Integrated Soil Analysis at an Inuit Tent Camp: Huntingdon Island 5 (FkBg-3), Sandwich Bay, South Labrador

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ABSTRACT

The history of Labrador Inuit archaeology reflects a disproportionate focus on the sod house, characteristic of the winter settlement. However, the sod house represents only a part of the traditional Inuit yearly foraging round. Throughout the warmer seasons, including spring, summer, and early autumn, Inuit lived in skin tents. Although they are representative of a broader seasonal range of subsistence practices, tent camps have seldom been studied. This is due to the poor material assemblages and limited structural remains that characterize these sites, which makes it difficult to approach them through conventional excavation methods. This thesis engages with the potential of a systematic study of Inuit tent camp sites through the development of a more suitable method of analysis. For this purpose, bulk soil samples and undisturbed cores were collected from soils associated with Tent Ring 1 and Tent Ring 4 from Huntingdon Island 5 (FkBg-3), in Sandwich Bay, southern Labrador, and a soil and vegetation survey were carried out at the site. Ethnographic data was used to interpret the structures, guide sampling procedures and formulate working hypotheses, which were tested through the joint application of thin section micromorphology, soil chemistry and paleoethnobotanical analysis under the heading of integrated soil analysis. This approach is designed to address specific issues connected to the southern Labrador landscape, such as the shallowness of acidic tundra soils and the narrow buffer zone between the active layer of plant growth and the archaeological layer, and to answer questions about the *taskscape* associated with the tent rings, as well as their environmental and taphonomic context. The analysis has provided information on the internal structure of the dwellings and designated activity areas, reoccupation events, the length and season of occupation, as well as a relative sequence of use, while simultaneously providing a perspective

on the environmental signature of these dwellings on the south Labrador tundrascape and the taphonomic processes that impact them.

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Chapter 1. Introduction

The sod house is the most familiar image associated with the Labrador Inuit and the most intensively studied element in the history of Labrador Inuit archaeology. Characteristic of the winter settlement, the sod house accounts for a relatively restricted portion of the traditional Inuit settlement system. In late autumn and early winter, Inuit lived in quarmat-style houses, whereas skin tents were in use throughout most of the warm season months, including spring, summer and early autumn. Even though they were used on a broader seasonal range, archaeological research has accorded comparatively little attention to tent camps. Often little more than clusters of circular or oval arrangements of rocks on the coastal Labrador tundrascape, these sites are poor in artifacts and faunal remains, which makes it difficult to study them.

This narrow focus is inadequate for more southern locations, such as southern Labrador, where incoming Inuit met with a novel environment that required a cultural response. This region, consisting of the coast of Labrador south of Hamilton Inlet (Figure 1), represents the southernmost reaches of the Inuit in Labrador, characterized by a subarctic and temperate climate, with longer, warmer summers

Figure 1. Map of Labrador indicating the most southern range of the Inuit in Labrador, consisting of the Southern Labrador coast.

and densely forested hinterlands, unlike the arctic regions where Thule culture developed. Therefore, for the Inuit that migrated here, the move south involved an environmental shift that elicited changes to warm season subsistence and settlement patterns, and potentially broader spiritual and social adjustments. These changes contributed to the development of a distinct Southern Inuit identity.

Inuit have established a presence in southern Labrador as early as the 16th century. Presently, many aspects of their life remain unknown, but excavations at southern sites have revealed many important differences relative to more northern locations. An earlier, more immediate European presence on the south coast made European goods and resources available at an earlier date, leading to earlier instances of Inuit directed trade and the appearance of communal houses as early as the 17th century. In the diverse cultural landscape of southern Labrador, close interactions with Europeans eventually led to the emergence of a hybrid ethnic group in the 19th century known as the Inuit-Métis. The study of warm season settlements would contribute to this image by helping to develop a broader, year-round picture of the Inuit experience of southern Labrador.

In order to make this goal feasible, this thesis engages with the potential of a systematic study of Inuit camp sites through the development of a more suitable methodological approach, grounded in environmental soil science. Soils can provide a record of human activities that took place at a site through the careful investigation of their physico-chemical properties. Soils are also complex, living ecosystems that respond to anthropogenic alterations. Therefore, an approach grounded in environmental soil science can also bring into focus the ecology of anthropogenic soil contexts, their effect on local environmental conditions, their visibility on the landscape, and their long-term stability.

In order to test the relevance of such a study, bulk soil samples and undisturbed cores were collected from soils associated with Tent Ring 1 and Tent Ring 4, from Huntingdon Island 5 (FkBg-3), in Sandwich Bay, southern Labrador (Figure 2), and a soil and vegetation survey were carried out at the site. Ethnographic data was used to interpret the structures, guide sampling procedures and formulate working hypotheses, which were tested through the joint application of thin section micromorphology, soil chemistry and paleoethnobotanical analysis under the heading of integrated soil analysis.

Figure 2. Map of Sandwich Bay, Southern Labrador, Indicating the Location of Huntingdon Island 5 (FkBg-3).

The absence of substantial structures requires a functional approach, focused on the activities that were taking place at the site, subsumed under the *taskscape* of the dwellings. By applying a range of methods that target different soil characteristics and integrating the results, this approach overcomes the limits of traditional excavation methods that depend on the recovery of large material assemblage. The use of an extensive comparative dataset, consisting of background samples, known disturbed contexts and samples from two of the sod houses excavated at Huntingdon Island 5 provides support for the interpretation and allows the study to answer the following questions:

1) What was the *taskscape* associated with the occupations? How was internal space structured in these dwellings and what kind of activities were taking place at the site?

2) What is the range of soil characteristics impacted by the occupations and how do they behave under current environmental conditions? Namely, what defines the environmental context of the dwellings?

3) What are the taphonomic factors impacting the site?

By answering these questions, this study aims to provide data relevant for both locating warm season camp sites during future surveys and more in-depth studies based on partial or complete excavations, as well as to bring a broader environmental perspective into focus. By looking at the ecology of anthropogenic soil contexts, this study integrates concerns about the impact of climate change on arctic and subarctic sites with the process of studying the past.

1.1. Overview of Chapters

Chapter 2 provides a review of past research on the Inuit in southern Labrador that underlines gaps in research which would be better addressed through a study of warm season dwellings. These gaps concern the landward section of territories colonized by Inuit, the extent of their inland forays and the encounter with local Amerindian populations, as well as the current understanding of Inuit culture in southern Labrador.

Chapter 3 looks more closely at the range of warm season dwellings that were previously studied in Labrador. This review finds that the range of known warm season sites is predominantly composed of spring and autumn camps, with only one or two known summer sites recorded. This further suggests that the development of survey strategies and interpretations based on data coming from winter sites is biased towards cold season occupations, which significantly impacts the archaeological understandings of Labrador Inuit culture. This chapter underlines the necessity to develop a method for the study of temporary warm season dwellings, characterized by scant archaeological assemblages, in order to address this imbalance.

Chapter 4 introduces integrated soil analysis as a means to study Inuit warm season occupations. Two central concepts to this approach, the *taskscape* and the *environmental context* of a dwelling site, are introduced in this chapter. The notion of *taskscape* is grounded in a review of early-contact arctic ethnography, whereby a range of traditional practices and resources are identified. They will be contrasted with findings from Huntingdon Island 5 in order to identify unique aspects of the experience of the southern Labrador landscape. The concept of *environmental context* subsumes types of data made available by environmental soil science approaches that more broadly concern the environmental signature of the dwelling on the landscape, including taphonomic processes that impact it. This aspect is discussed using methodological precedents established by previous soil-based studies.

Chapter 5 presents the study site and discusses field methods and sampling techniques. This chapter is based on the soil and vegetation survey conducted at the site. Sampling procedures are described and comparative datasets are introduced consisting of samples from House 2 and 4 from the winter component of Huntingdon Island 5, extensive background samples from all the relevant vegetation zones identified on the island and samples from modified contexts associated with recent activities that have taken place there. The latter will be used to assess the impact of these activities on the archaeological record.

Chapters 6, 7 and 8 present the results obtained through each individual line of research undertaken by the study. Each chapter also includes a discussion of the findings.

Chapter 9 provides an integrated perspective focused on the three goals of the analysis, outlined above. Elements of the *taskscape* of Tent Ring 1 and Tent Ring 4 are presented, as well as information pertaining to their distinct *environmental context* on the landscape of coastal southern Labrador and the taphonomic processes that impact them.

Chapter 10 provides a brief discussion of the strengths and shortcomings of integrated soil analysis and outlines prospective methodological directions. A section is dedicated to the potential of soil science based approaches to move archaeology in new research directions that recognize human groups as factors of soil formation and look at the broader environmental significance of human culture.

Chapter 2. The Inuit in Southern Labrador

2.1. Introduction

This chapter presents a brief history of research carried out in southern Labrador followed by a critical discussion. This critical discussion highlights recent findings that demonstrate the distinct cultural identity of Southern Inuit, relative to more northern Labrador locations and identifies sources of error resulting from the application of interpretive strategies developed on northern Labrador Inuit records in the south.

The sod house is the main locus of inquiry in Labrador Inuit archaoelogy and has been approached through the house typology (Bird 1945; Mathiasssen 1934; Schledermann 1971). This framework has been able to accommodate increasingly complex theoretical stands focused on the interplay between environmental conditions and historical agency, as well as various aspects connected to the use of newly available inland resources and the spiritual significance of the Labrador landscape (Jordan and Kaplan 1980; Kaplan 2012; Kaplan and Woollett 2000; Roy et al. 2012; Woollett 2007; Zutter 2009; 2012).

In southern Labrador, recent research has followed a similar direction, with a greater focus on regional differences specific to the south. Southern Labrador, defined as the coastal regions south of Hamilton Inlet, has supported more mobile populations of Inuit, responding to an earlier and more immediate European presence. In this diverse cultural landscape, close interactions eventually led to the emergence of a hybrid ethnic group in the 19th century known as the Inuit-Métis. Researchers have focused on identifying material signatures that define these groups, while simultaneously addressing regional variations in sod house architecture and the sequence of emergence of different house forms (Auger 1989; 1992; Beaudoin 2008; Beaudoin et al. 2010; Brewster 2005; Kelvin 2011; Murphy 2011; 2012; Rankin 2011a; 2013; In press; Rankin and Crompton 2013; Stopp 1997; 2002).

2.2. The Southern Inuit

The Labrador Inuit are one of many regional groups resulted from the migration of the Thule from the Bering Strait to the Eastern Arctic around the 12th to 13th century (Friesen and Arnold 2008; McGhee 2009; Park 1993; Ramsden and Rankin 2013; Rankin 2011(a): 335; In press). On the Labrador coast, the Southern Inuit represent populations south of Hamilton Inlet and potentially as far south as the Quebec north shore (Auger 1989, 1992; Stopp 2002). This is the most southerly located component of the Inuit cultural realm. A similar expansion into subarctic and temperate climates is only known on the coast of Alaska.

The Inuit presence in the south and the nature of this presence have often been debated. During the 1970s and 1980s, a number of archaeologists proposed that the Inuit never lived further south than Hamilton Inlet (Fitzhugh 1972; Jordan 1977; Jordan and Kaplan 1980). The main issue was that Inuit archaeological sites were largely unknown south of this imposed boundary; although, many historical accounts made reference to their presence as far south as the Northern Peninsula of Newfoundland (Martijn 2009; Stopp 2002).

For the first three quarters of the 20th century, hypotheses on the nature of the Southern Inuit presence were provided mainly based on historical data. Gosling (1910) places the Inuit in southern Labrador as of the late 1500s. According to Gosling (1910), the Inuit traveled south to trade with Europeans but did not establish permanent settlements. Hawkes (1916) states that the Inuit were permanently settled in the south of Labrador since the mid 1500s and that they were pushed northward by European expansion in the early 1700s. Martijn and Clermont's (1980) edition of Études/ Inuit/ Studies revisits the question of south Labrador Inuit occupation. Inuit presence is assumed for the 16th to the middle and late 18th century, but there is no consensus on the type of occupation. This publication marks the beginning of the modern archaeological investigation of Inuit settlement in southern Labrador.

Following Martijn and Clermont (1980), surveys conducted by Auger (1989, 1992), Stopp (1997) and Rankin (2006: 33; 2011) covered a large portion of the southern Labrador coast from Blanc Sablon to Groswater Bay (Figures 3 and 4). These surveys have uncovered significant evidence of the Inuit presence in southern Labrador, but have also brought into focus a host of difficulties that are characteristic of the south Labrador archaeological record. Issues of identification stem from the close cultural development of local Inuit and Europeans that produced similar archaeological assemblages. The cultural landscape is also complicated by the adoption of the sod house by European settlers in the 18th century, as well as the emergence in the 19th century of the Inuit-Métis (Beaudoin 2008; Beaudoin et al. 2010; Kennedy 1995; Stopp 2002: 85).

Between 1983 and 1989, Auger surveyed the coast between Blanc Sablon and Cape Charles, in the Strait of Belle Isle. Auger uncovered 21 sod houses dated between 1760 and 1850, but most of them could not be assigned a cultural affiliation (Auger 1989; 1992). Auger carried out a single excavation at Seal Island, in Chateau Bay (Figure 3), which revealed a modified Inuit sod house with potential wooden benches along the walls and a wooden floor. The house revealed a heterogeneous material assemblage, mainly consisting of European goods, suggesting that the occupants of the house were engaged in trade. Unable to locate earlier evidence, Auger concluded that the Inuit presence in south Labrador does not predate the 18th-century. Occasional earlier sites, both summer and winter, were attributed to Inuit trading ventures (Auger 1989; 1992).

Between 1991 and 1992, Stopp surveyed the coast between Cape Charles and Trunmore Bay. A historic Inuit presence was suggested by fox traps, tent rings, cairn burials and sod houses. Notably, historic Inuit houses could not be distinguished from European occupations due to the overlap in material culture caused by trade and the development of Inuit-Métis households. Inuit elements also tended to appear in close association with European merchant stations (Stopp 1997: 131).

In 2002, Stopp published an extensive review of the recently expanded south Labrador Inuit archaeological record, which cited 210 sod houses located between Blanc Sablon and Trunmore Bay, as well as cairns, caches, tent rings and fox traps. This archaeological evidence suggests that the Southern Inuit were engaged in a variety of resource-oriented, multi-seasonal activities (Stopp 2002).

Figure 3. Southern Labrador coast indicating the location of recent archaeological excavations at Southern Inuit Sites.

Sandwich Bay was deemed as a distinctive region, due to the large concentration of sod houses found there (Stopp 2002: 85). The area was surveyed again between 2001 and 2006 as a part of the *Porcupine Strand Project* (Rankin 2006; Rankin et al. 2012). The project identified 15 sites concentrated on islands and outer headlands in Sandwich Bay, some of which contained multiple sod houses in association with tent rings, fox traps, hunting blinds, caches and burials. Most sites were concentrated on the seaward side of Huntingdon Island (Rankin et al. 2012: 69).

