				

Shaded area initial testpit

Figure 45. Layer H-distribution of convex, concave, straight and wavy retouch

GROUND STONE FRAGMENTS SUM 30

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y				1	1		
98Y		1			1		
99Y					1		
100Y					2		
101Y				3	4		
102Y			1	5	2		
103Y			3	5			

ROUND STONES SUM 7

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y							
100Y				1			
101Y			1	1	1		
102Y		1	1		1		
103Y							

FLENSING KNIVES SUM 1

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y							
100Y							
101Y							
102Y					1		
103Y							

OTHER STONE ARTIFACTS SUM 2

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y							
100Y							
101Y							
102Y			1				
103Y				1			

Shaded area initial testpit

Figure 46. Layer H-distribution of groundstone tool fragments, round stones, flensing knives and other stone artifacts

BONE POINTS SUM 3

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y							
100Y							
101Y				1			
102Y			1		1		
103Y							

BONE NEEDLES/AWLS SUM 9

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y			2				
98Y			1				
99Y				1			
100Y				3	1		
101Y							
102Y			1				
103Y							

BONE HOOKS SUM 28

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y					1		
97Y			3	1			
98Y			2				
99Y			1	1	5		
100Y				6	1		
101Y			1				
102Y			2	1			
103Y			1	2			

OTHER WORKED BONE SUM 45

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y					1		
97Y			2				
98Y							
99Y			14	1	3		
100Y				4*	5		
101Y			2	3			
102Y			5	1	3		
103Y			1				

Shaded area initial testpit

* One decorated

Figure 47. Layer H-distribution of bone points, needles/awls, hooks, other worked bone fragments

noted in the blades is any indication this might be worthwhile if future work with activity areas is completed with this material.

Whereas retouched flakes and fragments are more frequent in Area 1 and are fairly frequent in Area 5, retouched blades are slightly more frequent in Area 2 than in Area 1 and are least frequent in Area 5 (Fig. 43). Expedient tools were concentrated in the two discard areas, the hearth and outside the dwelling. Area 2 seems to have been the major area of blade use.

The more formal, probably hafted, tools were concentrated in the central hearth area. Two of the three engravers were found in Area 1 and the third was found in the original test pit (Fig. 43). The scrapers are concentrated to the hearth (MS30) and the adjacent units in Areas 2 and 3 (Fig. 43). Three of five blade endscrapers and one scraper with convex retouch on all edges were found in Area 5. These scrapers are steeply retouched and they likely define a bone or wood working activity area. Four scrapers were also found in Area 4. Drills were fairly evenly distributed (Fig. 44) near the hearth but none in 110X101Y in the center of the hearth (MS30). The concentration of formal tools in the central hearth area reinforces the interpretation that this was the focus of discard.

Angle and shape of retouch indicate different functions and the distributions of these characteristics reflect different activities or areas of discard across the site. The retouch on all scrapers, retouched blades and retouched flakes are included as the basis for the distributions. What is noteworthy is that the distributions do not generally overlap even though they are all concentrated in Area 1. Weak (30-60°) retouch is concentrated along the western, southern and eastern edges of the hearth (MS30), normal (30-60°) retouch in the center of the hearth and to its west and steep (60-90°) retouch in the center of the hearth and on its northern edge. This indicates that the areas around the hearth are used in different manners. Weak retouch is the most common and is found spread across the remainder of the site (Fig. 44). Concave and wavy retouch are oriented to the southern and western units of Area 1, convex retouch to the northern units and straight retouch to the center of the hearth (Fig. 45). Convex retouch is also fairly frequent in Areas 4 and 5 as is wavy retouch in Area 4.

There are only a few other types of tools associated with Layer H. Groundstone tool fragments are concentrated in the hearth (MS30) but they are also relatively frequent in Area 2 and a few singular fragments are found spread in Areas 3, 4 and 5 (Fig. 46). The flensing knife fragment was found on the northern edge of the hearth (MS30) in the same area that the convex retouch was prevalent. Together, these may indicate that this area was the focus of hide work, but use-wear studies would be needed to confirm this. The round stones occur singularly and are spread along the southern, western and northern edge of the hearth (Fig. 46). The two other stone artifacts were a small grinding slab fragment which was found on the southern edge of the Area 1, and a small rock with a groove all around (61021) which was found on the eastern side of the hearth (MS30, Fig. 46).

The three bone points were found in three separate units within the hearth (MS30, Fig. 47). The bone awl/needles and fish hooks were concentrated in Areas 3 and 5, and none were recovered from Area 2. The other worked bone fragments were heavily concentrated in Area 3, well represented in Area 1 and minimally present in Areas 2 and 5. Quite distinct is a concentration of 14 worked bone fragments in 109X99Y in Area 3; these may be fragments of one tool. The one piece of bone with decoration (see Fig. 30) was recovered in the neighboring unit 110X100Y (Fig. 47).

Summaries of the faunal remains for two ash lenses in Layer H, MS28 and MS29, were presented (Hufthammer 1992a:26). MS29 is smaller and more confined and is partially superimposed over the hearth area MS30. Considering all fragments of mammal, fish or bird, the percentages for the two ash lenses are dominated by mammals whereas for the layer as a whole fish is the dominating element (Table 17). Whether this is due to preservation differences between the ash and the cultural layer, or it has to do with the ash lenses representing a specific season of occupation, or a specific method of food preparation remains to be determined.

Table 17
Faunal remains from some features at Kotedalen

	Layer H		Layer D						Layer B	
Feature designation	MS28	MS29	MS19	MS21	MS22	MS23	MS25	MS26	MS17	MS20
seals	34			1	1					
hoofed mammals	3							1		
wild boar	8									1
otter	36	4		1			1			
small mammals	1	2					1			
identified mammal	82	6		2	1		2	1		1
unidentified mammal	1208	162	38	110	36	98	107	17	18	288
total mammal	1290	168	38	112	37	98	109	18	18	289
ling	1									
pollack/saithe	217	6	101	8			26		5	17
cod and cod family	180	10	172	8	2	2	737	4		2
Labrus family (wrasse)	14	1								
salmon family	3						1			
identified fish	415	17	273	16	2	2	764	4	5	19
unidentified fish	296	39	850	5	7	1	1334		6	17
total fish	711	56	1123	21	9	3	2098	4	11	36
Auks	2								1	
cormorant/shag	4									
identified bird	6								1	0
unidentified bird	127	8	1				11		18	38
total bird	133	8	1				11		19	38
total remains	2136	232	1162	133	46	101	2218	22	48	363
# of liters analyzed	105	15	8	16	1	14	8	3	7	4
denisty #/liter	20	15	145	8	46	7	296	7	7	91

Source: Hufthammer 1992:24,29,32

The detail provided above indicates that the excavation units that comprise Area 1 were not all used in the same manner. The artifact distributions establish that Area 1 is the central focus of all but a few activities and acted as the central area of disposal. Most of the artifact categories are differentially spread around the hearth (MS30) in Area 1. The southwestern edge of the hearth was the primary area of blade production and stone tools with concave and wavy retouch, probably used for forming wooden or bone shafts, were also concentrated in this area. Together, these suggest the production and retooling of slotted points with blade inserts in this area. More tentatively, a hide working area was suggested for the northern side of the hearth based on the presence of the flensing knife and the tools with convex retouch.

Moving outside the central hearth area, retouched blades and other retouched tools were frequent in Area 2 which is interpreted as an area where daily activities resulting in the accumulation of expedient tools occurred. Area 3 defined by the extent of the ash had the greatest frequency of bone tools, and was otherwise dominated by primary refuse (flakes, core fragments and blades). This area is adjacent to the hearth and the blade production area to the southwest of the hearth and was probably an extension of both these areas within the dwelling. Area 4 was dominated by primary refuse and had fewer former tools. This is interpreted as either an area of stone tool production outside the proposed dwelling, or perhaps the entrance to the dwelling where primary refuse from the stone tool production area inside the dwelling accumulated. Area 5 seems to be a separate specific task area, outside the proposed dwelling with a small concentration of scrapers, some bone tools and less primary refuse.

Function and seasonality. The features, including the postholes, the ash lenses around the central hearth area, and the low embankment to the south of the hearth, indicate the presence of some kind of post supported structure with an interior hearth. This structure would have covered an area of at least 10 m^2, but was more likely in the order of 15 m^2. One additional hearth (MS12) which was originally assigned to Layer D, but provided a radiocarbon date contemporaneous with Layer H or slightly earlier, may represent an earlier occupation in the western part of the site, or it may be another hearth associated with Layer H.

The occupation of Layer H represents a residential camp. The dwelling structure with interior hearth, the high density of the artifacts, the large number of artifacts recovered (over 9000), the variety of retouched tools and bone tools, and the variety of faunal species found all indicate that the remains from Layer H represent a residential camp where a variety of activities occurred and that it lasted for some amount of some time. The types of artifacts found, their composition, and distribution and the variety of species represented also suggest that this was more than a special purpose camp, but perhaps less than a substantial year-round occupation. For example, one would expect to find at least some larger fragments of hammerstones, axes/adzes or other large stone artifacts at a site occupied year-round or repeatedly reoccupied over several different seasons, but these are lacking from Layer H. It also does not seem likely that the remains from Layer H represent several reoccupations of the terrace, as the features are distinct, and the layer is thin (5 cm thick). If this was the case, it was probably by the same group of people who used the terrace in a similar manner.

An interior hearth, the accumulation of ash and the dwelling structure, suggests occupation during the colder time of the year. That the artifacts were concentrated around the interior hearth and there was a greater percentage of formal retouched tools relative to more expedient retouched tools also creates the impression of occupation during the colder months when more emphasis might have been placed on maintenance activities.

The faunal remains indicate occupation at least in the spring and summer but the variety of the resources indicate occupation in some other seasons as well, particularly in the late winter (dominance of fish), but possibly also in the fall and early winter (gray seal, wild boar, red deer and brown bear see pp. 200-201).

A reasonable interpretation of the data available from Layer H is that it represents a residential camp occupied in the late winter, spring, summer and possibly fall. Considered together, the presence of the dwelling structure with the finds concentrated in and around the hearth, the accumulation of the ash lense, the remains of some wild boar, red deer, grey seal, fur bearing mammals, and hazelnuts all argue against this representing a purely spring, summer residential camp. The interior hearth was the center for most of the activity and for most of the discard. Many of the tools are differentially distributed around the hearth and an area of blade production and retooling was identified along the southwestern edge and an area possibly used for hide work was found on its northern edge. Area 5 was considered outside the dwelling (defined by the extent of the ash layer and the post holes) and represents specific activities that did not result in the production of large quantities of primary refuse.

The amount of unburned bone preserved, which is extremely seldom for an open air site in this region of western Norway, indicates that this site was abandoned and the layer was sealed off relatively quickly as the bone would have decomposed if left exposed.

The specific implications, as outlined in Chapter 4, relative to the data from each layer will be summarized at the end of this chapter when the occupations represented by the different layers are compared.

6.3 Layer D - (between ca. 7450-7300;7200-7075 BP)

Distributions. The center of the find concentration in Layer D is defined by the 800 isobase which corresponds to one of the hearths (MS7) in the eastern section of the site (Fig. 48). Note that this is roughly the center of the concentration in Layer H. The 400 isobase defines the general area of most of the finds and features. This also corresponds to the extent of the finds from Layer H. There is a less distinct concentration of artifacts associated with two hearths MS12 and MS15 in the western section of the site. MS12 has been radiocarbon dated and it may be contemporaneous with Layer H. In the northwest corner of the area excavated is another small linear concentration.

The isobase contours show a steep slope along the eastern and southern edges of the central concentration. This slope is less distinct to the north and the slight indentation along the northern edge is due to a bedrock outcrop which occurs in this area. Likewise, the concentration in the northwest corner of the excavated area is separated from the main concentration by a flat bedrock outcrop. Most of the finds and features were found within an area of ca. 24 m^2.

Layer D was more difficult to divide into areas than Layer H and several different divisions were tried based on ten, seven and five smaller areas. The results for seven areas are presented below as this level revealed some distinct differences (Fig. 49). Area 1, around the hearth (MS7), directly overlies Area 1 in Layer H. Area 2 is associated with a hearth (MS24) along the eastern and southern edges of Area 1. Area 3 is located between the eastern and western part of the site where MS22, a hearth which provided the youngest date for Layer D, was found. Area 4 was comprised of units along the southwestern edge of the excavated area and included one hearth MS13/19. Area 5 was centered around the hearths (MS12, MS15 and MS21) in the

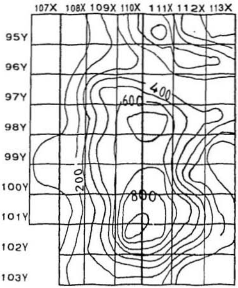


Figure 48.
Layer D-Artifact distribution.
100 find isobase lines

	107X	108X	109X	110X	111X	112X	113X
95Y			4	6	7	7	7
96Y		4	4	6	6	7	7
97Y		4	4	5	5	6	6
98Y	4	4	5	5	5	6	6
99Y	4	4	3	3		3	
100Y	2	2	3	3	3	3	3
101Y	2	2	2	1	1	1	1
102Y		2	2	1	1	1	1
103Y		2	2	2	2	2	

Figure 49.
Layer D-Areas defined.

western part of the site. Area 6 is located along the northern and western edge of Area 5 where few artifacts were found. Finally, Area 7 is the small linear concentration of finds in the far northwestern corner of the site where one probable hearth, MS68, was located.

The number of finds/100 liters excavated for each area indicates that most of the artifact types are concentrated in Areas 1, 3 and to a certain extent 5, whereas Areas 2 and 4 on the southern and eastern edge of the site and Areas 6 and 7 in the northwest corner have the fewest finds (Table 18).