Research focus was first placed on the 19th century Inuit-Métis household, but ultimately aimed to develop signatures for Inuit, European and Inuit-European households that would provide a means to refine identification in the southern Labrador assemblage (Beaudoin 2008; Beaudoin et al. 2010; Kelvin 2011). One Inuit-Métis house was excavated at North River (FkBg-24) (Figure 4) as a part of

Figure 4. Map of Sandwich Bay, southern Labrador, indicating locations excavated by L. Rankin.

the *Porcupine Strand Project*. The North River site consists of a single 19th-century European style house with an indoor cellar and a saw pit outside. However, characteristics of the artifact and faunal assemblages were Inuit, such as the predominance of hollowware for liquid-based meals, the presence of hourglass mending holes in ceramic shards, the abundance of embroidery beads, the predominance of seal in the faunal assemblage and the piling of domestic debris on each side of the entrance (Beaudoin 2008; Beaudoin et al. 2010). The division of Inuit and European elements between the inside and outside of the household was interpreted to reflect different work traditions that were being perpetuated along gender lines (Rankin et al. 2012: 77 – 79). Unions between Europeans and Inuit often involved a woman with Inuit roots and a European man. Therefore, Inuit work traditions were more likely to be evident inside the house, where women would spend most of their time (Cabak and Loring 2000; Rankin et al. 2012: 79).

More recently, researchers have carried out excavations at a number of Southern Inuit sites under the umbrella of *Understanding the Past to Build the Future Project.* This multi-disciplinary project uses archaeology, history, archival research and genealogical studies to investigate the pre-contact and contact history of Southern Inuit and the historical bases of the Inuit-Métis nation (Rankin In press; Rankin and Crompton 2013; Memorial University of Newfoundland 2014). Although most of these excavations have appeared only in preliminary publications, the distinct nature of the Southern Inuit archaeological record, relative to locations from central and northern Labrador, is becoming apparent.

Under the umbrella of *Understanding the Past to Build the Future*, the *St. Michael's Bay Archaeological Project* has been investigating Inuit occupations in St. Michael's Bay and St. Lewis Inlet. Excavations were carried out at Great Caribou Island and North Island 1 (Stopp and Jalbert 2010; Stopp and Wolfe 2011; Stopp 2012).

The Great Caribou Island (FbAv-13) site, located in St. Lewis Inlet (Figure 3), consists of two modified sod houses, with both Inuit and European architectural features, associated with collapsed fox traps and cobble beach pit features. Partial excavation at one of the houses did not indicate that an entrance tunnel was present, which may also have been a result of the entrance facing a downslope area. The absence of rocks embedded in the sod walls and the thin overburden suggest there may have been a wooden structure placed within the sod walls, which was salvaged by a later occupation. The artifact assemblages consist predominantly of European goods, suggesting a late 18th century occupation. Ceramics with characteristic Inuit repair features were present in the assemblage. The faunal assemblage revealed elements of a traditional Inuit diet, such as seal bones, but also contained a domesticated pig's tooth (Stopp and Jalbert 2010).

North Island 1 (FeAx-03), located at the Mouth of St. Michael's Bay (Figure 3), consists of two sod houses. Only one of the houses was extensively excavated. It was likely occupied on two separate occasions, once in the late 1500s to early 1600s and a second time in the mid 1700s. The structure has traditional Inuit architectural components, including an entrance passage, stone-lined floor, sleeping platform, lamp stands and caches (Stopp and Wolfe 2011; Stopp 2012). The artifact assemblage consists of both Inuit and European objects. All the ceramics recovered are French. The faunal remains associated with the dwelling suggest a traditional subsistence base, consisting of caribou, seals, birds and mussels, but Atlantic cod was also recovered (Stopp and Wolfe 2011; Stopp 2012).

The most substantial excavations undertaken by *Understanding the Past to Build the Future* are located on inner islands located near the mouth of Sandwich Bay (Rankin In press; Rankin et al. 2012; Rankin and Crompton 2013). Excavations were carried out at Snack Cove 1 (FkBe-1), Snack Cove 3 (FkBe-3), Huntingdon Island 5 (FkBg-3) and Pigeon Cove (FlBl-6).

Snack Cove 3 (FkBe-3), located on the eastern shore of Huntingdon Island (Figure 4), is a large settlement with a minimum of four semi-subterranean sod houses with associated kayak supports, caches and burials. House 1 and House 2 are two of the three structures that were excavated at the site. Both houses are rectangular, and are built with sod-covered wooden frames, stone-lined floors, entrance passageways, rear sleeping platforms and alcoves. The presence of a single sleeping platform inside each house indicates that they were home to single-family units (Rankin In press: 3). These houses were occupied between the late 16th and early 17th century (Brewster 2005; Ramsden and Rankin 2013: 305; Rankin et al. 2012: 70).

The investigation concluded that Inuit here lived a largely traditional lifestyle out of traditional houses. No formal Inuit-European trade is thought to have been taking place at this time, based on the absence of trade beads (Rankin In press: 3). All the objects recovered from the houses were available at abandoned fishing stations and could have been obtained by scavenging, including fragments of Normandy stoneware, which were very common at French fishing sites (Rankin In press: 3). However, a lot of the iron objects recovered seem to have been modified into standard forms and stored into caches for trade. The majority of the nails recovered have been flattened and had their heads removed. This suggests that some Inuit-directed trade was taking place at this time, potentially with other Inuit groups from more northern locations who did not have direct access to European items (Brewster 2005; Rankin et al. 2012: 64 – 70; Rankin 2013: 8; In press: 4).

Snack Cove 1 (FkBe-1), located adjacent to Snack Cove 3 (Figure 4), is the only warm season Inuit site in southern Labrador where a complete excavation has taken place. The site consists of three tent rings, one of which was excavated (Brewster 2005). The feature, labeled Tent A, consists of two conjoined rock rings. The area where the two rings join appears as shallow indents in the outline of the feature, which has a rectangular aspect. An additional arc of rocks makes up a partition in one of the circles and the other contains two rock clusters. One cluster consists of a U-shaped arrangement of boulders which was interpreted as a hearth, the second cluster consists of a flat slab of rock surrounded by boulders and was interpreted as a bench (Brewster 2005: 59 – 61). The excavation of the tent revealed very few faunal remains, consisting of mussel shells, seal and ptarmigan bones. Only two artifacts were recovered, a lead pendant and a fragment of a harpoon foreshaft fashioned out of mammal bone (Brewster 2005: 77, 93 – 94; Rankin et al. 2012: 72 - 73).

Tent A was interpreted as a single structure, with one side being a sleeping area and the other an activity area, similar to the Sculpin Island structures identified by Kaplan in northern Labrador (Brewster 2005: 62). Based on the number of artifacts, Brewster (2005) concluded that the tent was occupied for a very short period of time (Brewster 2005: 98, 106). Owing to its proximity to Snack Cove 3, Snack Cove 1 is likely the warm season counterpart and was in use in the same time (Rankin et al. 2012: 73).

Considering all the components of Snack Cove 1 and Snack Cove 3, Brewster concluded that Tent A represents a summer tent and proposed that the Southern Inuit that lived here practiced a restricted subsistence settlement-system, with year-round dwellings located at the same site. With a similar pattern known from adjacent Huntingdon Island 5 (FkBg-3), it is possible that this pattern is representative of the Southern Inuit settlement pattern (Brewster 2005).

Huntingdon Island 5 (FkBg-3) is located on a small promontory off the western shore of Huntingdon Island (Figure 4). It was occupied between the 17th and 18th-century and consists of five sod houses and numerous tent rings. Four sod houses, Houses 1 to 4, were excavated and constitute the most extensive occupation sequence researched at a Southern Inuit site. Excavations revealed important differences to central and northern Labrador.

House 1 and House 2 are the earliest occupations at the site, dated between the early and mid 17th century. Both houses are rectangular structures, accessed through entrance passageways built with sunken cold traps. Inside, both houses have a rectangular shaped floor paved with stones and flanked by multiple sleeping platforms, lamp stands and alcoves. The presence of multiple lamp stands suggests that the houses were occupied by multiple families and are therefore early expressions of the communal house form. These two houses represent the earliest known examples of this phenomenon in Labrador and are unique to southern Labrador for this time period (Rankin 2010; 2011a; 2011b; In press: 6 – 7).

House 1 contained a material assemblage dominated by European items, mostly iron nails, metal scraps, and roofing tiles, some of which had been modified into traditional Inuit forms. Its composition is consistent with early scavenged assemblages, and the absence of trade beads and ceramics also suggests an absence of direct trade (Rankin 2010; Rankin 2011a; Rankin In press: 6 – 7).

The material assemblage associated with House 2 consists of a greater amount of European items than House 1, but similar to House 1, its composition is suggestive of a scavenged assemblage. A single blue trade bead suggests that very limited trade was taking place (Rankin 2011b; Rankin In press: 7). The distribution of goods inside the houses was not uniform. Artifact distributions associated with each sleeping platform varied, indicating that different groups living inside the house had access to different resources. The recovery of a toy soapstone lamp from House 2 suggests that these different groups, or factions, were independent families that chose to live together (Rankin In press: 7 – 8).

House 3 and House 4 are typical communal houses from the 18th century (Rankin In press: 11). House 3 is a rectangular structure accessed through a long passageway built with a sunken cold trap. The inside has a rectangular stone-paved floor flanked by sleeping platforms on all sides with associated alcoves, linked to platform edges by flat horizontal rock slabs. As many as three lamp stands were present inside the house. In terms of architecture, House 3 does not deviate from the Labrador-Greenlandic communal house phase pattern; however, it is considerably smaller in size. The house was dated to the mid- to late 18th century (Murphy 2011; 2012; Rankin 2012a). The material assemblage associated with this house is predominantly composed of European objects, mostly made of iron, many of which had been modified into traditional Inuit items (Murphy 2011: 98; Rankin In press: 11). Although it is more sizable, it contains a more limited array of artifact types, more consistent with trade than scavenging (Murphy 2011: 101; Rankin In press: 11). Some prestige items have also been identified, such as sword hilts modified to be worn as pendants (Murphy 2011: 137). These items suggest that the house was inhabited by wealthy individuals (Murphy 2011: 137; Rankin In press: 11).

House 4 is a large, trapezoidal structure accessed through an entrance passageway terminated in a wide, paved area. The house had a stone-paved floor, flanked by sleeping platforms on all sides, similar to the other structures. Four alcoves were located in each corner of the floor, and two lamp stands were present near the rear left corner. This house dates to the 18th century and is thought to have been occupied slightly later than House 3 (Rankin 2012a: 8). Similar to House 3, the material assemblage was more substantial but contained a more limited array of predominantly European objects, suggesting trade (Rankin 2012a; Rankin In press: 6 – 7).

Recent Indian elements, in the form of chert flakes, have also been recovered from each of the houses excavated at Huntingdon Island 5. So far, these elements have been interpreted as earlier site components that have become embedded in the sod walls and roof (Rankin 2011b). A similar effect has been observed at northern Labrador sites with earlier Dorset components (Kaplan 1983). When house assemblages are compared, it appears that the amount of Recent Indian artifacts decreases with the age of the structures (Rankin 2011b; 2012a). This may suggest that they are not simply inclusions in the walls or the overhang, as has been previously suggested, but a potential component of the house assemblages. The Recent Indian-Inuit relationship is the least known aspect of the Inuit experience in south Labrador; although, it is considered that this encounter would have had as much of an effect on Inuit activities as the European presence (Fitzhugh 1972; 1977; Jordan 1977; Rankin 2011b; 2012a).

Zooarchaeological analyses have also revealed that the faunal assemblages recovered from these houses display slight differences relative to more northern locations (Murphy 2012). House 3 and House 4 were dominated by seal, but not in the same proportion as would be found in northern faunal assemblages, and contained some important secondary resources. Inland components like caribou were present in House 3, and Atlantic cod was a significant component in House 4 (Murphy 2012: 36 – 37; Rankin 2011). Murphy (2012: 102 – 107) proposed that the apparent difference in seal consumption signaled the use of seal products in trade but may also reflect diversification simply due to the availability of a broader resource base in the south.

Immediately north of Huntingdon Island 5, excavations carried out at Pigeon Cove (FlBl-6) (Figure 4) have uncovered a similar sod house dated to the same time period as Houses 3 and 4 from Huntingdon Island 5. House 1 contained a sizable assemblage predominated by European goods

(Rankin 2012b: 128). The size of the assemblage can be explained by a slightly longer period of occupation; however, it can be also attributed to the success in trade of its inhabitants (Rankin 2012b; In press: 12).

2.3. Discussion

The sites discussed above represent the total number of Inuit sites excavated in southern Labrador to date, with occupations spanning between the late 16th and 19th century. These excavations have revealed important differences to more northern locations in Labrador. Most of the sites investigated have no more than one or two houses, and where multiple structures are present they are the result of subsequent reoccupation over a lengthy period of time. This points to an increased mobility of Southern Inuit groups, perphaps as a result of the constant influx and retreat of Europeans (Rankin 2011a). The concentration of larger sites in Sandwich Bay, located north of the main areas of European activity, suggests that this area functioned as an Inuit stronghold or a refuge place in the face of incoming European settlers (Rankin 2013: 9).

House forms at Southern Inuit sites are also divergent from patterns established at northern and central Labrador locations (Bird 1945; Kaplan and Woollett 2000; Mathiassen 1934; Schledermann 1971; Whitridge 2008). The presence of two communal houses at Huntingdon Island 5, in the early 17th century, predates the communal house phenomenon in central and northern Labrador (Rankin 2013: 8). Artifactual studies indicate that the inhabitants of these houses were individual family units with differential access to European resources and that European goods were mostly obtained by scavenging abandoned European structures. Therefore, the communal house may represent a means for Inuit groups to band together and jointly exploit a new resource (Rankin In press: 8). Some Inuit-directed trade may have also been taking place at this time. Standardized iron items linked with trade activities are, in fact, present in earlier assemblages from Snack Cove 3, where the absence of trade beads is conspicuous (Rankin et al. 2012: 64 – 70; Rankin 2013: 8).

The relationship between architectural variations at Inuit sod houses and direct European influence does not reflect a typical acculturation scenario where increasing European contact results in greater changes. House 1 from Pigeon Cove contained the most sizable European assemblage but maintained a conservative, typically Inuit form. It may be that the reverse is the case and that contact with Europeans through trade leads to the development of wealthy traders that now have the resources to assert their Inuit identity by building communal houses (Kaplan and Woollett 2000; Murphy 2011).