Table 18
Layer D - artifact distribution by Area

		#/100 liters							
	n	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Layer D
Flakes and fragments	16035	453	226	377	16	266	196	195	268
Cores	125	2	2	2	1	2	3	2	2
Core fragments	380	7	6	4	5	6	8	8	6
Blades	3048	78	50	75	30	49	41	34	51
Retouched flakes	350	8	5	6	4	8	5	5	6
Retouched blades	254	6	2	4	3	6	5	3	4
Scrapers	307	8	6	7	4	4	5	3	5
Drills	38	0	1	1	0	0	1	1	1
Engravers	19	1	0	1	0	0	0	0	0
Stone points	11	0	0	0	0	0	0	0	0
Burins	5	0	0	0	0	0	0	0	0
Frg. of ground stone	117	4	3	3	1	2	1	1	2
Axe/adze	4	0	0	0	0	0	0	0	0
Flensing knife	4	0	0	0	0	0	0	0	0
Grinding slab	8	0	0	0	0	0	0	0	0
Round Stone	32	1	0	0	1	0	0	1	1
Hammerstone	12	0	0	0	0	0	0	0	0
Bone tools/fragments	117	3	1	5	0	4	0	0	2
Total	20866	571	303.6	485.4	211.3	347.1	265.8	254.1	349
Liters excavated		893	914	785	738	849	929	870	5977

Note: 111X 99Y not included

Area 1 is well represented by flakes, blades, retouched blades and flakes, scrapers, engravers and groundstone tool fragments. Cores, core fragments, bone tool fragments and round stones are also fairly numerous. Items that are not well represented are drills, axes and flensing knives. Area 3 is second to Area 1 in the frequency of flakes, blades, engravers, scrapers and groundstone fragments. Retouched blades do not follow this pattern and neither are core fragments nor round stones well represented. On the other hand, drills are well represented in Area 3, and its most distinguishing aspect is the occurrence of bone tools. Area 5 represents the concentration of artifacts in the western part of the site. Retouched flakes are as frequent here as they are in Area 1 and retouched blades are only slightly less frequent. Unlike Areas 1 and 3 the frequency of scrapers and engravers is low whereas axes and flensing knives are well represented. Area 5 is also well represented by bone tools. To summarize the characteristics of these three artifact concentrations: Area 1 contains a variety of primary refuse, and expedient and more formal tools, but lacks axes, flensing knives and bone tools; Area 3 lacks expedient stone tools but contains bone tools; and Area 5 lacks formal retouched tools, but contains axes, flensing knives and bone tools.

Areas 2 and 4 have comparatively few finds. Drills and points occur relatively frequently in Area 2 and hammerstones and round stones are the only items that are relatively frequent in Area 4. Areas 6 and 7 have roughly the same frequency of flakes and blades which is the lowest for this layer except for Area 4. Core fragments and burins are most frequent in areas 6 and 7 and cores are most frequent in Area 6. Round stones are frequent in Area 7 whereas points and flensing knives are fairly frequent in Area 6. There are few retouched tools or bone fragments in these two areas. These four areas represent special activities or disposal areas that are not specifically related to stone tool production.

The distribution of the artifact types by meter square provides a more detailed understanding of the distribution of the finds, most of which are concentrated in Area 1 (Figs. 50-57). Cores are fairly evenly distributed across the layer; the greatest concentration is associated with the northwest corner of the site (Fig. 50); smaller concentrations are present adjacent to the hearth (MS7) and also in the western part of the site near hearths MS15 and MS12. The distribution of core fragments and blades is similar to that of the cores with three concentrations (Fig. 50). Although the pattern is not as distinct, there is a similar tendency to that noted for Layer H, with medium and macroblades farther away from the central concentrations of microblades. The similar distributions of cores, core fragments, blades and to a certain extent flakes suggest that there were at least three somewhat separate areas of stone tool production or areas of disposal.

The greatest concentration of retouched flakes is in the vicinity of the hearths MS15 and MS12 (Fig. 51). Another concentration, which is larger in area but not as distinct, is around MS7 the hearth in Area 1. Two other small

CORES SUM 126

	107X	108X	109X	110X	111X	112X	113X
95Y				10	2		3
96Y				7	3	4	11
97Y		1	1	1	3	4	4
98Y			2	5	6	2	1
99Y		2	3	1			
100Y	1	1	3	5	5		
101Y		2	1	3	5	3	1
102Y		1	3	3	4	2	
103Y		1	1	4	1		

CORE FRAGMENTS SUM 389

	107X	108X	109X	110X	111X	112X	113X
95Y			7	10	20	7	7
96Y		2	3	7	9	17	22
97Y		4	7	10	7	6	14
98Y	1	6	6	16	9	12	12
99Y	4	3	6	1	9	2	
100Y	3	6	12	5	6	2	
101Y	2	3	4	22	7	8	3
102Y		5	19	2	3	7	9
103Y		6	3	1	5		

MACROBLADES SUM 1335

	107X	108X	109X	110X	111X	112X	113X
95Y			7	27	46	8	4
96Y			11	18	23	29	27
97Y		15	28	22	22	13	19
98Y	3	13	26	36	43	31	37
99Y	7	5	33	46	29	38	
100Y	7	15	53	48	39	12	9
101Y	1	11	32	58	41	42	9
102Y		19	21	51	48	38	16
103Y		31	16	30	20	2	

MICROBLADES SUM 1795

	107X	108X	109X	110X	111X	112X	113X
95Y			15	32	73	14	5
96Y		2	21	27	33	51	38
97Y		16	43	55	34	13	18
98Y	1	6	36	70	74	48	42
99Y	9	16	55	40	53	35	
100Y	5	14	43	49	71	9	5
101Y	1	12	49	52	67	59	9
102Y		8	29	88	55	45	15
103Y		21	22	45	42	5	

Shaded area initial testpit

Figure 50. Layer D-distribution of cores, core fragments, macroblades and microblades

RETOUCHED FLAKES SUM 355

	107X	108X	109X	110X	111X	112X	113X
95Y			6	11	15	2	1
96Y		1	3	5	2	12	13
97Y		7	6	8	9	3	12
98Y	2	5	11	16	21	9	7
99Y	2	1	8	8	5	3	
100Y		2	12	5	7	4	
101Y			9	11	14	10	1
102Y		3	9	12	12	7	1
103Y		1	4	11	6		

RETOUCHED BLADES SUM 258

	107X	108X	109X	110X	111X	112X	113X
95Y			3	12	7	5	
96Y		2	1	3	5	7	4
97Y		3	4	11	14	5	12
98Y	2	7	3	8	12	9	4
99Y		1	4	7	4	3	
100Y			4	3	6	4	2
101Y	1		2	8	16	6	1
102Y		1	6	2	10	11	2
103Y		4	3	2	2		

"SCRAPERS" SUM 320

	107X	108X	109X	110X	111X	112X	113X
95Y			5	3	6	3	
96Y			1	2	3	3	13
97Y		8	9	5	5	10	5
98Y	1	2	9	4	8	13	6
99Y		2	14	8	13	1	
100Y		3	13	10	8	3	
101Y		1	10	14	12	7	5
102Y		3	6	19	12	4	
103Y		6	4	9	9		

ENGRAVERS SUM 19

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y						1	
97Y			2	1			
98Y		1	1				
99Y			3	2			
100Y							
101Y			1	1	1	2	
102Y			1	1		1	
103Y							

Shaded area initial testpit

Figure 51. Layer D-distribution of retouched flakes, retouched blades, scrapers and engravers

DRILLS SUM 39

	107X	108X	109X	110X	111X	112X	113X
95Y				1	1	2	
96Y				1	1	2	
97Y		1	1	1		1	1
98Y			1		1	1	
99Y	1		1	2	1		
100Y		2		3	1		
101Y		1				1	
102Y		1			1	1	
103Y		2	1	4			

WEAK RETOUCH SUM 425

	107X	108X	109X	110X	111X	112X	113X
95Y			5	19	12	8	1
96Y		2	1	7	4	15	10
97Y		10	7	15	16	6	16
98Y	4	10	11	14	23	16	11
99Y	1		7	8	6	4	
100Y		1	10	6	6	6	2
101Y	1		7	11	25	5	
102Y		2	12	7	15	17	2
103Y		5	6	7	3		

NORMAL RETOUCH SUM 318

	107X	108X	109X	110X	111X	112X	113X
95Y			6	5	12	3	
96Y		1	3	4	6	8	10
97Y		3	12	7	7	4	4
98Y	1	3	8	11	13	6	1
99Y	1	4	10	12	7	3	
100Y		3	10	5	11	4	
101Y		1	8	10	9	14	2
102Y		4	4	17	13	2	1
103Y		2	2	11	10		

STEEP RETOUCH SUM 248

	107X	108X	109X	110X	111X	112X	113X
95Y			3	3	5	1	
96Y			1		1	2	10
97Y		6	3	4	5	9	10
98Y		2	6	3	6	10	5
99Y	1		13	7	10		
100Y		3	9	10	5	1	
101Y		1	7	13	9	7	5
102Y		2	6	10	7	5	
103Y		6	4	8	4		

Shaded area initial testpit

Figure 52. Layer D-distribution of drills, weak retouch, normal retouch, steep retouch

CONVEX SUM 307

Y	107X	108X	109X	110X	111X	112X	113X
95Y			4	6	8	3	
96Y			1	4	3	1	6
97Y		8	9	8	9	10	8
98Y	1	3	4	6	12	8	7
99Y			8	9	7		
100Y		5	9	8	11	4	
101Y			8	11	15	12	2
102Y		4	5	15	15	6	1
103Y		5	6	9	3		

CONCAVE SUM 85

Y	107X	108X	109X	110X	111X	112X	113X
95Y			1	1	2		1
96Y		2	1		1	2	7
97Y		2	1	3	1	2	2
98Y	1		3	2	5	1	4
99Y				1	2		
100Y			4			2	
101Y			1	2	3	5	1
102Y			5	1	3	5	
103Y			1	2	2		

STRAIGHT SUM 428

Y	107X	108X	109X	110X	111X	112X	113X
95Y			6	17	16	6	
96Y		1	2	5	5	15	11
97Y		7	8	11	12	5	16
98Y	3	8	14	17	18	16	4
99Y		2	11	12	7	6	
100Y			11	7	7	5	1
101Y	1		10	18	22	5	3
102Y		3	5	15	14	9	2
103Y		5	4	11	9		

WAVY SUM 84

Y	107X	108X	109X	110X	111X	112X	113X
95Y			2	2	2	2	
96Y			1	1		3	4
97Y			1	2	6		
98Y		3	2	3	3	3	1
99Y	1		7	1	3	1	
100Y			3	3	2		
101Y		1	2	1	2		
102Y			5	2	2	2	
103Y		1		1	3		

Shaded area initial testpit

Figure 53. Layer D-distribution of convex, concave, straight and wavy retouch

POINT SUM 11

	107X	108X	109X	110X	111X	112X	113X
95Y			1	1			
96Y						1	1
97Y							
98Y						1	1
99Y							
100Y					1		
101Y			1				
102Y			2				
103Y					1		

BURIN SUM 5

	107X	108X	109X	110X	111X	112X	113X
95Y					1		
96Y						1	
97Y				1		1	1
98Y							
99Y							
100Y							
101Y							
102Y							
103Y							

AXE/ADZES SUM 4

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							1
97Y				1	1		
98Y			1				
99Y							
100Y							
101Y							
102Y							
103Y							

GROUND STONE FRAGMENT SUM 118

	107X	108X	109X	110X	111X	112X	113X
95Y			1	3	3	2	
96Y					2	1	2
97Y				2	1		2
98Y	1	2	7	3	3	1	1
99Y	2		3	5	1		
100Y		1	4	5	5	1	
101Y		1	4	5	4	8	
102Y		3	4	8	7		
103Y		1	2	4	3		

Shaded area initial testpit

Figure 54. Layer D-distribution of points, burins, groundstone tool fragments and axes/adzes

FLENSING KNIVES SUM 4

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y				1			1
98Y			1				
99Y							
100Y							
101Y							
102Y					1		
103Y							

GRINDING SLABS SUM 8

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y				1			
99Y			1				
100Y				1			
101Y						1	
102Y			2		1		
103Y					1		

HAMMERSTONES SUM 13

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y		3					
98Y			1		1	1	1
99Y					1		
100Y	1				1		
101Y				1		1	
102Y						1	
103Y							

ANVIL STONES SUM 1

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y							
100Y							
101Y							
102Y							
103Y				1			

Shaded area initial testpit

Figure 55. Layer D-distribution of flensing knives, grinding slabs, hammerstones and anvil stones

SMOOTHING STONES SUM 2

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y				1			
98Y						1	
99Y							
100Y							
101Y							
102Y							
103Y							

GRINDING STONES SUM 1

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y							
100Y			1				
101Y							
102Y							
103Y							

ROUND STONES SUM 33

	107X	108X	109X	110X	111X	112X	113X
95Y			1	1	5	1	1
96Y			2	1	1		4
97Y			2				1
98Y			1		1		
99Y	1				1	1	
100Y							
101Y				1	2		
102Y		1	1		2		
103Y		1					

PERFORATED STONES SUM 4

	107X	108X	109X	110X	111X	112X	113X
95Y			1				
96Y			1				
97Y				1			
98Y							
99Y		1					
100Y							
101Y							
102Y							
103Y							

Shaded area initial testpit

Figure 56. Layer D-distribution of smoothing, grinding, round and perforated stones.

BONE POINTS/HARPOONS SUM 5

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y					1		
98Y			1		1		
99Y							
100Y					2		
101Y							
102Y							
103Y							

BONE NEEDLES/AWLS SUM 8

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y					1	1	
98Y							
99Y			1	1			
100Y							
101Y			2				
102Y					1		
103Y				1			

BONE HOOKS SUM 58

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y			1				
98Y			2	14	6		
99Y			4	7			
100Y					4		
101Y				8	2		
102Y			1	1	6		
103Y			1	1			

OTHER WORKED BONE SUM 46

	107X	108X	109X	110X	111X	112X	113X
95Y					1		
96Y							2
97Y		1	1				
98Y				4	1		
99Y			5	1			
100Y			5	1	6		
101Y		1	2	2	2		
102Y			1		9		
103Y			1				

Shaded area initial testpit

Figure 57. Layer D-distribution of bone points, needles/awls, hooks and other worked bone fragm.

concentrations are found near the hearth MS21 and in the northwest corner of the site. Retouched blades have a similar pattern although the concentration around MS21 is lacking (Fig. 51). Engravers were fairly evenly distributed around hearth MS7 in Area 1. Another concentration of engravers was located just west of hearth MS22 together with a small concentration of scrapers (Fig. 51). Along the northern edge of Area 5 and in the northwest corner of the excavated area are small concentrations of scrapers. However, the greatest concentration of scrapers was associated with the hearth MS7 (Fig. 51). Drills are distributed fairly evenly across the site, however their absence or minimal presence from most of the units with hearths is noteworthy (Fig. 52). A similar pattern was noted for Layer H and it would be interesting to find out if this was a more widespread phenomena at other sites in this region.

Weak retouch is distributed in the three main concentrations, one in Area 1 (MS7), one in Area 5 (MS12, MS15, MS21) and one in the northwest corner of the site (Fig. 52). These concentrations are fairly distinct from the surrounding areas. Normal retouch is also associated with these three areas although the concentrations are not as distinct (Fig. 52). The distribution of steep retouch is somewhat unique as it forms a NW-SE diagonal from Area 7 to Area 1 (Fig. 52). A concentration is found to the west of MS22 and is related to the presence of the engravers and wavy retouch there. Perhaps most interesting is the low numbers of tools with steep retouch associated with the features in Area 5. Here, weak retouch dominates and probably indicates activities related to softer materials, like hide working. It should be pointed out that flensing knives were also present in this area.

A distinct concentration of concave retouch was noted in the northwest corner associated with the probable hearth MS68 and less distinct concentrations were noted around the hearth MS12 and on the northern and southern edges of the central hearth MS7 (Fig. 53). Convex retouch was distributed over a large area associated with MS7. Another smaller concentration was associated with MS12 (Fig. 53). The distribution of straight retouch across the site is similar to that of the finds in general (Fig. 53). Wavy retouch is not specifically associated with the central hearth MS7 although a small concentration is on its southeastern edge. In fact, the highest concentration, which is very distinct, is found just west of hearth MS22 (Fig. 53). This is the same area where a small concentration of engravers and scrapers was found and probably represents some special activity related to work on bone or wood. Another concentration of wavy retouch is just north of Area 5.

The distribution of the few points and burins generally occurs along the edge of the find concentrations outside of the 600 find isobase, indicating that they were not discarded in the central parts of the site (Fig. 54). Points were found in both the eastern and western sections of the site, whereas burins were only found in the western half.

Four larger fragments of axes/adzes, one of them whole, were found in the western part of the site. Three of these were associated with Area 5, in particular hearth MS21 and the fourth one was associated with the more isolated hearth MS68 (Fig. 54). The fragments of groundstone tools, most of which are small resharpening flakes, were fairly evenly spread across the site following the pattern for the finds in general (Fig. 54). No complete axes were found in the eastern part of the site. Generally, axes/adzes are present in the western part of the site and groundstone tool fragments in the eastern part, indicating that these items were probably used and broken in the east and the larger fragments were discarded in the west suggesting a major functional difference between these two parts of the site. In this regards, it is noteworthy that the grinding slab fragments, were primarily from the eastern part of the site

(Fig. 55) and were probably used to resharpen the axes in this area.

Three of the four flensing knives were recovered from the western part of the site, two associated with a hearth (MS21) in Area 5 and one adjacent to MS68, a probable hearth in Area 7 (Fig. 55). The fourth flensing knife fragment was found in the east part and could be refitted with a fragment from Layer H.

The 13 hammerstones are distributed across the site primarily along the northern edge of find concentration from Area 1 to Area 5 (Fig. 55). Three hammerstones were found in one unit 108X98Y. One anvil stone was found to the east of MS7 (Fig. 55). The two smoothing stones were found in or near Area 5 and one was found in MS21 (Fig. 56). The only grinding stone was found associated with the hearth MS22 (Fig. 56). Most of the round stones were recovered from the western side of the site along the edges of Area 5 or associated with the linear concentration in the northwest corner of the site (Fig. 56). Only eight of the 33 were from the eastern part of the site, five directly associated with MS7 and the other 3 with MS24. The provenience of the round stones was checked to determine if they were associated with the younger part of Layer D. Of the 25 from the western section of the site at least 12 were assigned either Layer DC or D1 indicating they are probably from the younger part of Layer D. Taking this into account, the round stones appear to be more evenly distributed between the eastern and western halves of the site.

Two fragments of the same small perforated soapstone object were found on the southern edge of the site, both outside the major find concentrations (48104, Fig.27). The perforated stones (99178, 37114, Fig. 27) were found in the western part of the site to the southwest of Area 5 (Fig. 56). One was associated with MS21.

The largest concentration of bone tools was in several units associated with MS15 and MS12 and the area directly to the east of these (Fig. 57). Another more limited concentration is at the northern edge of MS7. Along the western edge of MS7 is a small ash lense, MS25, where another less numerous concentration occurs. Most of the bone tools were found within the 600 find isobase. Bone hooks mimic the concentrations of all the bone tools, other worked bone fragments are more oriented to the area around MS7. Needles and awls were found on the edges of MS7 and Area 5 and bone points were found in Area 5. The two harpoons found were from the same unit and associated with MS25 in Area 1.

The faunal remains from six of the features in Layer D were presented separately (Table 17). Two of the features from Layer D are dominated by fish remains MS13/19 and MS25. In MS13/19 only cod and coalfish were identified. MS25 is dominated by codfish but there was also one fragment each of otter, small mammal and salmon. MS25 is close to the central hearth and it was in the vicinity of this feature that the harpoon fragments were found. In the four remaining features where analysis was completed, mammals represent over 80% of the remains. In all cases only a maximum of two fragments could be identified. Seal and otter in MS21, seal in MS22, and cloven-hoofed mammals in MS26. Fish represented less than 20% of the remains and all identified fish were codfish or coalfish. As was the case for Layer H, Layer D contained a greater percentage of fish bones in the soil matrix than was found in specific features (the exceptions are noted above). This may be due to the different preservative qualities of the layers' soil. One possible explanation is that the hearths, were often cleaned out and the debris scattered over the surface, becoming part of the soil matrix. The smaller fish bones, in particular the vertebrae, would be more likely to survive under these circumstances than mammal bones would.

As gathered from the discussion above, the remains in Layer D are much more complex than was the case for Layer H. The sediments are thicker, the extent is greater, the number and variety of artifacts is greater and the number and variety of hearths is greater. Part of the problem of interpreting these remains is that the Layer D represents at least two occupations and without additional radiocarbon dates and a recorrelation of the excavation units based on, among other things, the vertical changes in material type percentages (see Fig. 19), it is difficult to separate the activities related to these two occupations. The discussion above reveals that there were some basic differences between the eastern and western part of the site and the reasons for these differences will be elaborated in the following.

Function and Seasonality. Several features indicate the presence of a post-supported structure in the lower part of Layer D which is associated with the structure in Layer H. It is clear from the field notes that at least some of the postholes originated in the lower parts of Layer D. These are slightly larger than those found in Layer H, but occur in the same general area in the eastern part of the site around a large central hearth. In both layers this is also the area with the greatest concentration of artifacts (Fig. 17)

In the western portion of the site, the possible remains of a tent in the form of a semi-circle arrangement of small stones was noted although these may also be rocks that were originally placed in the hearths and later discarded in the toss zone (see Binford 1978a:345). As this feature was reconstructed from the field notes, it is not known if these stones were affected by heat, which would support the supposition that they originated from the hearths. Because of the lack of any clear evidence for a dwelling structure in the western part of the site, it is interpreted as being outside any dwelling. As elaborated below, the distribution of the different artifact types and the kinds of activities they represent, support this interpretation of the site with a dwelling in the east and an outdoor work area in the west.

Layer D is about 15 cm thick and the well defined shallow hearths in upper part of Layer D in the eastern part of the site are about 7 cm above the interface with Layer H. The radiocarbon date from MS22 indicates that these are closely associated with the cccupation represented by Layer C. The discreteness of these hearths indicate that the site was abandoned after they were used and not returned to for some time, long enough for some vegetation to grow to protect them intact from later occupations. No large ash lenses like that noted in Layer H were encountered, although smaller concentrations were found. The hearths in the western part of the site assigned to Layer D are generally smaller and not as discrete. The radiocarbon date from MS12 indicates its association with Layer H or an even earlier occupation.

Although the two other hearths in this area were not dated, at least MS15 appears to belong to the early phase. It lies as much as 15 cm directly under a sample that was dated and found to be associated with Layer C. In summary then, three of the hearths in the western section of the site are all associated with the early occupation of Layer D, three in the eastern section are associated with the later occupation and the association of the other two (MS13/19 and MS68) is not known (see Fig. 17 and 18).

The number of artifacts (over 20,000) and diversity of the finds indicates either long continuous occupation, several different occupations, or a combination of both. The density of the flakes is considerably less than was true for Layer H. This may suggest deposition over a longer period of time, which would allow more soil build up and result in a lower density of flakes. However, this difference may also reflect that flint, the primary material used to produce stone tools, was becoming scarcer and the material was not wasted, or perhaps that the production of stone tools did not occur primarily at this site at this time, or perhaps discard procedures were different. The variety of finds for Layer D (Table 11), particulary when compared to Layer H suggests an increase in the variety of activities that occurred which, in turn suggests that the site was occupied in a number of different seasons. The most obvious artifacts to emphasize in this regards, are the ground stone tools, the grinding slabs, the flensing knives and the perforated stone tools. However, the distinction between the two layers may not be as clear once the excavation units are recorrelated as suggested above. Some of the artifacts from the lower part of Layer D should be associated with the Layer H occupation.

The activities associated with Layer D are varied and suggest that Kotedalen was used as a residential site. A variety of grinding slabs, hammerstones, round stones, perforated stones, formal retouched tools and more expedient tools were present. No specialization of any tool type or fauna was noted. The condition of the axes/adzes and their flakes indicate that the tools were brought to the site in finished form and taken from the site unless broken and discarded when no longer usable.

Most of the primary stone refuse was concentrated inside the proposed structure as defined by the postholes (see p. 150) and a variety of formal tools except for larger axe/adzes were also present here or in the nearby areas. Several more specific activity areas can be proposed. One is the area around MS22 in Area 3 where engravers, scrapers and tools with wavy retouch were concentrated. Few expedient tools were found in the vicinity and this is interpreted as a bone or wood working area. Area 5 is characterized by expedient tools and axes, flensing knives, bone tools and smoothing stones. The activities in this area were related to work on soft materials and it is interpreted as a hide working area. Another activity area is the northwestern part of the site (Areas 6 and 7) where there are few finds. Some of the items found here, like the flensing knives, and round stones were probably discarded from Area 5, the proposed hide working area. On the other hand, the concentration of burins and stone tools with concave retouch in this area may reflect a bone and wood working area.

The faunal remains from Layer D are very similar to those from Layer H and the conclusions for Layer H apply here, occupation from the late winter through the summer and possibly into the fall and early winter. In Layer D there is more evidence for fall and winter occupation as more fragments of red deer and fur bearing mammals were identified, moose was present and the percentage of pollack and cod relative to coalfish was greater (see p. 201).

The results from Layer D are not firmly established and there is room for reinterpreting the layer associations. It is likely that this layer represents at least two occupations and that its lower parts are more closely associated with Layer H and some of the upper parts with Layer C. There is evidence in both the eastern and western sections of the site for activity related to both an earlier and later phase. In effect, this lessens the differences noted between Layer D and the two adjacent layers.

Layer H and the lower part of Layer D are not exactly contemporaneous; Layer H underlies Layer D across the middle part of the site (see Fig. 9). They may be the remains of two closely related occupations or perhaps they represent the establishment or settling-in phase (Layer H), the occupational or use phase (lower Layer D), and the abandonment phase (upper Layer D with its intact, discreet hearths; see Stevenson 1985:64). If this was the case, then perhaps all of Layer H, with the central hearth, the surrounding ash and the low embankment, may represent the dwelling structure (settling-in phase) and the lower part of Layer D the actual occupation. Not until we have a better understanding of the formation processes of cultural layers and the rate of accumulation for different site types in this region can we begin to sort out different occupations that may have occurred at one site within a time span of 200 years.

6.4 Layer C - (between ca. 7250-7100 BP)

Distributions. Only a section of Layer C was excavated and some of that was affected by more recent disturbances. The general distribution of finds provides a different pattern than that of Layers D and H. The general distribution of all artifacts indicates a center with the artifacts dispersing in a gradual, even, oblong shape (Fig. 58). The only feature identified to Layer C was a hearth, MS10, and it was not associated with the artifact

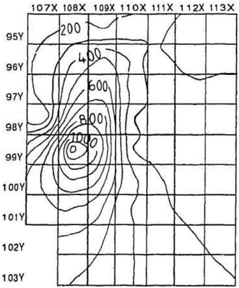


Figure 58.
Layer C-Artifact distributions
100 find isobase lines

concentration. If the artifacts and features from Layer D which are thought to be associated with Layer C are included, the distribution would be pulled to the north towards the hearth. The distribution of some of the specific artifact types complements the interpretation that some the younger features in Layer D should be associated with Layer C (Figs. 59-63).

The cores and core fragments are concentrated in three areas; one in the center of the find concentration, one immediately west of the hearth, MS10, and one in the eastern part of the site (Fig. 59). The blades are distributed as the finds in general. Large blades are more evenly distributed across the site with fewer in the units which have more microblades (Fig. 59).

Retouched blades, retouched flakes and scrapers are distributed as the rest of the finds with no concentration around MS10 (Fig. 60). There are three small concentrations of engravers, one just north of the center of the find concentration, one to the northeast of MS10 and one in the eastern part of the site (Fig. 60). The drills form a larger concentration on the northern edge of the artifact concentration and two of the drills were directly associated with MS10 (Fig. 61).