Other sites investigated point to variations in house architecture that signal the influence of local conditions. Wooden benches, wooden house frames or floors are present in houses from all time periods investigated, including the earliest structures from Snack Cove 3, irrespective of the amount of European items present in the assemblage. The increasing availability of wood on the Labrador coast south of the tree line, in particular, is attributed to these changes (Kaplan 2012: 33, 35; Murphy 2011: 124). This is, to date, an under-researched aspect of the Inuit presence in southern Labrador and it is not yet well understood what other local plant resources were favored (Lemus-Lauzon et al. 2012; Roy et al. 2012).

European artifacts and resources are abundant at all Southern Inuit sites. Early assemblages exhibit an increased hybridity, with many items having been modified for traditional Inuit use or for trade (Rankin 2013: 6). At Houses 1 and 2 from Huntingdon Island 5, items modified for traditional use tend to represent female property, such as *ulus*, suggesting that Inuit women continued to use traditional items even though social relations were in flux as a result of the opportunity created by the European presence (Rankin 2013: 6). The stable perpetuation of womens' work traditions was also noted in later Inuit-Métis houses, indicating that this was a long lived process (Beaudoin 2008; Beaudoin et al. 2010). In the 18th century, house assemblages are characterized by large quantities of a limited variety of European artifact types and the presence of trade beads and ceramics, consistent with the development of formalized trade (Rankin In press). The adaptation of European items to serve Inuit purposes, however, continues (Loring and Cabak 2000).

The use of European objects in an Inuit cultural framework at later 18th and 19th century sod houses is exemplified by the use of hourglass shaped mending holes to fix broken ceramics, the modification of various items for suspension on clothing and the predominance of hollowware in Inuit assemblages (Loring and Cabak 2000; Stopp and Jalbert 2010: 158; Rankin et al. 2012: 77 – 79). These characteristics have been used to identify Inuit assemblages for time periods when Inuit and European households become indistinct due to the adoption of the sod house by European settlers and the ubiquity of European objects in all archaeological assemblages (Stopp and Jalbert 2010: 157 – 158).

These findings demonstrate that southern Labrador is a distinct cultural region on the Labrador landscape that requires an interpretive approach tailored to its specific socio-economic and environmental conditions. However, the recent work undertaken also raises additional questions. The overarching focus on coastal settlements and the general perception that there are few inland Inuit sites, the emphasis placed on the role played by European groups in the history of Labrador Inuit, and to a certain extent current understandings of Inuit culture seem to be a result of a narrow focus on the winter settlement as the main locus of inquiry in research.

The current distribution of Southern Inuit sites disproportionately favors the coast, which coincides with the perception of Inuit as coastal hunter-gatherers. However, this also coincides with the absence of inland surveys (Rankin 2011a; Stopp 1997: 121). Even though they are known primarily as marine mammal hunters, ethnographic and ethohistorical evidence shows that most Inuit groups in the arctic practiced a yearly foraging round with a significant inland component that mainly took place in the summer (Aporta 2009: 136; Grønnow 2009; Collignon 2006: 35 – 36; Taylor 1977). Inuit groups traveled farthest inland where waterways permitted, such as in Chesterfield Inlet, Nunavut, where sites reach as far inland as Baker Lake (Friesen and Stewart 2013). The only Labrador location where the interior was investigated for Inuit sites is Hamilton Inlet, and investigations here have found Inuit tent sites far inland on the shores of Lake Melville, suggesting that at least some Labrador Inuit traveled inland in the summer (Fitzhugh 1972; Jordan 1977). In Sandwich Bay, the Paradise, Eagle and North Rivers provide access to the interior; additionally, a portage route may have been used to access Table Bay to the south (Rankin et al. 2012: 64 – 65), but it is not clear whether Inuit explored these landscapes because they have not been surveyed.

In north Labrador, Kaplan has shown that Inuit winter settlements experience a gradual shift inland following initial colonization in conjunction with the appearance of new house forms (Kaplan 1983; 2012: 18 – 27; Woollett 2007: 72). This inland shift is attributed to an increasing familiarity with the local environment as well as to a potential readjustment of the Inuit spiritual framework in which the inland landscape was traditionally seen as a dangerous place (Burch 1971; Grønnow 2009; Kaplan 2012: 35). These findings further suggest that an inland summer component may have been a significant part of the Southern Inuit yearly foraging round, and that it is simply not known archaeologically.

An additional aspect is the central role played by European groups in the history of Labrador Inuit. The presence of Recent Indian components in assemblages from the houses investigated at Huntingdon Island 5 raise questions about the relationship between Inuit and Amerindian populations. It has been assumed that similar to Dorset components in the north, Recent Indian artifacts represent prior site components that have become intermixed with the more recent Inuit assemblage, but this may not be the case. As was shown above, the percentage of Recent Indian artifacts identified at houses from Huntingdon Island 5 seems to decrease with age. This pattern may indicate a potential relationship with local Amerindian populations that has not yet been investigated. Writing of Hamilton Inlet, Fitzhugh noted that the period between AD 1500 and 1850 is unknown archaeologically for the

Point Revenge, but that there is nothing to suggest these Amerindian populations ever stopped occupying the region (Fitzhugh 1977: 18; Kaplan 2012: 21).

The influence of Europeans on Inuit groups may simply be exacerbated due to the nature of European culture, which is both more accessible and intelligible to modern researchers. A small body of literature, however, suggests that the Amerindian presence was as much of a determining factor on Inuit settlement as local European groups. Scant ethnohistorical references point to an extremely hostile Inuit-Innu relationship, stemming from the former's infringement upon Innu summer grounds along the coast, which caused their displacement inland (Fitzhugh 1972: 52; Fitzhugh 1977: 14 – 18; Kaplan 2012: 36; Lemus-Lauzon et al. 2012: 122 – 123). Local Amerindian groups may have also presented trade opportunities to the Inuit. In his ethnography of the Ungava District (1894), Turner noted that starting in the 19th century, the trading post period put an end to hostilities and fostered the development of an Innu-Inuit trade relationship that paralleled Inuit-European commerce.

It may simply be that while the seaward side of traditional Inuit territories document contacts with incoming Europeans, the inland reaches contain summer camp sites that hold information about the lesser known encounter between Inuit and local Amerindian populations. Therefore, the emphasis placed on the winter settlement not only limits current understandings of the Inuit experience of the Labrador landscape but may unwittingly emphasize contacts with certain groups over others.

Ultimately, the greatest issue raised by the overwhelming focus on Inuit winter sites is whether this impacts our entire archaeological understanding of Labrador Inuit culture. In the choice of excavation sites, this focus undoubtedly colludes with the visibility of the sod house on the Labrador landscape (Jordan 1977: 43), but many aspects that stem from an understanding of Inuit culture as a winter culture have also become the basic underpinnings of survey criteria. Auger noted that the soapstone pot is a characteristic Inuit marker for pre-17th century occupations (Auger 1992: 29). This approach ignores well-established knowledge about the seasonal use of many Inuit elements in the yearly foraging round that stems from differential seasonal travel. Even in the high arctic, heavy items like soapstone pots were often cached in the summer, when people were more mobile (Collignon 2006: 34). On the south Labrador landscape, employing such survey criteria signifies that the entire south Labrador presence is being investigated with a seasonally limited definition of what it means to be Inuit.

2.4. Summary and Conclusions

Recent work in southern Labrador has uncovered Inuit sod houses dating as far back as the late 16th century. The houses excavated at Snack Cove 3 represent this early period, characterized by single-family dwellings associated with standardized trade items but lacking in trade beads, which suggests the development of Inuit directed trade, prior to the formal trading period. House 1 and House 2, from Huntingdon Island 5, dated to the 17th century, are expressions of an early form of communal house, inhabited by independent family groups that banded together to obtain European goods, but maintained a relative independence from each other, evident in the patterned distribution of goods inside the dwellings. The large amount of European resources and objects refashioned into traditionally female items like *ulus* suggest that the female members of these households were the more conservative faction. In the 18th century, the communal house phenomenon, exemplified by House 3 and House 4 from Huntingdon Island 5, and House 1 from Pigeon Cove, is associated with formalized trade, mainly with French groups (Rankin In press). Artifact assemblages signal a change in the social relations between their inhabitants, evident in the uniform distribution of goods inside the houses, and the development of wealthy, high-status individuals, indicated by the presence of prestige items such as sword hilts modified for suspension on clothing (Murphy 2011: 137). The assemblages associated with these houses contained varying amounts of European artifact types relative to the size of the assemblage, suggesting that the success of different families or groups involved in trade varied (Rankin 2013; Rankin In press). For the 19th century, the excavation of an Inuit-Métis house from North River shows that acculturation was not a unidirectional process, with both the European and Inuit members of the household adopting elements of each other's culture, such as whale bone sled runners for the men involved in the trapping economy and hollowware ceramics and glass beads for the women (Rankin et al. 2012: 79). The interior of the house is more apt to preserve Inuit work traditions, which were perpetuated along female lines, in the stable gendered framework created by unions between predominantly European men and Inuit or Inuit-Métis women (Cabak and Loring 2000; Beaudoin 2008; Beaudoin et al. 2010; Rankin et al. 2012). Further south, at sod house sites in St. Lewis Inlet and St. Michael's Bay, findings are still preliminary, but future research may shed light on the increasing *entanglement* (Rankin In press: 15) between Inuit and European colonists.

This chapter has discussed a series of shortcomings in current Southern Inuit research that are linked to the focus on only one settlement type out of the range of occupations characteristic of the year-round Inuit foraging round. These shortcomings are related to the focus on coastal winter settlements, which overemphasize Inuit-European relations while minimizing the influence of Amerindian groups. Additionally, the use of survey criteria developed through the exclusive study of assemblages from winter houses perpetuate a skewed picture of Inuit culture. Although cairns, caches and tent ring sites are known throughout southern Labrador, they are under-researched.

The following section discusses the seasonal aspect of Inuit culture more closely. A survey of a small body of literature available on tent sites indicates that the lack of research carried out at Inuit warm season occupations is chiefly caused by the absence of a suitable investigative method and the use of an interpretive framework that does not incorporate the entire range of Inuit subsistence.

Chapter 3. The Question of Tent Camps in Labrador Inuit Archaeology

3.1. Introduction

While Inuit archaeology has limited its focus almost exclusively on the winter sod house, Inuit ethnography has always maintained a multi-seasonal perspective, undoubtedly due to the nature of anthropological field work. One of the earliest general theories on Inuit life, first published in 1906, takes as its main departure point the marked seasonal differences in the Inuit yearly foraging round (Mauss 1979). Based on an extensive review of ethnographic data available at the time, Mauss proposed that Inuit house forms and settlement patterns vary seasonally, in conjunction with an emphasis on community life in winter and the prevalence of individual and family-centered activities in summer (Mauss 1979; Saladin D'Anglurre 2006). This was evident, Mauss noted, in all aspects of social life from laws to religion and, more importantly for archaeologists, in the seasonal segmentation of material culture (Mauss 1979: 73). Winter and summer settlements are spatially segregated, and defined by opposing architectural forms and material assemblages. Furthermore, the seasonal use of material items takes place in different socio-economic regimes with winter items functioning as communal property while summer items remained individual property (Mauss 1979: 70 – 74).

Although the explanations employed to justify seasonal variation have more to do with scientific debates that were occurring at the time than with any objective considerations (Bravo 2006), Inuit anthropology has time and time again shown that Inuit life across the arctic varies seasonally with most groups spending winters in settlements along the coast, on land or directly on the ice and summers inland, fishing at lakes or hunting caribou (Collignon 2006: 38; Condon and Ongina 1996; Damas 1972; Jenness 1922; Mathiassen 1976; Stefansson 1913). Furthermore, research on the significance of the inland landscape in Inuit spirituality shows that this is not at all a negligible aspect of Inuit culture, as inland regions were seen as particularly dangerous epiphenomenal landscapes, populated by otherworldly beings and spirits (Burch 1971; Grønnow 2009; Kaplan 2012).

Comparatively, archaeological research on Labrador Inuit tent camp sites has been scant. The current prevailing theoretical framework centres on the winter sod house, one of the most visible aspects of the Inuit cultural landscape. This is due primarily to the shortcomings of traditional archaeological methods. The primary difficulty raised by tent camps is the paucity of artifacts and visible structures associated with these sites (Brewster 2005: 6 – 10; Jordan 1977: 44; Kaplan 1983; Murphy 2011: 29). Furthermore, Inuit employed the same tent form in spring, summer and early autumn (Fitzhugh 1972: 35), making it difficult for archaeologists to determine the precise season of occupation of a tent ring. The following presents the limited literature available on Labrador Inuit tent sites, and discusses in more detail the single complete excavation carried out at a tent site in south Labrador (Brewster 2005; Fitzhugh 1972; Jordan 1977; Kaplan 1983).

3.2. The Inuit Summer Camp: a Missing Component

In Hamilton Inlet, Fitzhugh (1972) and Jordan (1977) found warm season sites, consisting of tent rings in association with other structures such as hunting blinds, cairns and caches, concentrated in Groswater Bay and the Narrows, at locations favorable for fishing, sealing and bird hunting. Tent camp sites were identified at Ticoralak Lake, Big Black Island, Double Mer Point, Big Island, Black Island and Winter's Cove, occasionally adjacent to sod houses (Fitzhugh 1972: 61; Jordan 1977: 44). A small number of tent sites were also located further inland, on the western shore of Lake Melville, marking the extension of the Inuit summer component inland (Fitzhugh 1972: 61). All the sites were identified as summer sites, either gathering places or temporary fishing and hunting camps. They were not researched extensively; therefore, very little information is available on them.

A summer site identified at Ticoralak Lake, north of the Narrows, consists of 30 tent rings associated with graves, cairns and fox traps. Multiple Inuit, Dorset and Amerindian components were identified, and some of the tents produced historical artifacts (Fitzhugh 1972: 86). The Dorset component is located on an uplifted shoreline, above the Inuit and Amerindian components, which occur on the same level (Fitzhugh 1972: 85). This site was described as a large gathering place; however, no evidence was provided to support this interpretation nor was the distinction between Inuit and Amerindian tent rings made clear. The accumulation of tent rings may also be the result of repeated reuse of the same location by different groups over time; therefore, Fitzhugh's (1972) interpretation remains tentative.

At Big Black Island, ten tent rings were identified in association with caches, cairn burials, fox traps and duck blinds. Some of the tent rings revealed historical artifacts. This site is locally known as an old summer gathering place (Fitzhugh 1972: 92). No further research was conducted here.

Owing to the scant information revealed by these sites, both Fitzhugh (1972) and Jordan (1977) employed ethnohistorical data and resource availability patterns to discuss summer subsistence and settlement patterns in the Hamilton Inlet area. Jordan concluded that a typology similar to the one established for the winter component may become feasible when more work is done on summer settlements (Jordan 1977: 46).