CORES SUM 57

	107X	108X	109X	110X	111X	112X	113X
95Y			4				
96Y			4				
97Y			4				
98Y			2	6	6		
99Y	10	6	5	1	1	2	
100Y							
101Y				1			
102Y				5			
103Y							

CORE FRAGMENTS SUM 95

	107X	108X	109X	110X	111X	112X	113X
95Y			3				
96Y			7				
97Y			4				
98Y			7	9	3		
99Y	1	14	3	4	10	2	
100Y							
101Y				25			
102Y				3			
103Y							

MACROBLADES SUM 310

	107X	108X	109X	110X	111X	112X	113X
95Y			5				
96Y			21				
97Y			23				
98Y			17	14	13		
99Y	21	40	40	21	30	16	
100Y							
101Y				23			
102Y				26			
103Y							

MICROBLADES SUM 550

	107X	108X	109X	110X	111X	112X	113X
95Y			7				
96Y			33				
97Y			45				
98Y			50	26	19		
99Y	48	84	65	25	52	32	
100Y							
101Y				29			
102Y				35			
103Y							

Shaded area initial testpit

Figure 59. Layer C-distribution of cores, core fragments, macroblades and microblades

RETOUCHED FLAKES SUM 96

	107X	108X	109X	110X	111X	112X	113X
95Y			2				
96Y			8				
97Y			9				
98Y			13	3	5		
99Y	5	15	11	2	6	5	
100Y							
101Y				9			
102Y				3			
103Y							

RETOUCHED BLADES SUM 51

	107X	108X	109X	110X	111X	112X	113X
95Y			1				
96Y							
97Y			2				
98Y			2	3	3		
99Y	3	10	5	4	8	4	
100Y							
101Y				4			
102Y				2			
103Y							

"SCRAPERS" SUM 79

	107X	108X	109X	110X	111X	112X	113X
95Y			3				
96Y			3				
97Y			9				
98Y			4	3	2		
99Y	8	14	10	5	6	5	
100Y							
101Y				5			
102Y				2			
103Y							

ENGRAVERS SUM 15

	107X	108X	109X	110X	111X	112X	113X
95Y			1				
96Y							
97Y			2				
98Y				1			
99Y		1	3		1	3	
100Y							
101Y				3			
102Y							
103Y							

Shaded area initial testpit

Figure 60. Layer C-distribution of retouched flakes, retouched blades, scrapers and engravers

DRILLS SUM 27

	107X	108X	109X	110X	111X	112X	113X
95Y			1				
96Y			1				
97Y			3				
98Y			4		2		
99Y	1	2	3	3	3	1	
100Y							
101Y				1			
102Y				2			
103Y							

AXE/ADZES SUM 3

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y					3		
100Y							
101Y							
102Y							
103Y							

GROUND STONE FRAG. SUM 10

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y			2				
97Y							
98Y			1				
99Y		1	3			1	
100Y							
101Y				1			
102Y				1			
103Y							

GRINDING SLABS SUM 3

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y			1				
98Y							
99Y		1					
100Y							
101Y				1			
102Y							
103Y							

Shaded area initial testpit

Figure 61. Layer C-distribution of drills, axe/adzes, groundstone tool frag. and grinding slabs

HAMMERSTONES SUM 1

	107X	108X	109X	110X	111X	112X	113X
95Y			1				
96Y							
97Y							
98Y							
99Y							
100Y							
101Y							
102Y							
103Y							

GRINDING STONES SUM 1

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y	1						
100Y							
101Y							
102Y							
103Y							

SMOOTHING STONES SUM 1

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y				1			
100Y							
101Y							
102Y							
103Y							

ROUND STONES SUM 22

	107X	108X	109X	110X	111X	112X	113X
95Y			1				
96Y			2				
97Y			4	4			
98Y			2	1	3		
99Y			2		2		
100Y							
101Y							
102Y				1			
103Y							

Shaded area initial testpit

Figure 62. Layer C-distribution of hammerstones, and grinding, smoothing and round stones

SOAPSTONE TOOLS SUM 1

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y		1					
100Y							
101Y							
102Y							
103Y							

OTHER STONE TOOLS SUM 1

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y			1				
97Y							
98Y							
99Y							
100Y							
101Y							
102Y							
103Y							

BONE FISH HOOKS SUM 6

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y			1				
98Y							
99Y			3	1	1		
100Y							
101Y							
102Y							
103Y							

WORKED BONE TOOL SUM 1

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							
98Y							
99Y			1				
100Y							
101Y							
102Y							
103Y							

Shaded area initial testpit

Figure 63. Layer C-distribution of soapstone tool fragments, other stone tools and bone tools

The complete axes were all found in the same unit just east of MS10 (Fig. 61). This was the initial test pit and the correlation to Layer C is tentative. The fragments of groundstone tools and the grinding slabs were found both in the center of the find concentration and spread outside of it (Fig. 61). The hammerstone was found on the western part of the site outside the major find concentration, the grinding stone and the smoothing stone were found on opposite edges of the find concentration (Fig. 62). The round stones were found along the western extension of the concentration and they increase in number away from the center of the concentration (Fig. 62). Three of them were directly associated with the hearth MS10. Other artifacts associated with the hearth, MS10, include cores, drills and items with weak retouch. These items do not seem to represent a specific activity, but instead indicate that the hearth was used for refuse. Two fragments of soapstone tools were recovered. The one thought to be part of a perforated tool was found on the western side of concentration, and the other irregular piece with a groove all around was found in the center of the find concentration (Fig. 63). The association of the bone tools found in Layer C with the central concentration is questionable as five of the seven were found near a more recent disturbance MS1 (Fig. 63).

Function and seasonality. It is difficult to come to a general conclusion for Layer C as it was only partially sampled. It is not known if any type of dwelling structure existed, though no evidence of such was recovered. At least one, and possibly more, hearth is associated with Layer C. The fact that the artifacts are not generally concentrated around hearth MS10 indicates that the hearth was not a central activity area or a focus of discard activities, as was true for some of the hearths in Layers H and D.

The faunal remains provide a more one-sided picture of resource use than the other layers but only 68 fragments could be identified to species and 49 of those were fish. All of the identified remains could have been left by a fall occupation.

A variety of artifacts were found, but the question remains as to whether this can be interpreted as a residential occupation. The diversity of the artifacts is not as great as for Layer D. Drills and engravers are better represented relative to other retouched tools. Whether this is a result of occupation during only one season, or a different composition of people occupying the site, or the nature of the activities performed, or the limited sample acquired is not known, and can only be evaluated further after Layer D is recorrelated and we have an understanding of the nature of contemporary sites in the region.

The number of artifacts recovered was just over 7500 and the density of artifacts was only 2.6 finds/liter, which is the lowest of all the layers (Table 9). Though extremely tentative, the overall impression of the archaeological data from Layer C is that it represents a site that was primarily occupied in the fall or winter by a small group of people. The fact that a relatively thick (20 cm) layer accumulated, but few hearths or other features were observed, and relatively few artifacts were found (compared to Layer E), tentatively indicates that Kotedalen was reoccupied several times throughout the formation of Layer C. This conclusion is tentative, as the area sampled represents only a small section (ca. 10%) of a much more extensive occupation.

6.5 Layer B - (between ca. 7000-6900 BP)

Distribution. As was the case with Layer C, only a portion (ca. 10%) of Layer B was excavated. Slightly different from Layer C is that Layer B was much easier to identify and its stratigraphic integrity was reinforced by the consistency of the radiocarbon dates. From the 14 m² excavated the distribution of artifacts reveal a center in the vicinity of the hearth MS4/5 and the bone concentration MS2 (Fig. 64). The overall shape of the distribution

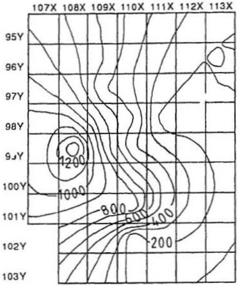


Figure 64.
Layer B-Artifact distribution
100 find isobase lines

indicates that only the northern and eastern part of the site was sampled. From the test pits and profiles in the trenches it is apparent that Layer B extended farther in these directions but has since been subject to erosion or incorporated in the plowzone. The distributions of specific artifact types across the terrace (Figs. 65-69) are only partially instructive as a large part of this layer remains unsampled.

Most of the artifact types have a distribution similar to that of the finds in general. This includes blades (Fig. 65), retouched flakes (Fig. 66), retouched blades (Fig. 66),

CORES SUM 100

	107X	108X	109X	110X	111X	112X	113X
95Y			2				
96Y			2				
97Y			14				
98Y			10	14	2		
99Y	14	15	9	2	7	1	
100Y							
101Y				5			
102Y				3			
103Y							

CORE FRAGMENTS SUM 113

	107X	108X	109X	110X	111X	112X	113X
95Y			5				
96Y			5				
97Y			7				
98Y			6	6	2		
99Y	13	19	6	2	8	2	
100Y							
101Y				30			
102Y				2			
103Y							

MACROBLADES SUM 227

	107X	108X	109X	110X	111X	112X	113X
95Y			3				
96Y			9				
97Y			15				
98Y			8	12	5		
99Y	29	30	17	13	34	17	
100Y					1		
101Y				26			
102Y				8			
103Y							

MICROBLADES SUM 574

	107X	108X	109X	110X	111X	112X	113X
95Y			35				
96Y			36				
97Y			34				1
98Y			25	22	15		
99Y	98	90	54	19	56	25	
100Y					1		
101Y				50			
102Y				13			
103Y							

Shaded area initial test pit

Figure 65. Layer B-distribution of cores, core fragments, macroblades and microblades

RETOUCHED FLAKES SUM 118

	107X	108X	109X	110X	111X	112X	113X
95Y			13				
96Y			8				
97Y			7				
98Y			12	11			
99Y	8	17	6	3	17	6	
100Y							
101Y				10			
102Y							
103Y							

RETOUCHED BLADES SUM 70

	107X	108X	109X	110X	111X	112X	113X
95Y			3				
96Y			5				
97Y			4				
98Y			5	1	2		
99Y	8	7	7	4	10	2	
100Y							
101Y				8			
102Y				4			
103Y							

"SCRAPERS" SUM 69

	107X	108X	109X	110X	111X	112X	113X
95Y			5				
96Y			6				
97Y			2				1
98Y			5	5			
99Y	8	13	9		8		
100Y							
101Y				6			
102Y				1			
103Y							

ENGRAVERS SUM 9

	107X	108X	109X	110X	111X	112X	113X
95Y			1				
96Y			1				
97Y							
98Y							
99Y		1	2		3		
100Y							
101Y				1			
102Y							
103Y							

Shaded area initial test pit

Figure 66. Layer B-distribution of retouched flakes, retouched blades, scrapers and engravers

DRILLS SUM 30

	107X	108X	109X	110X	111X	112X	113X
95Y			2				
96Y			1				
97Y			3				
98Y			2	2	1		
99Y	3	1	4		5	2	
100Y							
101Y				2			
102Y				2			
103Y							

WEAK RETOUCH SUM 112

	107X	108X	109X	110X	111X	112X	113X
95Y			8				
96Y			4				
97Y			6				
98Y			16	9			
99Y	14	8	6	5	17	4	
100Y							
101Y				12			
102Y				3			
103Y							

NORMAL RETOUCH SUM 101

	107X	108X	109X	110X	111X	112X	113X
95Y			6				
96Y			7				
97Y			4				
98Y			5	5	3		
99Y	5	18	14	2	15	5	
100Y							
101Y				10			
102Y				2			
103Y							

STEEP RETOUCH SUM 83

	107X	108X	109X	110X	111X	112X	113X
95Y			10				
96Y			10				
97Y			6				1
98Y			3	5			
99Y	8	13	8		11	1	
100Y							
101Y				5			
102Y				2			
103Y							

Shaded area initial test pit

Figure 67. Layer B-distribution of drills, weak retouch, normal retouch and steep retouch

AXE/ADZES SUM 14

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y	1					1	
97Y			1	1			
98Y					1		
99Y		4		2			
100Y	2						
101Y		1					
102Y							
103Y							

GROUND STONE FRAGMENTS SUM 28

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y			2			1	
98Y					1		
99Y	9	3	3		3	3	
100Y							
101Y				1			
102Y				2			
103Y							

GRINDING SLABS SUM 9

	107X	108X	109X	110X	111X	112X	113X
95Y			1				1
96Y							
97Y							
98Y				1			
99Y			2		1		
100Y	1						
101Y				2			
102Y							
103Y							

HAMMERSTONES SUM 9

	107X	108X	109X	110X	111X	112X	113X
95Y						2	
96Y							
97Y			1				
98Y							
99Y			2			1	
100Y							
101Y		1	1	1			
102Y							
103Y							

Shaded area initial test pit

Figure 68. Layer B-distribution of groundstone tool fragments, axe/adzes, grinding slabs and hammerstones

ROUND STONES SUM 32

	107X	108X	109X	110X	111X	112X	113X
95Y		1	3				
96Y				4			4
97Y			1				
98Y							
99Y	2	6	3			2	
100Y					1		
101Y		1		4			
102Y							
103Y							

SOAPSTONE WEIGHTS SUM 19

	107X	108X	109X	110X	111X	112X	113X
95Y			1				
96Y			6		1		
97Y							
98Y							
99Y	2	2	1		3	1	
100Y							
101Y	1			1			
102Y							
103Y							

BONE TOOLS SUM 2

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y							1
98Y							
99Y			1				
100Y							
101Y							
102Y							
103Y							

Shaded area initial test pit

Figure 69. Layer B-distribution of round stones, soapstone weights and bone tools

scrapers (Fig. 66), engravers (Fig. 66), and round stones (Fig. 69). Of these, retouched flakes have an additional concentration on the western edge of the excavated area where a number of tools with steep retouch (Fig.67) were also found. This probably represents a special activity area involving both expedient and formal tools. Drills are more evenly distributed across the site (Fig. 67).

Some of the artifacts are located in or around the hearth and the center of the find concentration. This is the case for such items as cores (Fig. 65), some axes/adzes (Fig. 68), groundstone tool fragments (Fig. 68), the flensing knife fragment, grinding slab fragments (Fig. 68), the hammerstones (Fig. 68) and the awl fragment (Fig. 69). Still other artifacts were found on the edges of the excavated area and outside the concentration as defined. This is particularly the case for the soapstone weights (Fig. 69), some of the complete axes, one of the grinding slab fragments, the bone hook (Fig. 69) associated with MS20 an ash lense which was outside the regular excavated area and some of the cores (Fig. 65). A concentration of core fragments was found in the eastern part of the site. As was the case for some of the hearths in the other layers, this one noted in Layer B served as the focus for a variety of activities.