Kaplan (1983) surveyed multiple tent sites at coastal locations in Nain, Okak, Hebron, Saglek and Ramah Bay. The tents were associated with sod houses, boulder structures, boulder pits, caches, hunting blinds and burials. Based on the seasonal availability of resources in those areas, and the analysis of scant faunal assemblages recovered from the sites, Kaplan established that all the tents located on islands in the fjords are autumn and spring sites with a single location where use likely extended into the summer season (Kaplan 1983: 519).

In most cases, dating the structures was difficult due to the paucity, and in several instances, complete absence of artifacts, as well as the multiple instances of reuse and the overlap of features. This issue was amplified by the shallowness of the soil and the lack of stratification, which complicates the relationship between artifacts found within or in association with a structure (Kaplan 1983: 223). In some instances, tents had been built on top of former Dorset site components or inside Dorset structures, in order to capitalize on the pre-existing paved stone floors and were associated with Dorset artifacts (Kaplan 1983: 664). At later tents, where artifact assemblages were present, European artifacts were more prevalent than Inuit artifacts and in some cases Inuit artifacts were absent (Kaplan 1983: 246). Kaplan (1983) established a tentative sequence based on a small number of sites that revealed scant artifact assemblages, using variations in tent ring shape and the presence of internal partitions evidenced by rows of hold-down rocks.

Early period structures are referred to as Sculpin Island structures after several autumn and spring sites identified on Sculpin Island in the Nain archipelago. They consist of rectangular arrangements of boulders, sometimes multi-tiered, with indents along the middle section of the longer walls, storage pits, U-shaped hearth features and ocassional paved floors (Kaplan 1983: 473 – 474, 500 – 509). They are common at many sites along the coast. Circular and D-shaped tents are often present within their perimeter (Kaplan 1983: 508).

At White Bear Island, a rectangular Sculpin Island structure contained a corroded nail, which places it in the historical period (Kaplan 1983: 546). At Tabor Island (HcCk-5), one of the structures contained a tool cache with the decomposed remains of a wooden box, inside which were a bone peg, a drilled bone fragment, a European knife handle and blade, an axe, a metal shaft and numerous nails and spikes. The cache was dated to the 16th or 17th century based on the absence of gun parts (Kaplan 1983: 464 – 465). The location of the site, as well as the faunal assemblage associated with it suggested autumn and spring use of these structures (Kaplan 1983: 574). Additionally, it is unclear whether they were used as tents, owing to the multi-tiered rock outlines that could have doubled as low-walls, which are sometimes associated with snow houses (Mathiassen 1927: 129).

Later period tents rings are circular, oval or D-shaped, with a diameter ranging between 5 m and 7 m. Some of these tents exhibit conspicuous entrances with paved surfaces sometimes extending into the perimeter of the feature. Raised platforms, lined by upright stones are sometimes present against the back wall. Some tent features have multiple partitions, outlined by rocks on the tent floors. Circular or rectangular hearths are sometimes found within the perimeter of the structures as well. These forms are considered common up to the 19th and 20th century, and even to the second half of the 20th century (Kaplan 1983: 246 - 247).

Similarly shaped, conspicuously larger tent rings are attributed to the 18th century as a likely summer correspondent of the communal house form (Kaplan 1983: 487). However, this may not be the case. It is unclear whether communal household members continued to live together in the warm seasons. One account from Angmassalik, Greenland, dated to the 19th century, describes the spring move from a communal house (Schledermann 1971: 107). The 38 individuals that shared a house in winter spent the summer in five tents, housing up to seven people each, erected in different locations (Schledermann 1971: 107). However, this may only reflect the practices of groups formed by individual families, rather than one extended family or polygynous group (Kaplan and Woollett 2000: 352; Woollett 2007: 71).

Dates for these structures have been determined based on a very small number of sites where test pits revealed artifacts. At Anchorstock Bay 3 (HkCk-5), in the Okak area, an oval tent ring revealed a fragment of earthenware, an axe and an iron hoop, suggesting an 18th or 19th century date (Kaplan 1983: 531 – 532). At Bear Guts 1 (IeCr-1), in Ramah Bay, three oval tent rings revealed soapstone pot fragments together with historic artifacts, and 19th and early 20th century ceramics (Kaplan 1983: 612). At Gulch Cape 1 (IgCt-2), in Nachvak Fjord, oval tent rings contained plastic net floats and metal, indicating a 20th century use date (Kaplan 1983: 662). At Bear Guts 3 (IeCs-1), several tent rings contained artifacts, including ceramics where the maker's mark was visible. These ceramics dated to 1950. The presence of other modern artifacts, such as a deodorant canister, pointed to a mid 20th century date (Kaplan 1983: 617).

3.3. Discussion

This overview has presented the very limited data available on Inuit warm season occupations, consisting predominantly of clusters of rock rings poor in artifactual remains, found in association with hunting blinds, caches and cairns, sometimes located in proximity to sod houses. Fitzhugh (1972) and Jordan (1977) used the location and size of the sites to interpret tent ring occupations as either summer hunting camps or gathering sites. These interpretations cannot be considered reliable due to the use of similar structures in spring and autumn and the possibility that clusters of hold-down rocks may represent repeated occupations. Kaplan's analysis used faunal remains to determine the season of occupation of tent rings in north Labrador, where available. It is important to note, however, that the faunal analysis predominantly indicated spring or early autumn sites and that only one site out of all the locations investigated could be identified as a summer site. This suggests a significant gap in the warm season archaeological record and a potential source of bias.

The identification of the Sculpin Island structure as an autumn or early spring site (Kaplan 1983: 484) calls into question Brewster's interpretations of Tent A from Snack Cove 1 and the proposal of a restricted seasonal foraging round in Sandwich Bay (Brewster 2005). Prior to this study, Tent A was the only Inuit summer camp excavated in Labrador. It is likely that Tent A represents a spring or autumn structure used in conjunction with the winter houses and that summer sites in Sandwich Bay are yet unknown. Therefore, the proposal that southern Inuit performed a limited yearly seasonal round with both winter and summer occupations present at the same site needs to be reevaluated.

The absence of summer sites from the Labrador Inuit archaeological record recalls the issue raised in Chapter 2, regarding the employment of seasonally-restricted criteria in archaeological investigations of Inuit culture and the general absence of inland surveys in Labrador. It appears that current survey procedures are more apt to locate spring and autumn sites which tend to occur in conjunction with winter sod houses and that tent camp sites representative of summer months have been overlooked. Furthermore, investigations at known tent camp sites have met with little success due to the paucity in artifacts and limited structural remains characteristic of these sites. Similarities exhibited by spring, summer and early autumn tent sites cannot be addressed by structural analysis alone. Kaplan's (1983) proposed typology for summer camps, based on structural analysis, consists of an amalgamation of spring and autumn structures, with summer tent camps being conspicuously absent. The use of this typology to interpret the single complete excavation of a tent ring at Snack Cove 1 in southern Labrador may, therefore, have led to a misinterpretation.

These findings suggest that current methods are inadequate to study warm season occupations. Artifactual analyses have been limited by the small assemblages associated with tent rings and structural analyses have not been successful due to the limited structural remains associated with a tent site. Therefore, a new investigative method is required to study these locales and produce data that will shed light on life in the warm seasons.

Owing to the limitations of structural analyses, a functional approach may be more suited to overcome the difficulties associated with these sites. This approach will capitalize on micro-artifactual and ecofactual evidence to provide a better understanding of these dwellings by uncovering the type and patterning of activities on the tent floors, which may also point to the age of the structures and their season of use. Furthermore, this approach will also broaden survey perspectives by throwing light on the environmental aspects that determined the limited impact of tent sites on the Labrador landscape relative to sod houses, and the taphonomic processes that influence them. An understanding of the latter will provide a basis for comparison and the integration of tent camp site data with information coming from winter settlements, in order to create a complete, year-round picture of the life of Inuit in southern Labrador. This picture will serve to enhance survey criteria and improve current understandings of the southern Labrador cultural landscape.

Lastly, a new research method needs to capitalize on the wealth of ethnographic data available on tent sites. Owing to its multi-seasonal focus, anthropology has amassed a wealth of data on Inuit tent sites throughout the arctic, starting with the early contact period that can be used to interpret tent rings. By looking at environmental differences between ethnographic sites in the high arctic and tent camp sites in southern Labrador, such studies have the potential to reveal cultural changes stemming from the experience of an environmentally distinct landscape in southern Labrador.

3.4. Summary and Conclusions

This chapter has reviewed the limited research carried out at tent camp sites in Labrador. Fitzhugh (1972) and Jordan (1977) surveyed tent sites in Hamilton Inlet and identified two types of sites, gathering places and hunting or fishing camps. Most of these sites were located in Groswater Bay and the Narrows, but some hunting camps extended far inland to the western shore of Lake Melville. Kaplan (1983) surveyed tent sites in north Labrador and conducted limited excavations there. Kaplan proposed a typology consisting of early-contact, rectangular, double-tiered structures with shallow indents along the mid-section of long walls creating separate compartments, known as Sculpin Island structures, and 18th, 19th and 20th century oval, round or D-shaped tent rings with internal partitions created by hold-down rocks, with paved floors and entrances and raised sleeping platforms. Larger circular or oval tents were interpreted as warm season counterparts to the communal house phenomenon of the 18th century. However, this typology is biased by the near absence of summer sites from the sample used to develop it, as all but one of the sites included in the analysis were identified as spring and early autumn dwellings.

A single complete excavation of a tent ring was carried out at Snack Cove 1 in southern Labrador (Brewster 2005). The structure was interpreted as a summer dwelling similar to the Sculpin Island structures identified by Kaplan (1983). This interpretation is, however, unreliable, owing to the fact that Sculpin Island structures have been predominantly identified as spring and autumn occupations. It is apparent, therefore, that summer camps remain largely unknown in Labrador due to the narrow focus of surveys on coastal regions and the inadequacy of traditional excavation methods.

In order to overcome these difficulties, the following chapter proposes an integrated soil science approach, consisting of the joint investigation of multiple aspects of soil, through the application of thin section micromorphology, soil chemistry and paleoethnobotanical analysis on a set of soil samples collected from tent rings at Huntingdon Island 5, in Sandwich Bay, southern Labrador. This approach uses the extensive record provided by early-contact arctic ethnography to interpret tent rings, guide sampling strategies and formulate working hypotheses. In an attempt to overcome structural analyses and address issues pertaining to the visibility and long-term stability of tent rings on the Labrador landscape, as well as the comparability of data collected from tent ring locales, the analysis will determine the *taskscape* associated with the occupations and define their environmental and taphonomic context.

Chapter 4. Fundamental Concepts and Research Precedents

4.1. Introduction

Soil samples collected from Tent Ring 1 and Tent Ring 4, Huntingdon Island 5, will be subject to an integrated soil analysis that simultaneously targets interrelated physical, chemical and ecological characteristics of soil. In the absence of physical partitions characteristic of built space, this approach uses environmental and ecofactual data, obtained through the application of micromorphological, chemical and paleoethnobotanical analysis, to determine the patterning of activities on tent floors, subsumed under the concept of *taskscape*. Further aspects, related to changes in vegetational cover and soil characteristics caused by the occupations will be investigated under the concept of *environmental context*, which also pertains to the taphonomy of the site.

This chapter introduces the application of joint methods under the heading of integrated soil analysis as a means to focus on interrelated aspects of soils from archaeological sites. This leads to the production of datasets that can simultaneously function as supportive evidence for each individual line of research, lending strength to the interpretation. This approach requires the use of extensive control samples, in order to determine baseline conditions and allow comparison with other modified contexts at the site. Data provided by a review of early-contact ethnography is used to interpret the structures, guide sampling procedures and formulate working hypotheses about the significance of each section of the floor.

4.2. A Method for the Study of Temporary Occupations: Integrated Soil Analysis

Integrated soil analysis consists of the application of multiple methods to investigate interrelated aspects of soil science. This leads to the recovery of data that provides a supportive framework of interpretation for the results of each individual method, lending strength to the analysis as a whole (Kooistra and Kooistra 2003: 603). Integration starts at the sampling level, with the creation of joint sampling strategies, which will provide interrelated datasets (Kooistra and Kooistra 2003: 615;

Sulas and Madella 2012: 145). An additional requirement is that each method provide data on aspects of soil that influence each other, thus offering a means to identify sources of error, to eliminate many of the uncertainties that can arise in soil studies and to increase the reliability of the results of each individual line of research (Butler 2008: 151; Kooistra and Kooistra 2003; Sulas and Madella 2012: 157; Tan 2000).

The choice of methods is determined as much by the complexity of soils and the requirements of the analysis, as by environmental conditions at the site and the nature of Inuit occupations. For the purpose of this analysis, a set of three methods, consisting of thin section micromorphology, soil chemistry and paleoethnobotany, was chosen that will reveal highly interrelated morphological, chemical and ecological aspects of soil. These methods offer access to data that is unavailable to traditional archaeological methods, due to the nature of temporary tent sites where traces of past human activities are microscopic (Sulas and Madella 2012: 145), while also touching on unique aspects of Inuit life in the warm seasons, such as the increased use of plant resources (Jones 2010). Furthermore, because they are interrelated, the results of each method can provide interpretive support for other segments of the analysis, which will compensate for the limited data available on Inuit tent sites.

Owing to the difficulties encountered by structural interpretations, this analysis focuses on the activities that took place at the site and uses environmental and ecofactual data to determine the patterning of space inside the dwellings. By decoding these aspects, the analysis is capable of addressing questions related to the *taskscape* of the occupations, as well as additional effects produced by these occupations on the local landscape, subsumed under the notion of *environmental context.*

The *taskscape* is a stable frame for the accomplishment of daily tasks, based on Margret Mead's notion that every object in itself is a collapsed act (Ingold 1993: 159 – 161). Unlike Bourdieu's concept of the *habitus,* which signifies a series of norms and beliefs that govern the daily behavior of individuals (Bourdieu 1990), the *taskscape* references a stable, material frame of action constituted and confirmed by the repetition of these actions. Inside a dwelling, the *taskscape* represents the physical space and its partitions, fixtures and furnishings present and their organization. These material settings must accommodate the physical dispositions of its inhabitants, summarized by the notion of *hexis,* to use another Bourdieuan term, or be attuned to their "grammar of performance" (Graburn 2006: 140). This pertains directly to the notion of a culturally defined, appropriate dwelling that encodes the unique dispositions of its inhabitants.

It is undoubtedly a fundamental difference in *hexis* that caused foreign observers, welcomed as guests in Inuit houses, to perceive what was to Inuit a comfortable home as crowded, cramped, too hot or too cold. These differences indicate that even comfort is ultimately a culturally constructed notion that reveals more about the observer than the condition of that which is observed.