The faunal remains from two ash lenses MS17 and MS20 in Layer B were analyzed (Table 17 p. 219). Of 48 fragments recovered from MS17, bird comprised 39%, mammal 37% and fish made up the remaining 23%. This is the only feature in all of the Mesolithic layers which has a noticeable contribution of bird bones. MS20 was more similar to most of the features in Layer D; the 363 fragments recovered here were dominated by mammals (80%). One of these fragments was identified as wild boar. The remaining 20% was equally divided between fish and bird. Both of these features were located outside the area formally excavated and the distribution of finds around them is not known.

Function and seasonality. As was the case with Layer C, no dwelling structure was identified, but it should be pointed out that only a small portion of the occupation was excavated. At least one small surface hearth was identified as well as several limited ash lenses in areas outside the concentration of the finds. The maximum extent of Layer B is 150 m^2, over twice that of Layer D. The sediments in Layer B, which on the average are 25 cm thick, are more homogenous and reworked like those of Layer C and are unlike those of Layers D and H. The nature of the sediments, and the consistency of the radiocarbon dates over a large area, give the impression of continuous accumulation either as a result of frequent of continuous accumulation either as a result of frequent reoccupation, or year-round occupation.

The finds are numerous (almost 9000 from ca 14 m^2), dense and diverse and suggest a residential base camp. The greater percentage of retouched flakes and blades relative to more formal retouched tools compared to the other layers should be noted, as well as the presence of soapstone weights for the first time at this site. On the one hand there is evidence for more expedient tools and on the other hand the introduction of a new artifact type. These differences may reflect a change in either technology, raw material availability, occupation duration, size and composition of the occupying group, small sample size, the nature of the tasks performed or a combination of these factors.

The faunal remains from Layer B, though the sample is small, were the most evenly distributed throughout the seasons. The diversity of species present is too great to represent just one season; occupation during just the summer and fall is possible. The presence of bird in the one features is the first sign of the trend towards an increased exploitation of birds that continues into the Neolithic (Hufthammer 1992a).

6.6 Discussion

Based on the variety of artifacts and the faunal remains found, the features present and the extent and thickness of the deposits, all layers, except for Layer C, are interpreted as representing residential camps of some duration. None are thought to represent short-term special purpose camps or a series of repetitive short-term camps by only a portion of the residential group. Layer C comes the closest to representing this kind of activity, but it should be remembered that only a sample of the entire layer is represented.

In all cases, except for Layer C, several different seasons are represented in the faunal remains. The question remains whether these represent year-round occupation or repetitive seasonal occupation. Although this cannot be answered with certainty, the implications set out in Chapter 4 and summarized in Table 19, provide guidelines for interpreting the characteristics described for each layer in the previous two chapters. These characteristics are summarized in Table 20. A comparison between the different layers and the implications is helpful. Layer H does not "fit" the year-round implications as it is a relatively small and thin layer with distinct features, no heavy artifacts, not very diverse artifacts and no dumps or middens present.

Table 19
Implications of settlement type for the archaeological record in western Norway.

characteristics	base camp occupied year-round or reoccupied in warm and cold seasons	reoccupied base camp primarily one season	special purpose camps short-term
location	general, inner coast	seasonally specific, variable	variable
size	large	large or small	variable
thickness	thick	thin	thin
features	diverse	more uniform	variable
hearths	indoor and outdoor	indoor or outdoor	variable
dwellings	substantial	substanial or temporary	temporary
feature distintiveness	blurred and distinct	distinct	variable
artifact density	dense	less dense	variable
artifact diversity	diverse	more specific	more specific
artifact composition	expedient and curated	expedient or curated	expedient or curated
heavy artifacts, "furniture"	present	may be present	may be present
fauna seasonality	all seasons (most seasons)	season specific	season specific
fauna diversity	diverse	less diverse	not diverse
storage facilities	present if necessary	not likely	not likely
dumps and middens	present	not necessary	not necessary

Table 20

Characteristics of the Middle and Late Mesolithic components at Kotedalen

characteristics	Layer H	Layer D	Layer C-small sample	Layer B-small sample	Source
location	general, inner coast	general, inner coast	general, inner coast	general, inner coast	
size (extent square meters)	small (30)	medium (60)	large (120)	large (150)	Table 9
thickness (average in cm)	thin (5)	medium (15)	thicker (20)	thickest (25)	Table 9
features (#, diverse)	22, diverse	25, diverse	1, uniform	5, less diverse	Table 10
hearths	indoor and outdoor	indoor and outdoor	probably outdoor	not known	
dwellings	present	present	not present	not present	
feature distintiveness	distinct	blurred and distinct	distinct	distinct	
artifact density (#/liter)	dense (10.8)	less dense (3.4)	not dense (2.5)	less dense (3.0)	Table 9
artifact diversity (# of 28 types)	less diverse, 19 types	diverse, 26 types	less diverse, 20 types	less diverse, 17 types	Table 11
artifact (% expedient tools)	55 %, more curation	61%, more expedient	55%, more curation	64 %, most expedient	Table 11
heavy artifacts (ex. grinding slab)	not present	present	present	present	Table 11
fauna seasonality	all except winter	all except winter	fall	summer, fall	p. 200-203.
fauna diversity (# of 46 types)	diverse, 34 types	diverse, 34 types	not diverse, 11 types	not diverse, 15 types	Tables 12-14
storage facilities	none, not necesary	none, not necesary	none, not necesary	none, not necesary	
dumps and middens	not present	not present	?	?	

However, it does have a number of the other implications for year-round occupation including, different kinds of features, a dwelling, indoor and outdoor hearths, high artifact density, a diverse faunal assemblage, a dominance of fish, which may indicate winter occupation, and all the other seasons represented in the faunal remains. Layer H does not seem to represent year-round occupation, or repetitive reoccupation, but neither does it fit the expectations of a base camp reoccupied primarily during one season, nor that of a special purpose camp. It probably represents a camp that was established for a substantial part of the year and then abandoned; the people taking with them most of their belongings.

In comparison, Layer D satisfies all of the implications for year-round occupation except that its artifact density is lower than was the case for Layer H and no dumps or middens were identified. It should be remembered that there is some evidence to indicate that Layer D represents more than one occupation. Although it is probably justifiable to refer to Layer D as a year-round or repeatedly reoccupied site, some attempt to separate out these two occupations in a more satisfying fashion should be made before this can be conclusive.

It is difficult to compare Layer C and B directly with Layers D and H because of the small samples taken from these components. These layers are each twice as large, and thicker than both Layer D and H and in that sense they seem as though they would be good candidates for year-round occupation, however only a few features were identified, no dwellings were found, the artifact density was low, and the artifacts and the faunal remains were not very diverse. Only the summer and fall (Layer B) and fall (Layer C) seasons were clearly represented in the faunal remains. The interpretations of Layer C and Layer B must remain open and no conclusions can be drawn.

This question concerning sedentary or more temporary base camps can be examined at two different levels at Kotedalen. The first level is for each stratigraphic layer considered in isolation, and this is the approach expanded on in this thesis. Perhaps, it is more important to step back and consider the characteristics of the different layers together to illustrate the use of this one place throughout a relatively short period of time.

The fact that relatively thick layers (>10 cm) are formed and that these are separated by stratigraphical changes seem to indicate that Kotedalen was either unoccupied for some amount of time (enough time for stratigraphical divisions to be formed) or that the character of the occupation changed significantly to result in stratigraphical divisions. Kotedalen was used as a residential camp at various times throughout the 200-500 year period represented by Layers H, D, C and B. In the case of Layer H and the lower part of Layer D, it appears that the terrace was used in the same manner by the same group of people, and may even represent a picture of different occupational stages: settling-in, occupation, abandonment (see Stevenson 1985). Even the surface hearths in the upper portion of Layer D, which may be as much as 200 years younger, correspond to the same area as the proposed dwelling structure in Layer H and hint at a similar organizational structure for use of the terrace during both occupations. Considered together the remains from these layers indicate that Kotedalen was an important place for the people living in this region from about 7400 to 6900 BP.

7 CONCLUSION

7.1 The Middle and Late Mesolithic at Kotedalen.

This thesis has examined in detail the features, artifacts and faunal remains from four stratigraphic layers at a large coastal site in western Norway to determine if year-round sedentary occupation occurred during the latter half of the Mesolithic. A series of implications for each of these data classes were developed to distinguish the characteristics of seasonal versus year-round occupation. Although the results from this one site cannot be expected to provide a clear answer, they do add valuable insight into how one place, located at a good fishing location, was used at different points throughout a 300 to 500 year time span.

The data indicate that at least three, and possibly four, separate occupations occurred at Kotedalen between ca. 7400 - 6900 BP. The radiocarbon dating method is not exact enough to arrive at a more fine-grained interpretation of the relationship between the different layers, but they are stratigraphically superimposed over one another. Interpreting Layer D was the most problematic, but based on the radiocarbon dates from some hearths and the distribution of features and artifacts it seems clear that what was identified as Layer D in the field actually represented two occupations, one that may be related to Layer H and the other which may be associated with Layer C. Additional studies of the vertical distribution of the raw materials from each excavation unit and additional radiocarbon dates from some the hearths should be undertaken to recorrelate the finds and features from Layer D, and new artifact distribution maps constructed. Such additional information may reveal that the remains from Layers H, D and C could be considered together as different stages (settling-in, use and abandonment) in the long-term, year-round, occupation of this one site. The weighted mean of eight radiocarbon dates from these three layers is 7236±33 BP and these can be interpreted as dating the same occupation, and the possibility that all three of these layers are related to one long-term, year-round occupation should not be dismissed. One of the problems in interpreting the remains from Kotedalen is that we do not have a good understanding of how cultural layers are formed or the rate of soil accumulation in this region. Another related problem is the difficulty in generating specific implications for linking mobility patterns directly to specific site data. There are other variables that also have to be controlled for that can account for the variability observed such as the size and composition of the group occupying the site, and the kinds of activities undertaken.

A reconstruction of the spatial and seasonal availability of major food resources provided the basis for several likely subsistence and settlement models for the region. This reconstruction revealed that the resources were relatively rich and varied throughout the year and that the availability of various species of codfish could provide a basis for year-round occupation along the coast. The resource structure was found to be non-constraining and various settlement strategies were possible. The reconstruction also showed that there were only a few species that could be used as seasonal indicators and this made the interpretations concerning season of site occupation tentative, at best.

7.2 The Middle and Late Mesolithic in western Norway

It is only after information from other sites which date to the same time period has been collected and analyzed on a comparative basis that a more certain answer to this question can be obtained. As was clear through the discussion of previous subsistence and settlement models for the Mesolithic in western Norway in Chapter 4, the detail of the data on a regional level is limited. Little, except for the distributions of stray finds (axes), and the remains from one cave site (Skipsheller) is known about the distribution of Middle and Late Mesolithic sites in the interior parts of this area. Only the coastal areas and mountain plateaus have had extensive test pit surveys which have revealed numerous sites from the Stone Age. The lack of survey data from the intermediate areas along the fjord and river valleys, and the limited number of extensively excavated sites from specific time periods greatly reduces the resolution of our interpretations. In addition, no systematic comparative study on a regional level of the Mesolithic sites already excavated has been completed, although this has been presented in summary fashion with an emphasis on site size and thickness (Nygård 1987, 1990). As many have realized, it is no longer adequate to lump together all Mesolithic sites into one analytical unit. It seems unlikely that given the variety of options inherent in the resource base for western Norway, as described in Chapter 3, that the settlement pattern would remain the same for a period of 5000 years or even 1000 years for that matter.

Bergsvik (1991) completed a survey of the region immediately surrounding Kotedalen (Fig. 6, p. 121), in part to determine local factors that influence the location of short-term and long-term sites (short-term being those sites assumed to be occupied for less than a month). Of 90 sites identified, a total of 18 could be dated to the Late Mesolithic. Up to 15 test pits were taken at each site to acquire some basic information about artifact frequency, layer thickness, site size, raw material variation, characteristics of the cultural layer and age. Based on this data the sites were classified as representing either long-term or short-term occupations (1991:205). Long-term sites were thought of as base camps occupied for a minimum of 2-3 months. Short-term sites were thought to be occupied for less than 2-3 months and probably represented the remains of specialized activity groups. Nine of the Late Mesolithic sites were classified as representing long-term occupations, 5 as several repeated short-term occupations and 4 as short-term occupations (Bergsvik 1991:257). Bergsvik concluded that the short-term late Mesolithic localities were more spread over the peninsula whereas the long-term sites were located near the strait where fish was available year round (1991:250). His study was designed to evaluate change throughout the Mesolithic and into the Neolithic and was spatially restricted. What is still lacking in order to get at settlement patterns for the Late Mesolithic over the entire region is a systematic, comparative study of the site types based on specifically defined criteria like site location, size, thickness, artifact content, feature content, activities represented, season of occupation, etc. These should be evaluated against one another based on some of the implications as outlined in Chapter 4.

7.3 Future research

Kotedalen will remain an important site for interpreting and reinterpreting subsistence and settlement patterns throughout the Stone Age of western Norway. There are many aspects of the material from this site that could be investigated further. One of the most important is a thorough analysis of some of the flotation samples so that a more rigorous comparison can be made between the layers in the Mesolithic and Neolithic parts of the site. Furthermore, additional radiocarbon dates from some of the hearth features might assist in interpreting the number and kinds of occupations that occurred. A recorrelation of some of the excavation units based on the vertical differentiation in raw material frequencies should assist in determining more securely the relationship between the different Mesolithic layers.

More importantly, the data from Kotedalen should be integrated into a regional study of excavated sites from the Middle and Late Mesolithic that focuses on comparing specific site characteristics in order to arrive at a better understanding of site formation processes on a regional level. This should be combined with more intensive surveys in the interior river and fjord valleys to acquire a comparable understanding of how these regions were or were not used at that time. At the same time this should be put into a framework that does not focus on available resources, as they were non-constraining, but focuses instead on other characteristics of hunter-gatherer life that may have been more important in constraining settlement patterns like population dynamics, obtaining lithic and other resources, and perhaps most importantly, maintaining social networks with neighboring groups. The impression after evaluating Kotedalen in detail is that there is considerable variability in hunter-gatherer settlement strategies, especially in areas like the west coast of Norway.

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APPENDIX 1.

Alphabetical list of mammals, fish, shellfish/crustaceans
and birds mentioned in the text;
English, Scientific and Norwegian names.

English	Scientific	Norwegian
MAMMALS	*MAMMALIA*	PATTEDYR
arctic fox	*Alopex lagopus*	fjellrev
badger	*Meles meles*	grevling
beaver	*Castor fiber*	bever
brown bear	*Ursus arctos*	bjørn
European polecat	*Mustela putorius*	ilder
gray seal	*Halichoerus grypus*	havert
harbor porpoise	*Phocoena phocoena*	nise
harbor seal	*Phoca vitulina*	steinkobbe
hare	*Lepus timidus*	hare
harp seal	*Pagophilus groenlandicus*	grønlandsel
hedgehog	*Erinaceus europaeus*	pinnsvin
killer whale	*Orcinus orca*	spekkhogger
lynx	*Lynx lynx*	gaupe
minke whale	*Balaenoptera musculus*	vågehval
moose	*Alces alces*	elg
otter	*Lutra lutra*	oter
pilot whale	*Globicephala melaena*	grindhval
pine marten	*Martes martes*	mår
red deer	*Cervus elaphus*	hjort
red fox	*Vulpes vulpes*	rev
reindeer	*Rangifer tarandus*	rein
roe deer	*Capreolus capreolus*	rådyr
small rodents	*Cricetidae, Muridae*	smågnagere
snow weasel	*Mustela nivalis*	snømus
squirrel	*Sciurus vulgaris*	ekorn
weasel	*Mustela erminea*	røyskatt
white-beaked dolphin	*Lagenorhynchus albirostris*	kvitnos
white-sided dolphin	*Lagenorhynchus acutus*	kvitskjeving
wild boar	*Sus scrofa*	villsvin
wildcat	*Felis sylvestris*	villkatt
wolf	*Canis lupus*	ulv
wolverine	*Gulo gulo*	jerv
FISH	*PISCES*	FISK
allis shad	*Alosa alosa*	maisild
angler	*Lophius piscatorius*	breiflabb
ballan wrasse	*Labrus berggylta*	berggylte
bass	*Dicentrarchus labrax*	havabbor
beryx?	*Beryx decadactylus*	beryx
black mouthed dogfish	*Galeus melastomus*	hågjel
blue ling	*Molva dypterygia*	blålange
blue whiting	*Micromesistius poutassou*	kolmule
bluemouth	*Helicolenus dactylopterus*	blåkjeft
brill	*Scophthalmus rhombus*	slettvar
char	*Salvelinus alpinus*	røye
coalfish (saithe)	*Pollachius virens*	sei
cod	*Gadus morrhua*	torsk

common eel	*Anguilla anguilla*	ål
conger eel	*Conger conger*	havål
cuckoo wrasse	*Labrus bimaculatus*	blåstål, rødnebb
cusk	*Brosme brosme*	brosme
dab	*Limanda limanda*	sandflyndre
dragonet	*Callionymus lyra*	vanlig fløyfisk
eelpout	*Zoarces viviparus*	ålekvabbe
father lasher	*Myoxocephalus scorpius*	vanlig ulke
five-bearded rockling	*Ciliata mustela*	femtrådet tangbrosme
flounder	*Platichthys flesus*	skrubbe
garfish	*Belone belone*	horngjel
greater forkbeard	*Phycis blennoides*	skjellbrosme
greater sand-eel	*Hyperoplus lanceolatus*	storsil
greater weever	*Trachinus draco*	fjesing
grenadier	*Coryphaenoides rupestris*	skolest
grey gurnard	*Eutrigla gurnardus*	knurr
haddock	*Melanogrammus aeglefinus*	hyse
hagfish	*Myxine glutinosa*	slimål
hake	*Merluccius merluccius*	lysing
halibut	*Hippoglossus hippoglossus*	kveite
herring	*Clupea harengus*	sild
John Dory	*Zeus Faber*	St. Peters fisk
l. spotted dogfish	*Scyliorhinus caniculus*	småflekket rødhai
larger argentine	*Argentina silus*	vassild
lemon sole	*Microstomus kitt*	lomre
ling	*Molva molva*	lange
long rough dab	*Hippoglossoides platessoides*	gapeflyndre
long-nosed skate	*Raja oxyrinchus*	spisskate
lumpsucker	*Cyclopterus lumpus*	rognkjeks
mackerel	*Scomber scombrus*	makrell
megrim	*Lepidorhombus whiffiagonis*	glassvar
norway haddock	*Sebastes viviparus*	lusuer
opah	*Lampris guttatus*	laksestørje
pelamid	*Sarda sarda*	stripet pelamide
plaice	*Pleuronectes platessa*	rødspette
pollack	*Pollachius pollachius*	lyr
porbeagle	*Lamna nasus*	håbrann
rabbitfish	*Chimaera monstrosa*	havmus
red mullet	*Mullus surmuletus*	mulle
red sea bream	*Pagellus bogaraveo*	flekkpagell
redfish	*Sebastes marinus*	uer
river lamprey	*Lampetra fluviatilis*	elveniøye
saithe (coalfish)	*Pollachius virens*	sei
salmon	*Salmo salar*	laks
scad	*Trachurus trachurus*	taggmakrell
sea lamprey	*Petromyzon marinus*	havniøye
shagreen ray	*Raja fullonica*	nebbskate
skate	*Raja batis*	storskate
skipper or saury	*Scombresox saurus*	makrellgjedde
snake blenny	*Lumpenus lampretaeformis*	langhalet langebarn
sole	*Solea solea*	tunge

spiny dogfish*	*Squalus acanthias*	pigghå
spotted catfish	*Anarhichas minor*	flekksteinbit
starry ray	*Raja radiata*	kloskate
sunfish	*Mola mola*	månefisk
swordfish	*Xiphias gladius*	sverdfisk
tadpole fish	*Raniceps raninus*	paddetorsk
thick lipped mullet	*Chelon labrosus*	tykkleppet multe
thin lipped mullet	*Liza remada*	tynnleppet multe
thornback ray	*Raja clavata*	piggskate
three bearded rockling	*Gaidropsaurus vulgaris*	3 trå tangbrosme
tope	*Gaeorhinus galeus*	gråhai
topknot	*Zeugopterus punctatus*	hårvar
trout	*Salmo trutta*	ørret
tub gurnard	*Trigla lucerna*	rødknurr
tunny	*Thunnus thynnus*	makrellstørje
turbot	*Psetta maximus*	piggvar
twaite shad	*Alosa fallax*	stamsild
velvet belly shark	*Etmopterus spinax*	svarthå
whiting	*Merlangius merlangus*	hvitting
witch	*Glyptocephalus cynoglossus*	smørflyndre
wolf fish	*Anarhichas lupus*	gråsteinbit
SHELLFISH/CRUSTACEANS	*MOLLUSCS/ARTHROPODS*	BLOTDYR/LEDDYR
black quohog	Cyprina islandica	kuskjell
dog whelk	Thais lapillus	purpursnegle
dublin bay prawn	Nephrops norvegicus	sjøkreps
edible crab	Cancer pagurus	taskekrabben
horse mussel	Modiolus modiolus	O-skjell
limpet	Acmea testudinalis	albuskjell
lobster	Homarus gammarus	hummer
mussel	Mytilus edulis	blåskjell
northern squid	Loligo forbesi	kalmaren
octopus sp.	Sepioidea Sp.	blekksprut
oyster	Ostrea edulis	Østers
periwinkle	Littorina sp.	strandsnegle
river mussels	Magaritana margaritifera	elveperlemusling
scallop	Pecten maximus	stor kamskjell
squid	Todarodes sagittatus	akkaren
waved whelk	Buccinum undatum	kongsneglen
BIRDS	*AVES*	FUGLER
Arctic skua	*Stercorarius parasiticus*	tyvjo
Arctic tern	*Sterna paradisaea*	rødnebbterne
avocet	*Recurvirostra avosetta*	avosett
bald coot	*Fulica atra*	sothøne
bar-tailed godwit	*Limosa lapponica*	lappspove
barn swallow	*Hirundo rustica*	låvesvale
barnacle goose	*Branta leucopsis*	hvitkinngås
bean goose	*Anser fabalis*	sædgås
Bewick's swan	*Cygnus columbianus*	dvergsvane
black grouse	*Tetrao tetrix*	orrfugl

black guillemot	*Cepphus grylle*	teiste
black kite	*Milvus migrans*	svartglente
black tern	*Chlidonias niger*	svartterne
black woodpecker	*Dryocopus martius*	svartspett
black-headed gull	*Larus ridibundus*	hettemåke
black-necked grebe	*Podiceps nigricollis*	svarthalsdykker
black-throated diver	*Gavia artica*	storlom
blackbird	*Turdus merula*	svarttrost
blackcap	*Sylvia atricapilla*	munk
blue throat	*Luscinia svecica*	blåstrupe
blue tit	*Parus caeruleus*	blåmeis
blue-headed wagtail	*Motacilla flava*	gulerle
bramble finch	*Fringilla montifringilla*	bjørkefink
brent goose	*Branta bernicula*	ringgås
broad-billed sandpiper	*Limicola falcinellus*	fjellmyrløper
brunnich's murre	*Uria lomvia*	polar lomvi
bull finch	*pyrrhula pyrrhula*	dompap
capercaillie	*Tetrao urogallus*	storfugl
chaffinch	*Fringilla coelebs*	bokfink
chiffchaff	*Phylloscopus collybita*	gransanger
coal tit	*Parus arter*	svartmeis
common buzzard	*Buteo buteo*	musvåk
common curlew	*Numenius arquata*	storspove
common guillemot	*Uria aalge*	lomvi
common gull	*Larus canus*	fiskemåke
common sandpiper	*Actitis hypoleucos*	strandsnipe
common scoter	*Melanitta nigra*	svartand
common snipe	*Gallinago gallinago*	enkeltbekkasin
common sparrow	*Passer domesticus*	gråspurv
common tern	*Sterna hirundo*	makrellterne
cormorant	*Phalacrocorax carbo*	storskarv
corn crake	*Crex crex*	åkerrikse
crane	*Grus grus*	trane
crested tit	*Parus cristatus*	toppmeis
crossbill	*Loxia curvirostra*	grankorsnebb
crow	*Corvus corone*	kråke
cuckoo	*Cuculus canorus*	gjøk
curlew sandpiper	*Calidris ferruginea*	tundrasnipe
dipper, water ouzel	*Cinclus cinclus*	fossekall
dotterel	*Charadrius morinellus*	boltit
eagle owl (horned)	*Bubo bubo*	hubro
eider duck	*Somateria mollissima*	ærfugl
fieldfare	*Turdus pilaris*	gråtrost
flycatcher ?	*Ficedula hypoleuca*	svarthvit fluesnapper
fulmar petrel	*Fulmarus glacialis*	havhest
gadwall	*Anas strepera*	snadderand
gannet	*Sula bassana*	havsule
garden warbler	*Sylvia borin*	hagesanger
garganey	*Anas querquedula*	knekkand
golden eagle	*Aquila chrysaetus*	kongeørn
golden plover	*Pluvialis apricaria*	heilo

golden crested wren	*Regulus regulus*	fuglekonge
goldeneye	*Bucephala clangula*	kvinand
goshawk	*Accipiter gentilis*	hønsehauk
goosander	*Mergus merganser*	laksand
great auk	*Alca impennis*	geirfuglen
great black-backed gull	*Larus marinus*	svartbak
great grey shrike	*Lanius excubitor*	varsler
great northern diver	*Gavia immer*	islom
great snipe	*Gallinago media*	dobbeltbekkasin
great tit	*Parus major*	kjøttmeis
great crested grebe	*Podiceps cristatus*	toppdykker
greater spotted woodpecker	*Dendrocopus major*	flaggspett
green finch	*Carduelis chloris*	grønnfink
green sandpiper	*Tringa ochropus*	skogsnipe
green woodpecker	*Picus viridis*	grønnspett
greenshank	*Tringa nebularia*	gluttsnipe
grey plover	*Pluvialis squatarola*	tundralo
grey-headed woodpecker	*Picus canus*	gråspett
greylag goose	*Anser anser*	grågås
gyr falcon	*Falco rusticolus*	jaktfalk
jack snipe	*Lymnocryptes minimus*	kvartbekkasin
hawk owl	*Surnia ulula*	haukugle
hazel grouse	*Bonasa bonasia*	jerpe
hedge sparrow	*Prunella modularis*	jernspurve
hen harrier	*Circus cyaneus*	myrhauk
heron	*Ardea cinerea*	gråhegren
herring gull	*Larus argentatus*	gråmåke
honey buzzard	*Pernis apivorus*	vepsevåk
house martin	*Delichon urbica*	taksvale
icterine warbler	*Hippolais icterina*	gulsanger
jackdaw	*Corvus monedula*	kaie
jay	*Garrulus glandarius*	nøtteskrike
kestrel	*Falco tinnunculus*	tårnfalk
kite	*Milvus milvus*	glenten
kittiwake	*Rissa tridactyla*	krykkje
knot	*Calidris canutus*	polarsnipe
lapland bunting	*Calcarius lapponicus*	lappspurv
lapwing, peewit	*Vanellus vanellus*	vipe
lesser black-backed gull	*Larus fuscus*	sildemåke
lesser spotted woodpecker	*Dendrocopus minor*	dvergspett
little auk	*Alle alle*	alkekonge
little gull	*Larus minutus*	dvergmåke
little stint	*Calidris minuta*	dvergsnipe
long-eared owl	*Asio otus*	hornugle
long-tailed duck	*Clangula hyemalis*	havelle
long-tailed skua	*Stercorarius longicaudus*	fjelljo
long-tailed tit	*Aegithalos caudatus*	stjertmeis
magpie	*Pica pica*	skjære
mallard	*Anas platyrhynchos*	stokkand
marsh tit	*Parus palustris*	løvmeis
meadow pipit	*Anthus pratensis*	heipiplerke