Through the study of the material setting of a dwelling, the researcher can decode the structuring of daily tasks that took place inside the dwelling, and thus access aspects of the day to day life of its inhabitants. These aspects ultimately relate to people's movements on the landscape and their experience of southern Labrador, as the resources required for their completion set in motion the complex schedule of exploitation that hunter-gatherers follow in their yearly foraging round.

In the absence of significant structural elements, the structure of lived space inside tents is constantly renewed through the accomplishment of daily routines. Therefore, the structuring of daily tasks lends a functional understanding of the structure of the tents that can become a solid basis for the definition of types and the construction of a warm season typology.

For this analysis, emphasis is placed on those aspects that distinguish southern Labrador warm season dwellings from their northern counterparts. Therefore, the elements of a traditional *taskscape* will be gleaned from an extensive review of ethnographic literature on summer camps from the arctic and contrasted to the *taskscapes* identified at Tent Ring 1 and Tent Ring 4. This approach targets differences in the ordering of warm season dwellings that arise from the colonization of new environments and the use of new resources.

A further aspect arising from the analysis is the environmental imprint of the dwelling on the contemporary landscape. Archaeological assemblages are not just stand-alone arrays of items, but also delimit areas of altered soil conditions, determined by the cultural behaviors exhibited by individuals at that site and their choice of resources. Furthermore, archaeological assemblages are not sealed off entities, rather they take part in ongoing exchanges with the immediate environment. Only some of these exchanges, as far as they impact the intactness of archaeological materials, have been recognized under the concept of site taphonomy.

In order to obtain a broader perspective, the concept of *environmental context* is employed to designate those aspects that are directly related to the history of occupation and therefore to the *taskscape* of the dwellings and their impact on processes that pertain to the environmentally reactive nature of the site. An *environmental context* is defined as a discrete soil area on the landscape, delimited by the extent of human activity, defined by physical, chemical and vegetational characteristics that differ from surrounding soil conditions, where environmental processes have been altered to reflect these changes. Based on the concept of archaeological site and the pedological concept of a soil unit, or pedon (Buol et al. 2003: 30), the environmental context subsumes the altered ecological characteristics of soils delimited by the area of past human activity.

Some of the aspects that have been subsumed under the concept of *environmental context* pertain to soil and vegetation conditions that define the archaeological site as a visible context on the landscape that has always been an informal part of archaeological surveys (Fitzhugh 1972; Kaplan 1983). In this study, the *environmental context* is intended to overcome this limited perspective by including those aspects that define the site's ecological interactions with the landscape in which it is grounded. The *environmental context* of the site, therefore, includes the range of ecological conditions impacted by past human action, which determine local taphonomical processes as well as the site's broader susceptibility to changes that impact the landscape.

The following two sections focus more closely on the concepts of *taskscape* and *environmental context.* Section 4.3. consists of a review of data available on Inuit tents across the arctic, obtained from early-contact ethnographic accounts and interviews with Inuit elders. These data will be used to define a traditional *taskscape,* which will be contrasted to data obtained from Tent Ring 1 and 4 from Huntingdon Island 5. Section 4.4. establishes methodological precedents for the application of integrated soil analyses.

4.3. Ethnographic Review

The Inuit are a large ethnic group spread out over an area comprising several thousand kilometers between the east coast of Siberia, Greenland and Labrador. These largely circumpolar groups are traditional coastal hunter-gatherers, practicing a marine mammal-based subsistence. The uniformity of domestic space over this vast expanse is well known ethnographically, as regional groups have developed variations over a similar array of dwelling forms and material culture (Lee and Reinhardt 2003: 168). The cohesiveness exhibited over this vast territory is likely connected to its rapid colonization by early Thule and the relatively recent date of the migration (Lee and Reinhardt 2003: 168).

Traditional lifeways are subsumed under the *taskscape* associated with the summer tent within the traditional Inuit cultural realm, stretching mostly over arctic regions. Elements of this *taskscape* have been gleaned from an extensive ethnographic review of early-contact period ethnography, as well as interviews with Inuit informants, elders and traditional hunters that offer a balanced etic and emic perspective on domestic practices connected to the summer camp. The environmental differences between the main areas of reference and the study site will be used as an advantage rather than a weakness. By focusing on the differences between a traditional *taskscape* and elements identified at

Tent Ring 1 and Tent Ring 4, in Sandwich Bay, the research is apt to identify those cultural differences stemming from the colonization of new environments and the impact this event had on the traditional lifeways of the Inuit.

The *taskscape* of a dwelling becomes constituted in the daily succession of domestic practices that transform or maintain the space, such as piling twigs on top of a sleeping platform or tending a fire. These practices ensure the dwelling is appropriate according to its inhabitants needs and culturally informed notions of comfort, safety, and ultimately, a good life. The traditional *taskscape* of an Inuit dwelling, then, is constituted by a range of activities and resources that are used to create and maintain it.

When Inuit traveled to new landscapes where those traditional resources are no longer available, they continue to reproduce the *taskscape* inside their dwellings by employing a range of new resources. The transformation of lived space in new environmental settings, where novel resources and other cultural influences are present, takes place through negotiation from the standpoint of a traditional *taskscape*. Therefore, the investigation of differences emerging from the colonization of southern Labrador will be carried out by comparison to a traditional *taskscape,* compiled from ethnographic data collected at summer dwellings from across the arctic.

This approach is determined by the remarkable similarities observed in Inuit dwellings, despite seasonal variations and regional differences (Collignon 2006: 92). Whether they were sod houses, iglus, tents or cabins, Inuit dwellings traditionally exhibited a similar array of features and spatial organization. The inside contained a sleeping platform, a stand with a cooking lamp and collecting pot for blubber, usually placed in the front left of the house, or on either side of the door when more stands were present, and a drying rack or alternately a means to hang articles from the ceiling over the fire for drying. The sleeping platform, raised with stones and turf, was generally placed in the rear, and side benches could be added to accommodate more inhabitants (Bennet and Rowley 2004: 245; Lee and

Reinhardt 2003: 28). The location of these elements has occasionally shifted with changes in house form. These shifts are thought to encode changes in social relations at the level of the household. Inside the precontact house for example, the shift of the hearth, a focal point for women, to a more central location is seen as an indication of a change in gender relations (Whitridge 2008: 301 – 302).

The remainder of this section describes tent forms associated with different Inuit groups across the arctic. The last paragraphs cover the host of mainly plant-based resources that were traditionally used to furnish summer dwellings and some of the plant species consumed by Inuit during the warm season in the arctic. This data informed sampling procedures and was used to formulate working hypotheses during the interpretation of Tent Ring 1 and Tent Ring 4.

Across the arctic, tents consisted of a wooden frame covered with skins. Several forms are present, generally referred to as *tupiq* or *tupek,* likely spelling variations of the same word. A teepee-style form is also known from central arctic groups and is thought to be an Amerindian influence (Lee and Reinhardt 2003: 59). The greatest differences between these forms are the architectural elements employed in the frame. These elements are the arch, the bipod, the tripod and the ridge-pole. Further variations are obtained based on the number of these elements employed to create a structure.

The teepee-style tent had poles fanning out from the centre, creating a circular conical tent, with an opening at the top which allowed the hearth to be placed centrally on the tent floor. It required more wood, so it was more common in the inland regions on mainland Nunavut. The teepee-style tent is made of caribou skins with the fur on the inside. The central peak is left open for smoke to escape when the fire is burning inside (Bennett and Rowley 2004: 243; Lee and Reinhardt 2003: 59).

Greenlandic tents possess arches made of two poles lashed together by a crossbar. A common single arch form was the *tupeq*. It consisted of a front arch made of two poles lashed together by a curved crossbar, which made-up the entrance. Poles were lashed with thong to the arch and fanned out towards the back, making the back slope down gradually. A raised sleeping platform was placed at the back. The entryway was covered by a windbreak. Stones, turf and wood were used to raise the sleeping platform and to steady the tent poles (Lee and Reinhardt 2003: 22).

In west Greenland, a form known as *tupinaq* had an added fore-chamber, which was obtained by weighing down the skins a bit of a distance from the arch in the front. A curtain separated the forechamber from the sleeping area in the back. The curtain was made of strips of seal skin alternated with seal intestine, to allow the light in. Two lamp stands were present on each side of the arch. An upright stone slab could be used as a threshold. The tent had a double skin cover, consisting of an outer layer of hairless seal skin rubbed in blubber to make it waterproof and an inner layer, consisting of a seal skin with the fur inward that provided insulation (Lee and Reinhardt 2003: 23 – 24).

A double arched form was also known, the *erqulik*, with an arch at the rear that raised the height of the structure. Sleeping platforms were placed along the sides and the back, and lamp stands were placed at the front. A wall of turf or stones was sometimes constructed around the structure (Lee and Reinhardt 2003: 26).

In the Central Arctic, the arch is replaced by the bipod or tripod and tents are ridged (Lee and Reinhardt 2003: 55). In Cumberland Sound, Boas describes a summer tent, a *tupiq*, made up of two bipods at the front and back, connected by a ridge pole. Poles were fastened from the back bipod in a half cone arrangement. Sleeping platforms were placed against the back and side walls but not raised from the ground. They were separated from the floor of the tent by a pole. The cover consisted of alternating strips of seal skin and intestine, or seal skin membrane, which allowed light inside. Coming from each side, the ends of the cover overlap over the entrance. The tent cover is held down by stones (Boas 1974: 551 – 552). Boas also documented the use of smaller, conical tents in the spring and noted that some families preferred to continue using their tents in winter. Winter tents were better insulated and snow walls were built around them (Boas 1974: 553).

In Iglulik, builders were often faced with the lack of wood. The tent frame consisted of a bipod at the front and a single upright pole at the back, held in place by rocks, and connected by a ridge-pole or thong. The general housekeeping area was at the front, with the cooking place and a storage area, but sometimes the women cooked outside in the open or in cooking tents. The sleeping platform was placed at the back of the tent and was not raised from the ground. Caribou or seal skins were used for the cover, with haired skins covering the back and unhaired skins the front. The cover was fastened by rocks and when removed a tell-tale rock ring was left in place (Lee and Reinhardt 2003: 59; Mathiassen 1976: 131 – 135).

On mainland Nunavut, Inuit groups used ridge-pole tents with half-cone arrangements, similar to those described in Cumberland Sound. Generally, a tent was used by a single family, but families would often join the entrances of the tents (Bennett and Rowley 2004: 242). Sometimes, the tents were used throughout the winter. An additional tent cover was added to provide better insulation (Bennett and Rowley 2004: 242 – 243).

The Netsilik used pole and thong ridged tents in the early historical period. These tent forms appear in historical photographs but are thought to be late introductions (Lee and Reinhardt 2003: 58). During his stay with the Netsilik Inuit at Nunariarssuaq, Rasmussen described conical tents, covered either with seal or caribou skins, but the structures are not described in detail (Rasmussen 1931: 50). These conical tents are potentially the short-pole conical tents that were traditionally employed by the Netsilik, made up of a central pole, from which poles or thongs are extended and fastened at the base by hold-down rocks. The covers came up over the poles so that the frame was not visible to an observer (Lee and Reinhardt 2003: 60).

The Inuinnait, also known as the Copper Inuit, used both ridge-pole and teepee-style tents (Lee and Reinhardt 2003: 58). According to Jenness, ridge-pole tents were predominantly heavy spring tents and belonged to wealthy individuals, both because of their size and the amount of caribou skins required to make them. The back end had many poles lashed together and appeared semi-circular. The front had two poles crossed together, producing a triangular opening. Along its length, poles were fixed against the ridge-pole. The poles leaning against the ridge-pole were not lashed. The skins were pulled over the frame so that they close up at the front across the entrance. They were laced together along the ridge-pole and fastened down with large hold-down rocks around the edges. If it was still cold and snowy, a low wall of snow was built around the tent and snow was packed between the skins and the wall. Sometimes a passageway was built leading up to the entrance. Inside this tent form, the sleeping platform was located in the back and the lamp and cooking pot stand were set-up on snow blocks on the front. When erected on snow, the interior of the tent would be identical to the winter house. If the tent was erected on bare ground and the sleeping platforms could not be raised, the platform covers were arranged in the same way but on the floor. The lamp would also be set up on the ground, with the cooking pot arranged on top of it, over two stones. Often in spring and summer, two tents were joined by building a common entrance (Jenness 1922: 78).

A more basic version of the ridge-pole tent was built in summer. It was smaller, consisted of fewer structural elements and was covered with lighter skins. The covers would often be made of sealskin from which the hair had been removed. Cooking took place outside or at the doorway of the tent. Before the return of autumn, the Inuinnait would revert to the spring tent form (Jenness 1922: 79 - 81).

Less common varieties are known in Nunavik. The Inuit here used a long-pole conical tent of considerable size. The frame consisted of a bipod with loose poles fastened in the crotch that fanned out. This tent form was also used by the Inuinnait (Lee and Reinhardt 2003: 59 – 60). The Sallirmiut on Southampton Island had the most distinctive tent form in the Central Arctic. It was cubic in shape and the frames were constructed out of whale bone (Lee and Reinhardt 2003: 61).

In Labrador, the Inuit used the ridge-pole and the conical variety (Lee and Reinhardt 2003: 55). The tent consisted of a rear bipod or tripod, connected to a front bipod or single pole by a ridge-pole. Additional poles were added to the rear in a cone-like arrangement, which produced an absidal floor plan. A variety of skins could be used to make up the cover, including caribou and seal. Inside, the back section was reserved for the sleeping platform, which was symbolically separated from the floor by a pole or stick. Sometimes the platform was raised with turf. The front of the tent was where activities were carried out. Additional sleeping places were created for guests or relatives along the side walls, if necessary. Heating was done with an oil lamp (Lee and Reinhardt 2003: 55 – 56).

Turner described ridge-pole tents in use at Fort Chimo during his stay there (1894). A tent was made of as many as 10 to 15 skins, and about 11 wood poles were needed for support. The height of the tent was determined by the length of a skin. The interior of the tent was roomy, with a sleeping area at the back, separated by a stick on the ground. The central place was reserved for cooking and heating. Turner noted that only wealthy individuals who possessed an umiak could own such a tent, given the resources required to make it and transportation requirements. This is one of the few ethnographies available for Labrador, but it was written long after contact as Fort Chimo has been instated in 1831 (Turner 1894).

The squat conical tent is also known from Labrador. This tent variety appears in historical photographs. At Okak, in 1896, an extended family was photographed in front of a large conical tent (Figure 5).

Multiple observes have noted that structural variations were obtained by joining tents. Tents were joined by building shared walls, predominantly front walls. These joined structures would leave behind rock-ring arrangements that could be mistaken for overlapping structures used at different times.

Although their general arrangement and interior elements are similar to winter houses, summer

Figure 5. Inuit family posing in front of a conical tent at Okak, Labrador, 1896. Hettasch Collection, Centre for Newfoundland Studies, Memorial University.

tent sites are distinctive due to the greater employment of a variety of plant species. Plants had a wider use in summer than in winter. Large bundles of woody plants were used as insulation on sleeping platforms and as fuel for cooking fires. Various plant species also represented major sources of food (Bennet and Rowley 2004; Jones 2010).

Among Inuinnait and Netsilik groups, arctic bell-heather (*Cassiope tetragona*) was used as fuel in the summer and as platform covering in winter, but it was not available everywhere. When heather was not available, mountain avens (*Dryas integrifolia)* was used. This species is not an effective fuel and was only used when no other plant species could be obtained (Jenness 1922: 98, 108 – 109; Rasmussen 1976: 66 – 67). Heather was also preferred at Iglulik, but when unavailable, local Inuit used willow (*Salix arctica*) and bilberry (*Vaccinium*) twigs. Cotton-grass (*Eriophorum*) and various mosses were used to make wicks for oil lamps during the winter months. In the warmer months, when the snow melted, Inuit used heather, willow or white dryas (*Dryas octopetala*) as fuel to make fires (Mathiassen 1976: 12).

In Nunavut, Inuit preferred heather as fuel and as insulation on sleeping platforms. Some groups would exchange caribou skins to obtain it (Bennett and Rowley 2004: 81). Plants were also used as tinder and wicks, which were stored inside specially designed containers made of seal kidneys or the skin from the feet of duck, goose or seagull, which were stiffened so that the wicks would not break. Wicks were made out of cotton-grass, moss or heather dipped in seal oil. These plants were also burned to keep mosquitoes off in the summer (Bennett and Rowley 2004: 82). Heather, sphagnum moss and lichen were used as fuel for fires (Bennett and Rowley 2004: 83).

The principal vegetable food noted by Mathiassen at Iglulik was *qisaruaq*, made of the contents of caribou stomachs. Bilberries (*Vaccinium uliginosum*) and crowberries (*Empetrum nigrum*) were sometimes consumed in a mix with fat or blubber. The roots of *Pedicularis* were eaten raw or boiled. The roots of cushion pink (*Silene acaulis*), branching cinquefoil (*Potentilla pulchella*) and creeping willow (*Salix repens*), and the branches of mountain sorrel (*Oxyria digyna*) were occasionally eaten mostly by women and children *(*Graburn 2006: 142; Mathiassen 1976: 207). Among the Inuinnait, Jenness observed the consumption of mountain sorrel (*Oxyeria digyna*), alpine bearberry (*Arctostaphylos alpina*) and crowberry, but noted that cloudberries (*Rubus chamaemorus*) were avoided. On Victoria Island, *Polygonum* roots were consumed during times of food scarcity (Jenness 1922: 97).

In Nunavut, alpine bearberries, cloudberry, crowberry, bilberries and mountain cranberries (*Vaccinium vitis-idaea*) were eaten fresh but also stored. Berries for storage were left to freeze outside in the snow. Fresh berries were added to mixtures of fat, oil and blood either with meat or by themselves. Roots were sometimes cooked with fat or fried over the fire (Bennett and Rowley 2004: 78 - 81).

4.4. Methodological Considerations and Research Precedents

This study takes place at the boundary of archaeological and environmental soil science, and is grounded in the basic principles of these sciences. The employment of soil analysis in archaeology has led to the recognition of anthrosols, settlement-affected soils or soils that have significant chemical and physical modifications as a result of human activity (Holliday 2004: 26). These soils are commonly associated with substantial occupations and agricultural systems. In Europe, Dark Earths are soils developed in stratified urban contexts, between ancient horizons dated to the 3rd and 5th centuries, and medieval horizons, dated to the 11th century and onwards (Devos et al. 2009: 270 – 272). A similar range of anthrosols present in South America are the Amazonian Dark Earths, including *terra preta* and *terra mulata*, which were created by steady additions of charcoal, bone, plant residues and manure as fertilizers to crop fields. These soils are estimated to span over several thousands square kilometers (Certini and Scalenghe 2011: 1271; Fraser et al. 2011). More recently, *terra preta*-type soils have also been identified in Borneo and Australia (Downie et al. 2011; Sheil et al. 2012). A complementary transdisciplinary concept, the *cultural soilscape*, recognizes culture as a significant factor in the process of soil formation itself, without applying a threshold approach (Lehmann and Stahr 2007; Wells 2006: 125-126). This leads to soil science perspectives which recognize that all human groups, regardless of their size and subsistence type, have the capacity to modify soils and transform landscapes.

Humans habitually impact aspects of soil such as structure, soil reactivity (pH), soil aeration, permeability and water-holding capacity, nutrient cycling, soil organism activity and soil temperature regimes through physical modifications or the addition of anthropogenic materials and other contaminants. Changes effected on the soil by human activity can be defined as either chemical or physical (Wells 2006: 126). Physical impacts can be the result of construction, agriculture or the harvesting of various resources, whereas compaction is commonly associated with living floors (Macphail 2008: 2070). Chemical modifications consist of either an enrichment or depletion of soil chemical elements caused by human activity (Oonk et al. 2009a: 36), with enrichment being known as eutrophication (Holliday 2004: 290 – 298; Butler 2008: 17). The complexity of soils require that human impacts be investigated from multiple perspectives, as physical and chemical properties are highly interrelated, and further determine conditions for plant growth (Gobat et al. 2004; Holliday 2004: 3). Human activities lead to changes in the morphology, chemistry and ecology of soils which determine the distinct *environmental context* of the site. In order to capture these aspects, this study applies a methodological apparatus consisting of thin section micromorphology, soil chemistry and paleoethnobotany, preceded by extensive on-site investigations of soils and vegetation conditions. These methods reveal aspects of the *taskscape* of the tent rings, while also offering a complete understanding of how human occupations in the past have transformed the modern landscape.

This study also draws on environmental archaeology. According to Driver (2001), environmental archaeology is not defined by a high theoretical stance but by the challenges encountered during analysis and the methodological solutions proposed. Interest in the human impact on natural phenomena and the responses to methodological challenges generated by their study is what unifies the field (Driver 2001: 49 -51). Methodological challenges, primarily posed by the multiple instances of reuse, and the artifactual and structural paucity exhibited by Inuit tent sites are addressed through the use of comparative samples from a variety of contexts associated with Huntingdon Island 5.

On-site investigations are a preliminary requirement for any geoarchaeological analysis. These investigations consist of macroscopic observations of sediments and soil horizons that will direct sample collection and ultimately support the findings (Borisov et al. 2012; Demkin et al. 2010; Goldberg and Macphail 2006; Rapp and Hill 2006). Owing to the environmental focus of the analysis, these investigations have been broadened to include aspects of the ecological dimension of soils, including organic horizon classification, the identification of vegetation zones and the link between variations in soil and vegetation conditions (Deal and Butt 2002: 19; Green et al. 1993).

Micromorphology is the microscopic study of soil fabrics and components in soil thin sections using a petrographic microscope (Bullock et al. 1985; Stoops 2003; Stoops et al. 2010). Micromorphology has been used to investigate a wide range of problems at archaeological sites, including site formation, the impact of geo- and pedogenic processes, the nature and extent of human activity, and elements of micro-stratigraphy (Angelucci 2003; Goldberg and Berna 2010; Lewis 2007; Walkington 2010; Zerboni 2011), as well as to approach broader aspects of prehistoric land use, such as prehistoric cultivated fields (Currie 1994; Davidson 2002). Micromorphological analyses have been particularly successful in the investigation of built, as well as informal living floors (Karkanas and Efstratiou 2009; Macphail 2008: 2070) due to their capability to identify allochtonous elements and other microscopic evidence of human activity (Stoops et al. 2010: 25). The utmost advantage of micromorphological analysis, however, is its versatility. In this analysis, micromorphology will be used to study the soils associated with the site, to identify and describe them, as well as to contribute to the other components of the analysis. The elucidation of taphonomic processes and sources of bias that affect the comparability of tent ring floors will increase the reliability of the results.

Chemical analysis will target the macro- and micronutrient or plant-available form of eight soil chemicals, which are nitrate nitrogen, phosphorus, potassium, aluminum, iron, calcium, magnesium and manganese. These constitute some of the main soil chemical elements impacted by human domestic activity. In their available form, they have a direct impact on vegetation communities at the site (Derry et al. 1999; Holliday 2004: 298-300; Oonk et al. 2009a). They are also subject, by varying degrees, to leaching, reduction, oxidation and plant uptake (Holliday 2004: 298; Oonk et al. 2009b) which are investigated at the micromorphological level and through vegetational cover analysis.

In the arctic, a similar study at the Dorset/Thule site of Arnaqquaksaat, on Igloolik Island, used plant cover density estimates to delimit areas of anthropogenic chemical enrichment associated with domestic activities (Derry et al. 1999). Derry et al. (1999) demonstrated that increases in soil nutrients, related to domestic activities stimulated both soil development and vegetation growth. However, this study was conducted in the polar desert region, where surrounding soil was poorly developed and vegetation cover was absent. The location of the study site in a subarctic heath tundra environment, with considerably more vegetation cover, required a refinement of this approach through the study of plant communities and the ecological status of individual plant species (Klinka et al. 1995), while paleoethnobotanical analysis furnished a quantitative expression of vegetational cover productivity.

Another aspect investigated by the analysis is the significance of various combinations of elemental concentrations, which bear directly on the *taskscape* of the dwellings. Whereas some elements, like phosphorus, have a broad significance because the majority of human domestic activities lead to phosphorus enrichment, others are indicative of a more restricted range, such as the use of fire, bone processing, or deposition of animal or vegetal waste. Some elements, like nitrogen, which have a rapid rate of dissolution, also impart a relative chronological dimension to the analysis (Dore and Varela 2010; Holliday 2004: 300 – 303; Wilson et al. 2005; Wilson et al. 2008).

Paleoethnobotanical analysis was employed to study both the impact of humans on the landscape as well as to determine aspects of plant use. Based on the ethnographic review, increased plant use is considered to be representative of the *taskscape* of Inuit summer dwellings; therefore, this aspect of the analysis addresses the seasonal differences between Inuit dwellings and targets those aspects that are unique to the summer season. This analysis also contains a significant ecological dimension, imparted by the focus on post-occupational regrowth.

The ecological dimension of this analysis was developed in a preliminary study on soil samples collected form the sod houses excavated on Huntingdon Island 5 (Dobrota 2014) and is based on patterns of post-occupational regrowth. As this study was conducted on samples from the same site, it has a heightened relevance to the analysis. At the surface of sod houses, regrowth communities are composed of species that differ from both the pre-occupational vegetation cover and those commonly used by Inuit for consumption or domestic purposes. On-site vegetational survey and a careful study of the patterning of charred and uncharred seeds allowed the study to distinguish between these groups of species, even where the soil cover was so shallow that the archaeological specimens were intermixed within the active layer of plant growth. In fact, it is the shallowness of the soil layer that required that investigations of plant use first address the post-occupational effect on local vegetation.

This approach is grounded in edaphic principles. Edaphology is a subdivision of soil science that studies the relationship between soils and vegetation (Gobat et al. 2004: 235) and is particularly suited for arctic and subarctic regions where the vegetation cover is the overarching factor that influences soil development. In these regions, the contribution of the vegetation layer to pedogenesis is amplified because the climate prohibits the chemical weathering of the mineral substrate. In these regions, vegetation communities and soils develop concomitantly and find themselves in a relationship of equilibrium (Duchaufour 1982: 108). According to Duchaufour:

"Vegetation contributes a specific kind of organic matter to the mineral material, which profoundly influences pedogenesis by its effects on weathering, the formation of organomineral complexes and the biogeochemical cycling of elements. Thus humus occurs as the connecting link between the living and the mineral worlds, where it integrates all environmental factors, controls the direction of pedogenic development and gives the soil its major properties" (Duchaufour 1982: 119)

On this type of landscape, the impact of human chemical inputs on the soil and vegetation relationship are more evident. Additions of organic matter such as animal and vegetal debris, associated with domestic activities and midden formation, determine characteristic chemical and physical changes in humus, which will be discordant with surrounding soil conditions and will cause differential plant growth. Unless the local vegetation succeeds to recolonize it, the area can reach a relatively stable state, known as *paraclimax* (Duchaufour 1982: 140). This effect has informally guided surveys on the coast of Labrador for decades, and has contributed to the differential emphasis on sod house locations until now. Remarks on differential regrowth appear in many survey notes (Fitzhugh 1972; Kaplan 1983; Stopp 1997), but no attempt has yet been made to systematically study these variations.

A very important characteristic of this analysis is the close integration of data coming from these disparate lines of research, to create a supportive framework of interpretation, in which anthropogenic modifications of soil and vegetation, and the full range of their effects, will become more apparent. Integration has been achieved following guidelines established by Kooistra and Kooistra (2003). Analyses benefit from a joint sample collection scheme, which allows close integration of results, and leads to a surplus of knowledge not otherwise obtainable (Kooistra and Kooistra 2003: 616).

In a similar integrative approach at the site of Songo Mnara, in Tanzania, Sulas and Madella (2012) successfully correlated microscopic variations in chemistry and phytolith composition to macroscopically distinct sediments. These sediments were successfully identified as anthropogenic soils coming from prehistoric gardens and orchard plots (Sulas and Madella 2012: 157). The study concludes that an integrative approach successfully widened the range of information available and refined understanding of the site (Sulas and Madella 2012: 157).

A last point concerns the use of an extensive control dataset. This dataset is composed of multiple background samples as well as samples coming from inside House 2 and House 4, from the winter component of the site, which allowed the study to identify those aspects that define the tent rings and establish a comparative link with the winter settlement. Only through an in-depth understanding of the differential ecological and taphonomic regimes of summer and winter settlements will archaeology be able to integrate multiple types of settlements into a single framework that can serve as the basis for a cross-seasonal understanding of Inuit culture.

4.5. Summary and Conclusions

This chapter has introduced integrated soil analysis as a method to study the *taskscape* of human occupations poor in structural and artifactual remains and to understand their effects on the modern landscape. This study will integrate micromorphology, soil chemistry and paleoethnobotany to study three interrelated aspects of soils, their physical, chemical and ecological characteristics, and how they have been impacted by human activity. The study will reveal information about the activities that took place at the site and their patterning on the tent floor with an emphasis on plant use. Based on an ethnographic review, an emphasis on plant resources has been identified as the major difference between summer and winter occupations, which otherwise tend to be similarly structured. The study will also provide a framework within which the effects of these activities on the modern landscape will be identified. These effects have been subsumed under the concept of *environmental context*, which defines the range of physical, chemical and ecological characteristics that have been altered at sites occupied by humans.

Chapter 5. Sampling Procedures

5.1. Study Site

Huntingdon Island 5 (FkBg-3) is located on Indian Harbour, a small promontory off the western coast of Huntingdon Island, in a protected inner area of Sandwich Bay that faces the mainland. A sandbar connects Indian Harbour to Huntingdon Island at low tide, making it accessible on foot.