mealy redpoll	*Carduelis flammea*	gråsisik
merganser (smew)	*Mergus albellus*	lappfiskand
merlin	*Falco columbarius*	dvergfalk
moor hen	*Gallinula chloropus*	sivhøne
mute swan	*Cygnus olor*	knoppsvane
nightjar	*Caprimulgus europaeus*	nattravn
North Atlantic shearwater	*Puffinus puffinus*	havlire
nutcracker	*Nucifraga caryocatactes*	nøtteskrike
nuthatch	*Sitta europaea*	spettmeis
osprey	*Pandion haliaetus*	fiskeørn
oyster catcher	*Haematopus ostralegus*	tjeld
parrot-crossbill	*Loxia pytyopsittacus*	furukorsnebb
partridge	*Perdix perdix*	rapphøne
peregrine	*Falco peregrinus*	vandrefalk
pink-footed goose	*Anser brachyrhynchus*	kortnebbgås
pintail	*Anas acuta*	stjertand
pochard	*Aythya ferina*	taffeland
pomarine skua	*Stercorarius pomarinus*	polarjo
ptarmigan	*Lagopus mutus*	fjellrype
puffin	*Fratercula arctica*	lunde
purple sandpiper	*Calidris maritima*	fjæreplytt
pygmy owl	*Glaucidium passerinum*	spurveugle
raven	*Corvus corax*	ravn
razorbill	*Alca torda*	alke
red-backed sandpiper	*Calidris alpina*	myrsnipe
red-breasted merganser	*Mergus serrator*	siland
red-crested pochard	*Netta rufina*	rødhodeand
red-necked grebe	*Tachybaptes ruficollis*	dvergdykker
red-necked grebe	*Podiceps griseigena*	gråstrupedykker
red-necked phalarope	*Phalaropus lobatus*	svømmesnipe
red-throated diver	*Gavia stellata*	smålom
redshank	*Tringa totanus*	rødstilk
redstart	*Phoenicurus phoenicurus*	rødstjert
redwing	*Turdus iliacus*	rødvingetrost
reed bunting	*Emberiza schoeniclus*	sivspurv
reeve	*Philomachus pugnax*	brushane
ring dove	*Columba palumbus*	ringdue
ring ouzel	*Turdus torquatus*	ringtrost
ringed plover	*Charadrius hiaticula*	sandlo
robin	*Erithacus rubecula*	rødstrupe
rough-legged buzzard	*Buteo lagopus*	fjellvåk
sand martin	*Riparia riparia*	sandsvale
sanderling	*Calidris alba*	sandløper
sandwich tern	*Sterna sandvicensis*	splitterne
scaup	*Aythya marila*	bergand
sea dotterel	*Arenaria interpres*	steinvender
sea eagle	*Haliaeetus albicilla*	havørn
sedge warbler	*Acrocephalus schoenobaenus*	sivsanger
shag	*Phalacrocorax aristotelis*	toppskarv
shelduck	*Tadorna tadorna*	gravand
shorelark (horned)	*Eremophila alpestris*	fjellerke

short eared owl	*Asio flammeus*	jordugle
shoveler	*Anas clypeata*	skjeand
siskin	*Carduelis spinus*	grønnsisik
skua	*Stercorarius skua*	storjo
skylark	*Alauda arvensis*	sanglerke
slavonian grebe	*Podiceps auritus*	horndykker
snow bunting	*Plectrophenax nivalis*	snøspurv
snowy owl	*Nyctea scandiaca*	snøugle
song thrush	*Turdus philomelos*	måltrost
sooty shearwater	*Puffinus griseus*	grålir
sparrow hawk	*Accipiter nisus*	spurvhauk
spotted crake	*Porzana porzana*	myrrikse
spotted flycatcher	*Muscicapa striata*	gråfluesnapper
spotted redshank	*Tringa erythropus*	sotsnipe
starling	*Sturnus vulgaris*	stær
stock dove	*Columba oenas*	skogdue
stork	*Ciconia ciconia*	stork
swift	*Apus apus*	tårnseiler
tawny owl	*Strix aluco*	kattugle
teal	*Anas crecca*	krikkand
Temminck's stint	*Calidris temminckii*	temmincksnipe
Tengmalm's owl	*Aegolius funereus*	perleugle
three-toed woodpecker	*Picoides tridactylus*	tretåspett
tree creeper	*Certhia familiaris*	trekryper
tree pipit	*Anthus trivialis*	trepiplerke
tree sparrow	*Passer montanus*	pilfink
tufted duck	*Aytha fuligula*	toppand
twite	*Carduelis flavirostris*	bergirisk
velvet scoter	*Melanitta fusca*	sjøorre
wagtail	*Motacilla alba*	linerle
water pipit	*Anthus spinoletta*	skjærpiplerke
water rail	*Rallus aquaticus*	vannrikse
waxwing	*Bombycilla garrulus*	sidensvans
wheatear	*Oenanthe oenanthe*	steinskvett
whimbrel	*Numenius phaeopus*	småspove
whinchat	*Saxicola rubetra*	buskskvett
white throat	*Sylvia communis*	tornsanger
white-backed woodpecker	*Dendrocopus leucotos*	hvitryggspett
white-billed diver	*Gavia adamsii*	gulnebblom
whooper swan	*Cygnus cygnus*	sangsvane
wigeon	*Anas penelope*	brunnakke
willow grouse	*Lagopus lagopus*	lirype
willow tit	*Parus montanus*	granmeis
willow warbler	*Phylloscopus trochilus*	løvsanger
wood sandpiper	*Tringa glaeorla*	grønnstilk
woodcock	*Scolopax rushicola*	rugde
wren	*Troglodytes troglodytes*	gjerdesmett
wryneck	*Jynx torquilla*	vendehals
yellow bunting	*Emberiza citrinella*	gulspurv

APPENDIX 2.

Norwegian alphabetical list of all animals
with english names

Norwegian	English
3-trådet tangbrosme	three bearded rockling
5-trådet tangbrosme	five-bearded rockling
akkar	squid
albueskjell	limpet
alke	razorbill
alkekonge	little auk
avosett	avocet
bergand	scaup
berggylte	ballan wrasse
bergirisk	twite
beryx	beryx?
bever	beaver
bjørkefink	bramble finch
bjørn	brown bear
blekksprut	octopus sp.
blåkjeft	bluemouth
blålange	blue ling
blåmeis	blue tit
blåskjell	mussel
blåstrupe	blue throat
blåstål, rødnebb	cuckoo wrasse
bokfink	chaffinch
boltit	dotterel
breiflabb	angler
brosme	cusk
brunnakke	wigeon
brushane	reeve
buskskvett	whinchat
dobbeltbekkasin	great snipe
dompap	bull finch
dvergdykker	red-necked grebe
dvergfalk	merlin
dvergmåke	little gull
dvergsnipe	little stint
dvergspett	lesser spotted woodpecker
dvergsvane	Bewick's swan
ekorn	squirrel
elg	moose
elveniøye	river lamprey
elveperlemusling	river mussels
enkeltbekkasin	common snipe
fiskemåke	common gull
fiskeørn	osprey
fjellerke	shorelark (horned)
fjelljo	long-tailed skua
fjellmyrløper	broad-billed sandpiper
fjellrev	arctic fox
fjellrype	ptarmigan
fjellvåk	rough-legged buzzard
fjesing	greater weever
fjæreplytt	purple sandpiper
flaggspett	greater spotted woodpecker
flekkpagell	red sea bream
flekksteinbit	spotted catfish
fossekall	dipper, water ouzel
fuglekonge	golden-crested wren
furukorsnebb	parrot-crossbill
gapeflynder	long rough dab
gaupe	lynx
geirfuglen	great auk
gjerdesmett	wren
gjøk	cuckoo
glassvar	megrim
glenten	kite
gluttsnipe	greenshank
grankorsnebb	crossbill
granmeis	willow tit
gransanger	chiffchaft
gravand	shelduck
grevling	badger
grindhval	pilot whale
grønlandsel	harp seal
grønnfink	green finch
grønnsisik	siskin
grønnspett	green woodpecker
grønnstilk	wood sandpiper
gråfluesnapper	spotted flycatcher
grågås	greylag gouse
gråhai	tope
gråhegren	heron
grålir	sooty shearwater
gråmåke	herring gull
gråsisik	mealy redpoll
gråspett	grey-headed woodpecker
gråspurve	common sparrow
gråsteinbit	wolf-fish
gråstrupedykker	red-necked grebe
gråtrost	fieldfare
gulerle	blue-headed wagtail
gulnebblom	white-billed diver
gulsanger	icterine warbler
gulspurv	yellow bunting
hagesanger	garden warbler
hare	hare
haukugle	hawk owl
havabbor	bass
havelle	long-tailed duck
havert	gray seal
havhest	fulmar petrel
havlir	North Atlantic shearwat
havmus	rabbitfish
havniøye	sea lamprey
havsule	gannet
havørn	sea eagle
havål	conger eel
heilo	golden plover

heipiplerke	meadow pipit
hettemåke	black-headed gull
hjort	red deer
horndykker	Slavonian grebe
horngjel	garfish
hornugle	long-eared owl
hubro	eagle owl (horned)
hummer	lobster
hvitkinngås	barnacle goose
hvitryggspett	white-backed woodpecker
hvitting	whiting
hyse	haddock
hønsehauk	goshawk
håbrann	porbeagle
hågjel	black-mouthed dogfish
hårvar	topknot
ilder	European polecat
islom	great northern diver
jaktfalk	gyr falcon
jernspurve	hedge sparrow
jerpe	hazel grouse
jerv	wolverine
jordugle	short-eared owl
kaie	jackdaw
kalmaren	northern squid
kattugle	tawny owl
kjøttmeis	great tit
kloskate	starry ray
knekkand	garganey
knoppsvane	mute swan
knurr	grey gurnard
kolmule	blue whiting
kongeørn	golden eagle
kongsneglen	waved whelk
kortnebbgås	pink-footed goose
krikkand	teal
krykkje	kittiwake
kråke	crow
kuskjell	black quahog
kvartbekkasin	jack snipe
kveite	halibut
kvinand	goldeneye
kvitnos	white-beaked dolphin
kvitskjeving	white-sided dolphin
laks	salmon
laksand	goosander
laksestørje	opah
lange	ling
langhalet langebarn	snake blenny
lappfiskand	merganser (smew)
lappspove	bar-tailed godwit
lappspurv	lapland bunting
linerle	wagtail
lirype	willow grouse
lomre	lemon sole
lomvi	common guillemot
lunde	puffin
lusuer	norway haddock
lyr	pollack
lysing	hake
løvmeis	marsh tit
løvsanger	willow warbler
låvesvale	barn swallow
maisild	allis shad
makrell	mackerel
makrellgjedde	skipper or saury
makrellstørje	tunny
makrellterne	common tern
mulle	red mullet
munk	blackcap
musvåk	common buzzard
myrhauk	hen harrier
myrrikse	spotted crake
myrsnipe	red-backed sandpiper
måltrost	song thrush
månefisk	sunfish
mår	pine marten
nattravn	nightjar
nebbskate	shagreen ray
nise	harbor porpoise
nøttekråke	nutcracker
nøtteskrike	jay
O-skjell	horse mussel
orrfugl	black grouse
oter	otter
paddetorsk	tadpole-fish
perleugle	Tengmalm's owl
pigghå	spiny dogfish
piggskate	thornback ray
piggvar	turbot
pilfink	tree sparrow
pinnsvin	hedgehog
polar lomvi	brunnich's murre
polarjo	pomarine skua
polarsnipe	knot
purpursnegle	dog whelk
rapphøne	partridge
ravn	raven
rein	reindeer
rev	red fox
ringdue	ring dove
ringgås	brent goose
ringtrost	ring ouzel
rognkjeks	lumpsucker
rugde	woodcock
rødhodeand	red-crested pochard
rødknurr	tub gurnard
rødnebbterne	Arctic tern
rødspette	plaice
rødstilk	redshank
rødstjert	redstart
rødstrupe	robin

rødvingetrost	redwing
rype	[illegible]
røyskatt	weasel
rådyr	roe deer
sandflyndre	dab
sandlo	ringed plover
sandløper	sanderling
sandsvale	sand martin
sanglerke	skylark
sangsvane	whooper swan
sei	coalfish (saithe)
sidensvans	waxwing
siland	red-breasted merganser
sild	herring
sildemåke	lesser black-backed gull
sivhøne	moor hen
sivsanger	sedge warbler
sivspurv	reed bunting
sjøkreps	dublin bay prawn
sjøorre	velvet scoter
skjeand	shoveler
[illegible]	greater forkbeard
skjære	magpie
skjærpiplerke	water pipit
skogdue	stock dove
skogsnipe	green sandpiper
skolest	grenadier
skrubbe	flounder
sletthvar	brill
slimål	hagfish
smørflyndre	witch
småflekket rødhai	l. spotted dogfish
[illegible]	small rorqual
smålom	red throated diver
småspove	whimbrel
snadderand	gadwall
snømus	snow weasel
snøspurv	snow bunting
snøugle	snowy owl
sothøne	bald coot
sotsnipe	spotted redshank
spekkhogger	killer whale
spettmeis	nuthatch
spissnutet skate	long-nosed skate
splitterne	sandwich tern
spurveugle	pygmy owl
spurvehauk	sparrow hawk
St. Petersfisk	John Dory
stamsild	twaite shad
steinkobbe	harbor seal
steinskvett	wheatear
steinvender	sea dotterel
stjertand	pintail
stjertmeis	long-tailed tit
stokkand	mallard
stor kamskjell	scallop
storfugl	capercaillie
storjo	skua
stork	stork
storlom	black-throated diver
storsil	greater sand eel
storskarv	cormorant
storskate	skate
storspove	common curlew
strandsnegle	periwinkle
strandsnipe	common sandpiper
stripet pelamide	pelamid
stær	starling
svartand	common scoter
svartbak	great black backed gull
svartglen	black kite
svarthalsdykker	black-necked grebe
svarthvit fluesnapper	flycatcher ?
svarthå	velvet belly shark
svartmeis	coal tit
svartspett	black woodpecker
svartterne	black tern
svarttrost	blackbird
sverdfisk	swordfisn
svømmesnipe	red-necked phalarope
sædgås	bean goose
taffeland	pochard
taggmakrell	scad
taksvale	house martin
taskekrabben	edible crab
teiste	black guillemot
temmincksnipe	Temminck's stint
tjeld	oyster catcher
toppand	tufted duck
toppdykker	great-crested grebe
toppmeis	crested tit
toppskarv	shag
tornsanger	white throat
torsk	cod
trane	crane
trekryper	tree creeper
trepiplerke	tree pipit
tretåspett	three-toed woodpecker
tundralo	grey plover
tundrasnipe	curlew sandpiper
tunge	sole
tykkleppet multe	thick-lipped mullet
tynnleppet multe	thin-lipped mullet
tyvjo	Arctic skua
tårnfalk	kestrel
tårnseiler	swift
uer	redfish
ulv	wolf
vandrefalk	peregrine
vanlig fløyfisk	dragonet
vanlig ulke	father lasher
vannrikse	water rail

varsler	great grey shrike
vassild	larger argentine
vendehals	wryneck
vepsevåk	honey buzzard
villkatt	wildcat
villsvin	wild boar
vipe	lapwing, peewit
vågehval	minke whale
ærfugl	eider duck
ørret	trout
østers	oyster
åkerrikse	corn crake
ål	common eel
ålekvabbe	eelpout

APPENDIX 3.