Indian Harbour is covered by a wetland that stretches out from east to west, occupying the centre and southern portion of the island. On the south shore, the wetland is bounded by two steep hills which drop abruptly to the water, allowing only a narrow strip of sandy beach to develop. On the north shore, the wetland is bound by a flat, low-lying terrace with a narrow strip of sandy beach and boulders. A string of fresh water ponds extends from the western hill eastward, along the edge of the wetland. All the sod houses recorded at Indian Harbour are clustered at the western extremity of the terrace, sheltered into the foot of the hill and lining the shore of a pond. On the other side of the hill, fast currents allow a polynya to remain open in winter. The summer component, consisting of circular arrangements of boulders forming tent ring features, extends out onto the terrace. Most features cluster at the eastern extremity of the winter component, with Tent Ring 1 and Tent Ring 2 located farthest east (Figure 6).

The site was located by Stopp and Reynolds in 1992 and briefly tested by Ramsden and Rankin in 2006 (Rankin 2012). House 1, House 2, House 3, and House 4 were excavated between 2009 and 2011 (Murphy 2011; 2012; Rankin 2009; 2010; 2011). In 2010, Tent Ring 2 was test pitted. Items recovered include eight fragments of leather, two pieces of lead shot and nine glass beads, representing a largely undiagnostic 18th to 19th century assemblage of European origin (Rankin 2011; Rankin 2012: 2).

In 2013, Tent Ring 1 and Tent Ring 4 were excavated. The excavation of Tent Ring 1 revealed two rings that shared a connective wall, marked by an opening where the remains of a hearth and

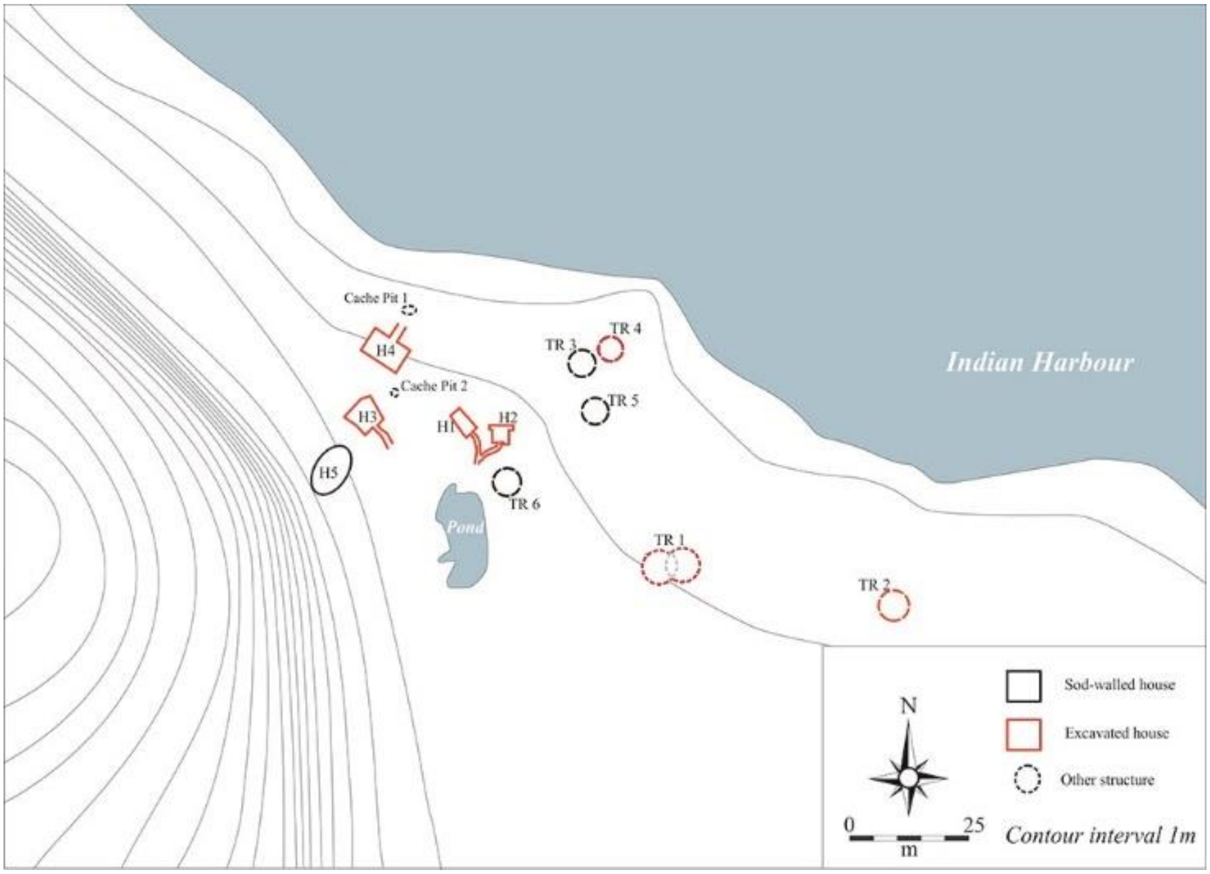

Figure 6. Site Map of Huntingdon Island 5, Indian Harbor (reproduced with the permission of L. Rankin)

cooking cluster were located (Figure 7). A potential bench was located against the north wall, inside the eastern ring. A total of 102 artifacts were recovered, the majority of which come from the western ring. The assemblage includes mostly European items, but some Ameridian tools are also present. No traditional Inuit artifacts were recovered; however, both miscellaneous scrap metal and ceramics are commonly found in Inuit assemblages. Artifacts found include a chert projectile point and chert flakes most likely of Recent Indian provenience, two fragments of fabric, a small number of nails, unidentifiable fragments of leather, a metal button, as well as pieces of glass and ceramic. Ceramics were the most abundant artifact type recovered. The eastern ring was poor in artifacts. It contained one unidentified fragment of metal, one glass fragment, one ceramic fragment that was found

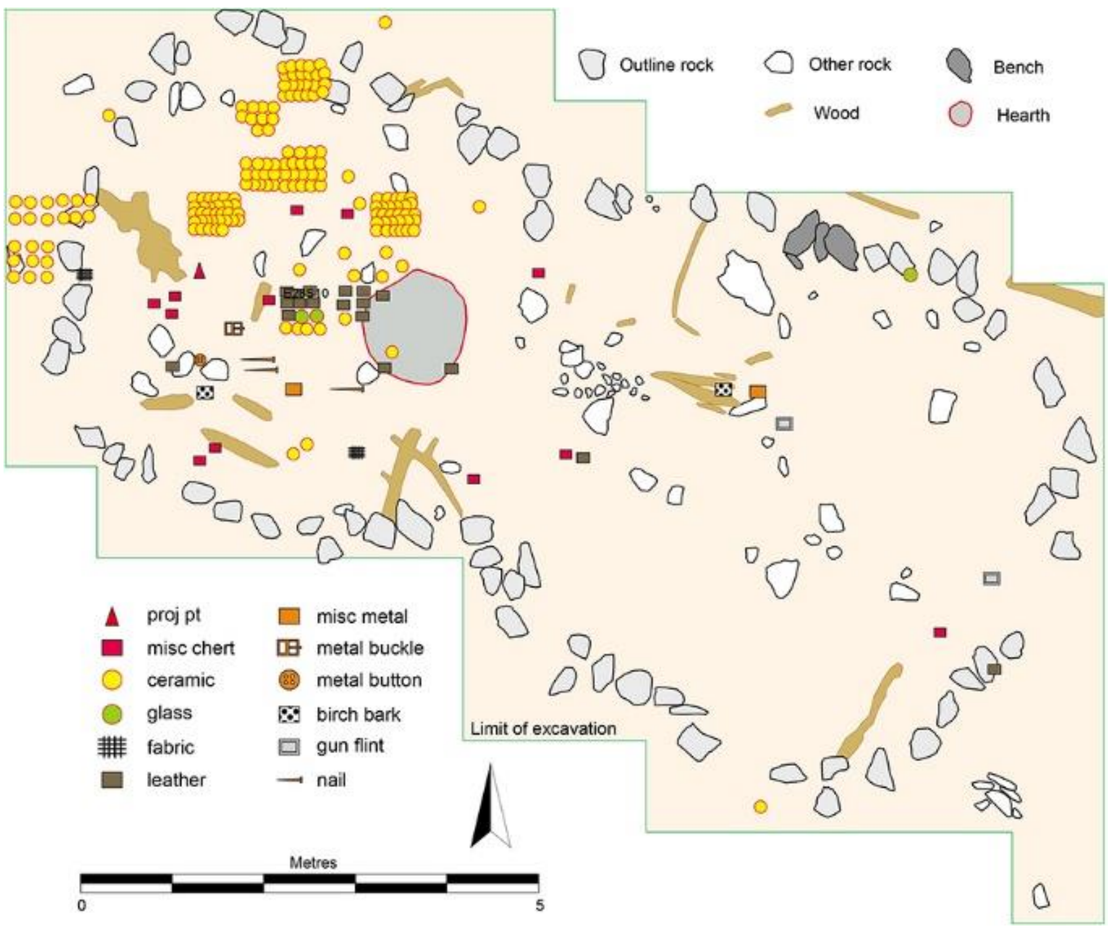

Figure 7. Illustration of Tent Ring 1 depicting structural elements and artifact distribution (reproduced with the permission of L. Rankin)

outside the tent ring at the south eastern extremity, gunflints, chert flakes and two unidentifiable pieces of leather. Two pieces of birch bark were also identified, one in each tent ring.

The excavation of Tent Ring 4 revealed a circular ring of hold-down rocks with a potential bench against the western wall, consisting of a large flat rock (Figure 8). The tent ring yielded 642 artifacts. The assemblage consists both of Inuit and European items. A large quantity of lead shot was recovered both within and outside the perimeter of the enclosure. Two whale bone sled runner fragments, one modified piece of whale bone, two shears and one piece of leather were found in proximity to the bench, inside the tent ring. One iron nail was found against the south wall and another

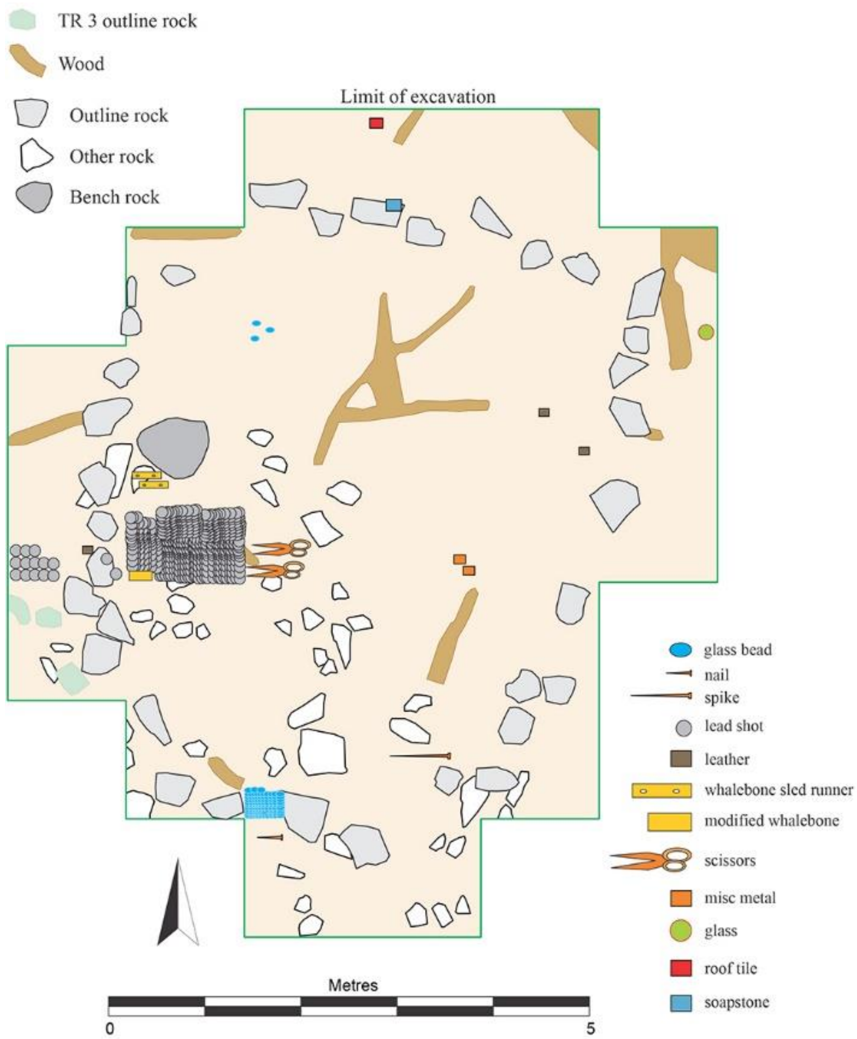

Figure 8. Illustration of Tent Ring 4 depicting structural elements and artifact distribution (reproduced with the permission of L. Rankin).

one outside of the enclosure. Adjacent to this nail, a large quantity of beads were found, potentially forming a cache. The bead cache and nail, however, are located within the perimeter of adjacent Tent Ring 3 and may be associated with it. Miscellaneous metal, two pieces of leather and three beads were found on the tent floor. One piece of roofing tile was found outside the enclosure, along the northern boundary and one piece of soapstone was collected against a hold-down rock, on the northern edge of the enclosure. One piece of glass was found outside the eastern boundary.

Tent Ring 1 consists either of an overlap of structures that were used at different times or a conjoined structure, similar to the Sculpin Island structures identified by Kaplan (1983) in north

Labrador and Brewster (2005) at Snack Cove 1. The presence of European and Recent Indian components inside a typically Inuit structure is comparative to the assemblages identified inside adjacent sod houses; however, in this case, no Inuit elements are present. It may be that Inuit and European elements function in different regimes of consumption, which causes the former to be removed from houses and tent sites more readily prior to abandonment. The presence of relatively large amounts of European artifacts in the structure, similar to the later 18th and 19th century tents, investigated by Kaplan in north Labrador, may also signal changes in the Inuit seasonal regime of consumption determined by the availability of European items with more objects being transported in the summer and lost or discarded when the camp was dismantled.

Tent Ring 4 revealed a typically Inuit oval tent ring, containing Inuit and European artifacts. The presence of beads is suggestive of an occupation date within the formal trade period. However, the southern extremity of the feature overlaps with Tent Ring 3 and may contain an amalgamated assemblage.

In order to advance the understanding of Tent Ring 1 and Tent Ring 4 and provide a new interpretation, soil samples were collected from inside the tent rings. Results will be compared to two datasets consisting of background samples, representative of existing soil and vegetation conditions on the island and feature-specific samples taken from House 2 and House 4 from the winter component of Huntingdon Island 5.