Artifact distributions for Layers B, C, D and H.

-All stone artifacts	-Liters excavated
-Density (#/liter)	-Other material types
-Flint	-Quartz/quartzite
-Crystal quartz	-Mylonite

ARTIFACT DISTRIBUTIONS-LAYER B

ALL ARTIFACTS — SUM 8919

	107X	108X	109X	110X	111X	112X	113X
95Y			591	1			
96Y			602				
97Y			509				3
98Y			703	533	165		
99Y	1075	1400	781	413	832	232	
100Y					16		
101Y	1			916			
102Y				146			
103Y							

LITERS EXCAVATED — SUM 2933

	107X	108X	109X	110X	111X	112X	113X
95Y			253	O			
96Y			236				
97Y			230				4
98Y			242	142	77		
99Y	351	327	184	110	259	149	
100Y					7		
101Y	O			277			
102Y				85			
103Y							

DENSITY - #/LITER — SUM 3,0

	107X	108X	109X	110X	111X	112X	113X
95Y			2,3	O			
96Y			2,6				
97Y			2,2				0,8
98Y			2,9	3,8	2,1		
99Y	3,1	4,3	4,2	3,8	3,2	1,6	
100Y					2,3		
101Y	O			3,3			
102Y				1,7			
103Y							

OTHER MATERIAL TYPES — SUM 196

	107X	108X	109X	110X	111X	112X	113X
95Y			5	1			
96Y			16				
97Y			9				O
98Y			6	6	4		
99Y	41	51	13	3	20	4	
100Y					O		
101Y	1			13			
102Y				3			
103Y							

Shaded areas not fully excavated,111X 99Y initial test pit

ARTIFACT DISTRIBUTIONS - LAYER B

FLINT SUM 3489

	107X	108X	109X	110X	111X	112X	113X
95Y			189	O			
96Y			171				
97Y			184				1
98Y			298	183	58		
99Y	482	400	333	163	411	132	
100Y					9		
101Y	O			406			
102Y				69			
103Y							

QUARTZ/QUARTZITE SUM 3259

	107X	108X	109X	110X	111X	112X	113X
95Y			276	O			
96Y			306				
97Y			179				1
98Y			266	207	54		
99Y	325	629	263	160	219	43	
100Y					6		
101Y	O			283			
102Y				42			
103Y							

CRYSTAL QUARTZ SUM 1607

	107X	108X	109X	110X	111X	112X	113X
95Y			100	1			
96Y			87				
97Y			108				O
98Y			105	116	46		
99Y	170	248	135	73	153	48	
100Y					1		
101Y	O			185			
102Y				31			
103Y							

MYLONITE SUM 368

	107X	108X	109X	110X	111X	112X	113X
95Y			21	O			
96Y			22				
97Y			29				O
98Y			28	21	3		
99Y	57	72	37	14	29	5	
100Y					O		
101Y	O			29			
102Y				1			
103Y							

Shaded areas not fully excavated. 111X 99Y initial test pit

ARTIFACT DISTRIBUTIONS - LAYER C

ALL ARTIFACTS SUM 7646

	107X	108X	109X	110X	111X	112X	113X
95Y			205				
96Y			542				
97Y			657				
98Y	135		868	305	283		
99Y	591	1246	927	303	449	330	
100Y							
101Y				400			
102Y				405			
103Y							

LITERS EXCAVATED SUM 3021

	107X	108X	109X	110X	111X	112X	113X
95Y			152				
96Y			278				
97Y			325				
98Y	70		330	162	158		
99Y	190	248	225	144	237	117	
100Y							
101Y				229			
102Y				156			
103Y							

DENSITY - #/LITER SUM 2,5

	107X	108X	109X	110X	111X	112X	113X
95Y			1,3				
96Y			1,9				
97Y			2				
98Y	1,9		2,6	1,9	1,8		
99Y	3,1	5	4,1	2,1	1,9	2,8	
100Y							
101Y				1,7			
102Y				2,6			
103Y							

OTHER MATERIAL TYPES SUM 41

	107X	108X	109X	110X	111X	112X	113X
95Y			0				
96Y			5				
97Y			1				
98Y			2	O	1		
99Y	3	13	7	O	5	1	
100Y							
101Y				2			
102Y				1			
103Y							

Shaded area initial testpit

ARTIFACT DISTRIBUTIONS - LAYER C

FLINT SUM 4210

	107X	108X	109X	110X	111X	112X	113X
95Y			93				
96Y			281				
97Y			422				
98Y	72		430	133	138		
99Y	314	578	513	203	290	247	
100Y							
101Y				266			
102Y				230			
103Y							

QUARTZ/QUARTZITE SUM 1942

	107X	108X	109X	110X	111X	112X	113X
95Y			72				
96Y			164				
97Y			168				
98Y	23		260	103	90		
99Y	139	391	248	56	50	43	
100Y							
101Y				62			
102Y				73			
103Y							

CRYSTAL QUARTZ SUM 1378

	107X	108X	109X	110X	111X	112X	113X
95Y			36				
96Y			85				
97Y			62				
98Y	39		168	63	52		
99Y	127	245	156	42	102	37	
100Y							
101Y				67			
102Y				97			
103Y							

MYLONITE SUM 75

	107X	108X	109X	110X	111X	112X	113X
95Y			4				
96Y			7				
97Y			4				
98Y	1		8	6	2		
99Y	8	19	3	2	2	2	
100Y							
101Y				3			
102Y				4			
103Y							

Shaded area initial testpit

ARTIFACT DISTRIBUTIONS - LAYER D

ALL ARTIFACTS SUM 21196

	107X	108X	109X	110X	111X	112X	113X
95Y			164	397	701	226	107
96Y		27	212	184	380	620	556
97Y		172	536	552	364	264	295
98Y	41	149	454	729	818	486	463
99Y	126	131	573	614	411	357	
100Y	128	158	533	664	754	172	107
101Y	18	109	346	900	838	624	193
102Y		160	425	954	825	488	243
103Y		315	295	385	391	35	

LITERS EXCAVATED SUM 6093

	107X	108X	109X	110X	111X	112X	113X
95Y			113	174	296	132	43
96Y		22	129	87	144	191	208
97Y		124	147	169	120	123	140
98Y	27	82	182	191	187	120	141
99Y	44	50	126	120	116	57	
100Y	47	47	146	154	137	30	15
101Y	10	69	120	174	122	151	37
102Y		71	119	138	136	112	23
103Y		131	112	114	60	14	

DENSITY - #/LITER SUM 3,5

	107X	108X	109X	110X	111X	112X	113X
95Y			1,5	2,3	2,4	1,7	2,5
96Y		1,2	1,6	2,1	2,6	3,2	2,7
97Y		1,4	3,6	3,3	3	2,1	2,1
98Y	1,5	1,8	2,5	3,8	4,4	4,1	3,3
99Y	2,9	2,6	4,5	5,1	3,5	6,3	
100Y	2,7	3,4	3,7	4,3	5,5	5,7	7,1
101Y	1,8	1,6	2,9	5,2	6,9	4,1	5,2
102Y		2,3	3,6	6,9	6,1	4,4	11
103Y		2,4	2,6	3,4	6,5	2,5	

OTHER MATERIAL TYPES SUM 308

	107X	108X	109X	110X	111X	112X	113X
95Y			5	4	9	3	4
96Y			3	1	3	4	9
97Y		5	2	8	4		4
98Y	1	5	13	6	7	6	3
99Y	6		7	7	7	1	
100Y	1	3	10	9	7	1	
101Y	1	6	5	20	8	13	2
102Y		5	12	19	19	8	
103Y		9	4	5	4		

Shaded area initial testpit

ARTIFACT DISTRIBUTIONS - LAYER D

FLINT SUM 16203

	107X	108X	109X	110X	111X	112X	113X
95Y			103	258	467	143	60
96Y		24	151	141	263	376	327
97Y		130	425	452	276	207	211
98Y	36	121	354	527	695	425	388
99Y	103	92	431	488	306	317	
100Y	113	123	425	522	535	133	97
101Y	11	87	256	739	674	457	158
102Y		131	322	769	631	405	220
103Y		228	225	297	317	31	

QUARTZ/QUARTZITE SUM 1955

	107X	108X	109X	110X	111X	112X	113X
95Y			36	50	89	29	17
96Y		1	39	27	51	107	111
97Y		19	56	47	33	28	37
98Y	3	14	52	119	54	22	29
99Y	10	12	71	58	42	17	
100Y	6	21	29	36	62	8	4
101Y	4	2	20	40	48	50	21
102Y		10	13	76	53	26	11
103Y		50	27	29	27	2	

CRYSTAL QUARTZ SUM 2524

	107X	108X	109X	110X	111X	112X	113X
95Y			19	82	134	50	26
96Y		2	17	15	62	130	103
97Y		14	47	38	50	28	37
98Y	1	9	35	77	50	23	32
99Y	6	26	53	54	53	10	
100Y	7	11	66	92	147	29	4
101Y	2	14	62	95	104	97	10
102Y		14	77	87	116	42	9
103Y		26	38	54	38		

MYLONITE SUM 179

	107X	108X	109X	110X	111X	112X	113X
95Y			1	3	2	1	
96Y			2		1	3	6
97Y		4	6	7	1	1	6
98Y					12	10	11
99Y	1	1	11	7	3	12	
100Y	1		3	5	3	1	2
101Y			3	6	4	7	2
102Y			1	3	6	7	3
103Y		2	1		5	2	

Shaded area initial testpit

ALL ARTIFACTS SUM 9185

	107X	108X	109X	110X	111X	112X	113X
95Y					43		
96Y					26		
97Y		20	70	108	82		
98Y		10	357	336	406		
99Y			177	458	935	376	
100Y	18		393	455	374		
101Y			283	684	516		
102Y		59	699	658	471		
103Y		219	473	479			

LITERS EXCAVATED SUM 858

	107X	108X	109X	110X	111X	112X	113X
95Y					20		
96Y					?		
97Y		17	15	36	17		
98Y		9	44	10	42		
99Y			23	17	51	64	
100Y	7		65	52	24		
101Y			40	36	29		
102Y		14	53	36	28		
103Y		24	47	39			

DENSITY - #/LITER SUM 10,7

	107X	108X	109X	110X	111X	112X	113X
95Y					2,2		
96Y							
97Y		1,2	4,7	3	4,8		
98Y		1,1	8,2	34	9,7		
99Y			7,7	27	18	5,9	
100Y	2,6		6	8,8	16		
101Y			7,1	19	18		
102Y		4,2	13	18	17		
103Y		9,1	10	12			

OTHER MATERIAL TYPES SUM 57

	107X	108X	109X	110X	111X	112X	113X
95Y							
96Y							
97Y		1		1	1		
98Y		1		1	1		
99Y			1		1	1	
100Y	1			5	3		
101Y				4	7		
102Y			4	7	4		
103Y		1	6	6			

Shaded area initial testpit

ARTIFACT DISTRIBUTIONS - LAYER H

FLINT — SUM 8315

	107X	108X	109X	110X	111X	112X	113X
95Y					35		
96Y					19		
97Y		17	63	99	68		
98Y		9	318	310	375		
99Y			157	437	791	354	
100Y	15		374	398	323		
101Y			263	626	474		
102Y		58	650	592	438		
103Y		198	419	435			

QUARTZ/QUARTZITE — SUM 411

	107X	108X	109X	110X	111X	112X	113X
95Y					4		
96Y					6		
97Y		1	5	6	5		
98Y			26	15	20		
99Y			8	20	48	12	
100Y	1		11	31	24		
101Y			5	23	12		
102Y			27	31	18		
103Y		12	23	17			

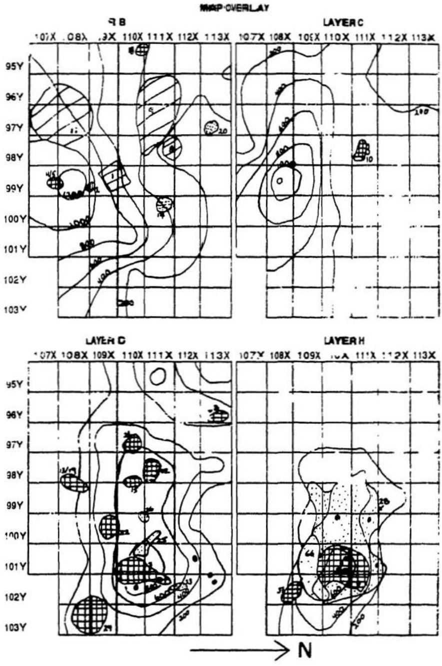
CRYSTAL QUARTZ — SUM 271

	107X	108X	109X	110X	111X	112X	113X
95Y					3		
96Y					1		
97Y			2	1	3		
98Y			12	2	3		
99Y			11		80	2	
100Y			7	10	16		
101Y			12	14	12		
102Y		1	12	20	9		
103Y		5	17	16			

MYLONITE — SUM 131

	107X	108X	109X	110X	111X	112X	113X
95Y					1		
96Y							
97Y		1		1	5		
98Y			1	8	7		
99Y				1	15	7	
100Y	1		1	11	8		
101Y			3	17	11		
102Y			6	8	2		
103Y		3	8	5			

Shaded area initial testpit


MAP OVERLAY
LAYER C
LAYER D
LAYER H
110X 111X 112X 113X
107X 108X 109X 110X 111X 112X 113X
95Y
96Y
97Y
98Y
99Y
100Y
101Y
102Y
103Y
N