5.2. Field Methods

Field investigations aimed at a comprehensive understanding of the environmental setting of the island, focused on soil and vegetation conditions. An in depth survey of soils and vegetation patterning on the island was carried out and environmentally representative samples, linked to vegetation zones, were collected. Sampling targeted natural variations in soil characteristics. Investigations and collection procedures are detailed in Appendix A and B. The findings of the geomorphological investigations were cross-referenced with the results of a geological field assessment carried out in nearby Porcupine Strand (Smith et al. 2003) and are presented in the following section.

5.2.1. Environmental Setting

Most of Labrador was covered by the Laurentide ice sheet until 10 000 years ago. Deglaciation proceeded unevenly, with open sections of the coast becoming ice free as early as 12 000 years ago, while the ice persisted in bays and inlets. The ice in Sandwich Bay persisted until approximately 8000 years ago. During deglaciation, glacier melt-water was directed through the bay, carrying glacial sediments from the plateau and depositing them onto the ocean floor (Smith et al. 2003).

After deglaciation, isostatic rebound led to the gradual uplift of the continental shelf and the emergence of small islands like Indian Harbour all along the coast. The ongoing process is historically attested, as known navigation routes from two hundred years ago in southern Labrador are too shallow to be navigable by small boats today (Stopp 1997: 121).

Geomorphological investigations suggest that the southern extremity of Indian Harbor, consisting of two steep hills, would have been the first to be uplifted by this process. It is also possible that it was never submerged completely. Primary peat formation (Wieder and Vitt 2006: 10) commenced in the poorly drained depression between the two hills, where a histic horizon sits directly on top of glaciomarine sediments consisting of fine yellow sand. Peat formation was taking place concomitantly with the deposition of glaciofluvial sediment into the bay. A layer of poorly sorted glaciofluvial sediments, consisting of sand, pebbles and cobbles with a gleyed aspect appears at the northern edge of the bog and continues on the terrace. This suggests that the terrace feature emerged later than the bog. On the northwest section of the shore, the layer of gleyed deposits reaches its most discontinuous aspect and is intermixed with more recent additions of well sorted sediment carried by waves, which produced buried horizons. These buried horizons differ only minimally from the overlying soil, suggesting a young age. The northeast section of the shore is protected by large boulders, which prevent further additions of marine sediment, creating a distinct soil context (Figure 9; Appendix B).

Figure 9. South view of Indian Harbor from Huntingdon Island.

Following emergence, soil formation commenced on the terrace. A shallow, organic regosol developed between 10 and 15 cm thick. Soil profiles are characterized by an O_f (- O_m) – C_g – C sequence (Agriculture Canada 1977: 131 – 134; Agriculture Canada 1998: 118). The O_m horizon develops only in sheltered sections of the northeast shore and on the terrace. The northwest section is defined by an O_f – C_g – C sequence, with frequent additions of driftwood (Appendix B).

Regosols are young, typical postglacial soils, characteristic of boreal tundra regions (Buol et al. 2003: 259 – 267; Gobat et al. 2004: 185). They are shallow and weakly developed, with little evidence of horizonation. This is undoubtedly due to the young age of the soil but also due to the harsh coastal climatic conditions, which halt the expression of some pedogenic processes (Buol et al. 2003: 262).

Current climatic conditions on the coast of south Labrador are classified as subarctic. The expansion of arctic and subarctic climates along the coast of Labrador is maintained by the Labrador Current, which carries arctic waters down the coast. Unstable weather conditions, with wind storms, showers and sun succeeding each other rapidly, are caused by the clashes between the Atlantic weather system and continental air masses (Fitzhugh 1972: 14 – 19).

The mean annual temperature in Sandwich Bay is 0 degrees Celsius. August is the warmest month, with a temperature average of 12.7 degrees Celsius, and January is the coldest, with -14. 3 degrees Celsius. This region is part of the area of widely spaced discontinuous permafrost, with over 210 days/ year of freezing conditions (Burn 2012:127). Precipitation per year is 1073.5 mm, 616.8 of which is rainfall and 462 mm snowfall (Environment Canada 2014).

5.2.2. Vegetation Patterns on Indian Harbor

The vegetation survey identified three main vegetation zones, an *Empetrum* heath that makes up the vegetational cover of the terrace, a raised *Sphagnum* wetland, or blanket bog, and a coastal transition area (see also Appendix A). Tent Ring 1 is located within the *Empetrum* heath vegetation zone, associated with the terrace unit. It is characterized by an *Empetrum nigrum* cover, with areas of *Cladonia rangiferina* growing on desiccated vegetal substrates. The vegetational cover over the surface of Tent Ring 4 is at the intersection of the *Empetrum* heath and the coastal transition area, at the shoreward edge of the terrace. The area was further impacted by activities carried out in connection with the archaeological excavations that took place between 2009 and 2011. It consists of *Empetrum* interspersed with *Kalmia precumbens, Potentilla anserina* and *Salix uva-ursi* as well as *Carex,* growing at widely spaced distances in between the shoreline and the contexts of the former sod houses. A path from the main landing area on the beach transects the northeast section of Tent Ring 4 (Appendix A; Table A.1.).

Background samples were collected from three locales, within and along the edge of the *Empetrum* heath, on the constrained section of the shore, and within the coastal transition area (Table 1). The aim was not to obtain samples from a so-called undisturbed location, but rather to understand the make-up of soil samples that have not been recorded as a part of a living floor from similar vegetational zones. These samples, in conjunction with samples from inside the sod houses excavated at Huntingdon Island 5, were used as background samples in the analysis.

Background samples were collected along transects extending from the excavation grids placed over Tent Ring 1 and Tent Ring 4, and from a location north of Tent Ring 2, along the constrained section of the shore. These transects, labeled Transect 1, 2 and 4 according to the nearest feature present, provided samples from three locales, consisting of the inland section of the *Empetrum* heath, the constrained section of the shore of the *Empetrum* heath, and the coastal transition area (Figure 10; Table 1).

Transect 1, oriented southward from Tent Ring 1 towards the wetland, provided samples from the *Empetrum* heath. Three samples each, TERR 1 to 3 and TERR 4 to 6, were collected from the corners of two test pits (Table 1). For the purposes of the analysis, these sets have been averaged together, as they are spatially related. The aim is to provide representative background values from two locales with an area of 0.5 m^2, as opposed to a potentially biased, spatially restricted context, as the *Empetrum* heath is the largest vegetation zone considered. All terrace samples were collected from areas with a similar vegetation cover as Tent Ring 1, consisting of *Empetrum nigrum*, with an occasional cover of *Cladonia rangiferina* developing over sections of desiccated vegetal substrates.

Transect 4 extends northward from Tent Ring 4 and intersects the coastal transition area up to the edge of a narrow beach (Figure 10). This transect spans a vegetation gradient that culminates in the replacement of *Ericaceous* vegetation by coastal grasses, associated with increasingly sandy soils close to the water's edge. At the time of the excavation, one *Carex* species had already migrated far inland on

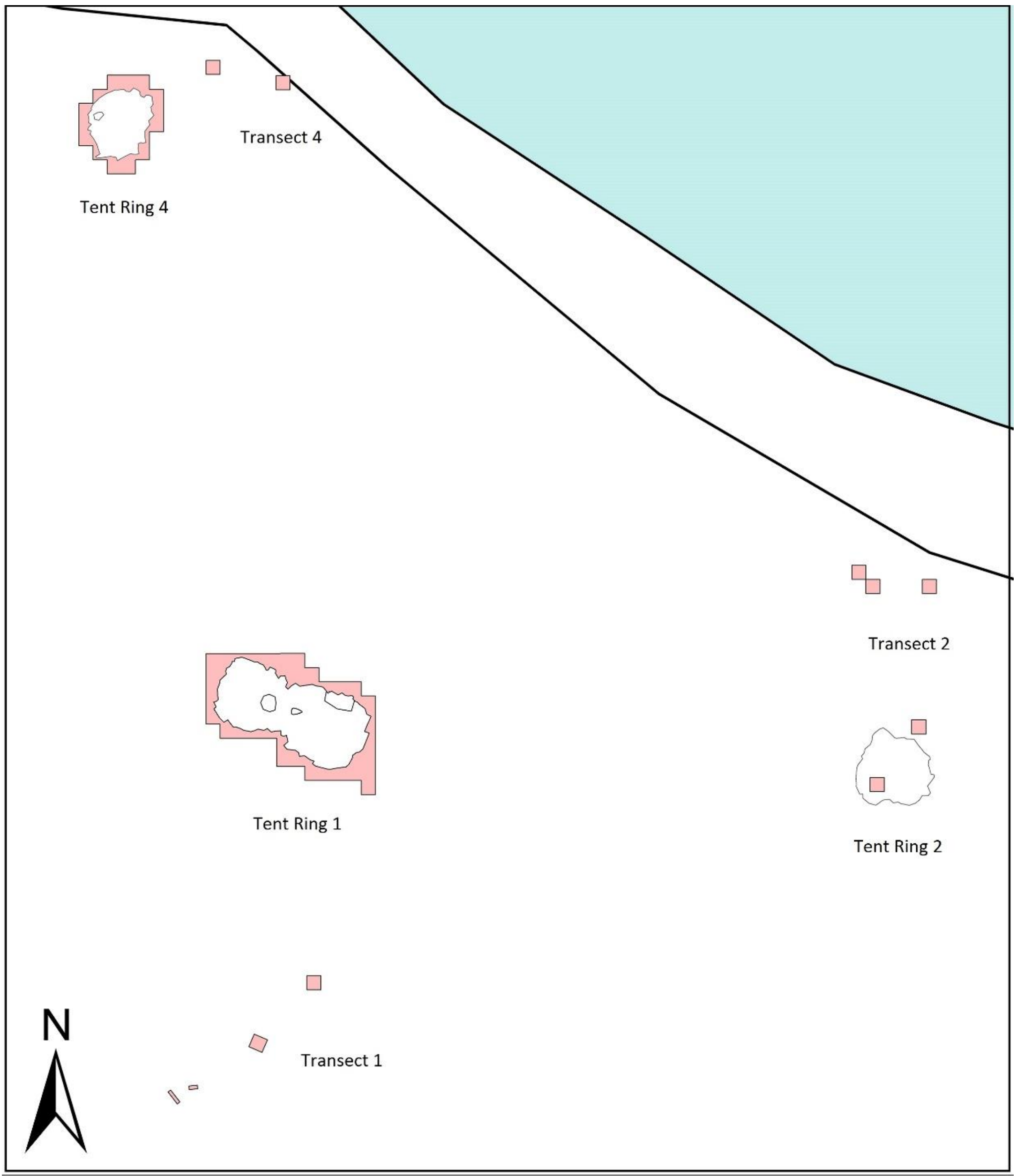

Figure 10. Illustration of the terrace unit with the location of excavation grids as well as the position of collection transects 1, 2 and 4 relative to excavation grids. The test pit depicted inside Tent Ring 2 is adjacent to the location of the test pit excavated in 2010. This test pit was opened for the collecton of micromorphological samples from the 2 years old backfill.

sections of disturbed soil, following the activities connected to the archaeological excavations that were carried out on this section of the terrace in previous years (see Appendix A). A single sample was collected from a test pit excavated in an area of widely spaced *Carexes* and *Salix* over a cover of

Table 1. Background samples collected from vegetation zones identified on the terrace unit at Huntingdon Island 5.

Sample	Provenience	Description	W (g)	V (l)	Flot W (g)	Coarse W (g)	Method	pH
Terr 1	Terrace		576	1.4	12.9	76.7	PBOT	5.2
Terr 2	Terrace		783	1.9	53.5	162.5	PBOT Chem	5.1
Terr 3	Terrace		602	1.5	52.7	114	PBOT chem	N/A
Terr 4	Terrace		645	1.5	43.8	177.3	PBOT chem	5.2
Terr 5	Terrace		774	1.9	39.3	115.5	PBOT	4.9
Terr 6	Terrace		584	1.3	27.9	132.5	PBOT chem	5.1
N35E25	Transitional coast area	+ 100 Mustard	503	1.7	65.2	83.5	PBOT chem	7.2
S0E72	Rocky shore		547	1.5	15.1	136.2	PBOT chem	5.5
S1E76	Rocky Shore	+100 Mustard seeds	527	1.1	5.2	124.6	PBOT chem	6.6
	Modern kitchen		80				Chem	6.6

(W = weight; V = volume; PBOT = paleoethnobotany; chem = soil chemistry).

Empetrum, as the vegetation cover was deemed similar to the shoreward section of Tent Ring 4 (Table 1).

Transect 2 is oriented east to west, along the boulder shore, leading away from Tent Ring 2 (Figure 10). This context is unique because the boulders do not permit the formation of a transitional vegetation area and preclude the influence of waves and driftwood additions. Wood layers in varying stages of decomposition were identified, including a cut plank associated with a recent iron knife blade, which suggest that human activities tend to concentrate on the shore. A total of two background samples were taken from test pits opened on either side of the activity area (Table 1).

The analysis has also considered the impact of modern activities on the chemical properties of soil. A survey of modern activities taking place on the island has determined that modern land use practices are not substantial. Locals often use the southern shore to fish, but most of these activities are carried out from boats. A modern cabin is located on the southwestern tip of the island, effectively isolated by the western hill. Surveys of local land-use practices directed under the umbrella of *Understanding the Past to Built the Future* identified the island as a modern location for berry picking (Memorial University of Newfoundland 2014); however, these activities are not extensive enough to have a significant impact. The only significant modern influence consists of three years of recent archaeological excavations carried out at Huntingdon Island 5. During each year of fieldwork, burning, cooking and cleaning were carried out in the easternmost section of the terrace, while the crew members camped alongside the tent rings. In order to determine the impact of these activities, a sample was collected from behind the kitchen tent during the 2013 field season. This sample, labeled Modern Kitchen, was added to the background dataset used for the soil chemistry section of the analysis (Table 1).

5.2.3. Sampling the Floors of Tent Ring 1 and Tent Ring 4

Excavation was performed in a checkerboard pattern, exposing soil profiles for analysis and micromorphological sample collection, consisting of undisturbed cores. Chemical and paleoethnobotanical samples were obtained from the baulks of excavation units, where not otherwise specified. The floors of Tent Ring 1 and Tent Ring 4 were sampled in order to investigate the paleoethnobotanical and chemical composition of the floors. Additionally, both features were sampled for micromorphological analysis in order to interpret variations in the soil layer and to reveal potential remains of the functional floor associated with the tent rings.

A total of 40 samples from Tent Ring 1 and 15 from Tent Ring 4 were collected for paleoethnobotanical and chemical analysis (Figures 11 and 12; Tables 2 and 3). Sampling targeted features identified during the excavation as well as wide sections of unassigned floor space, interstitial

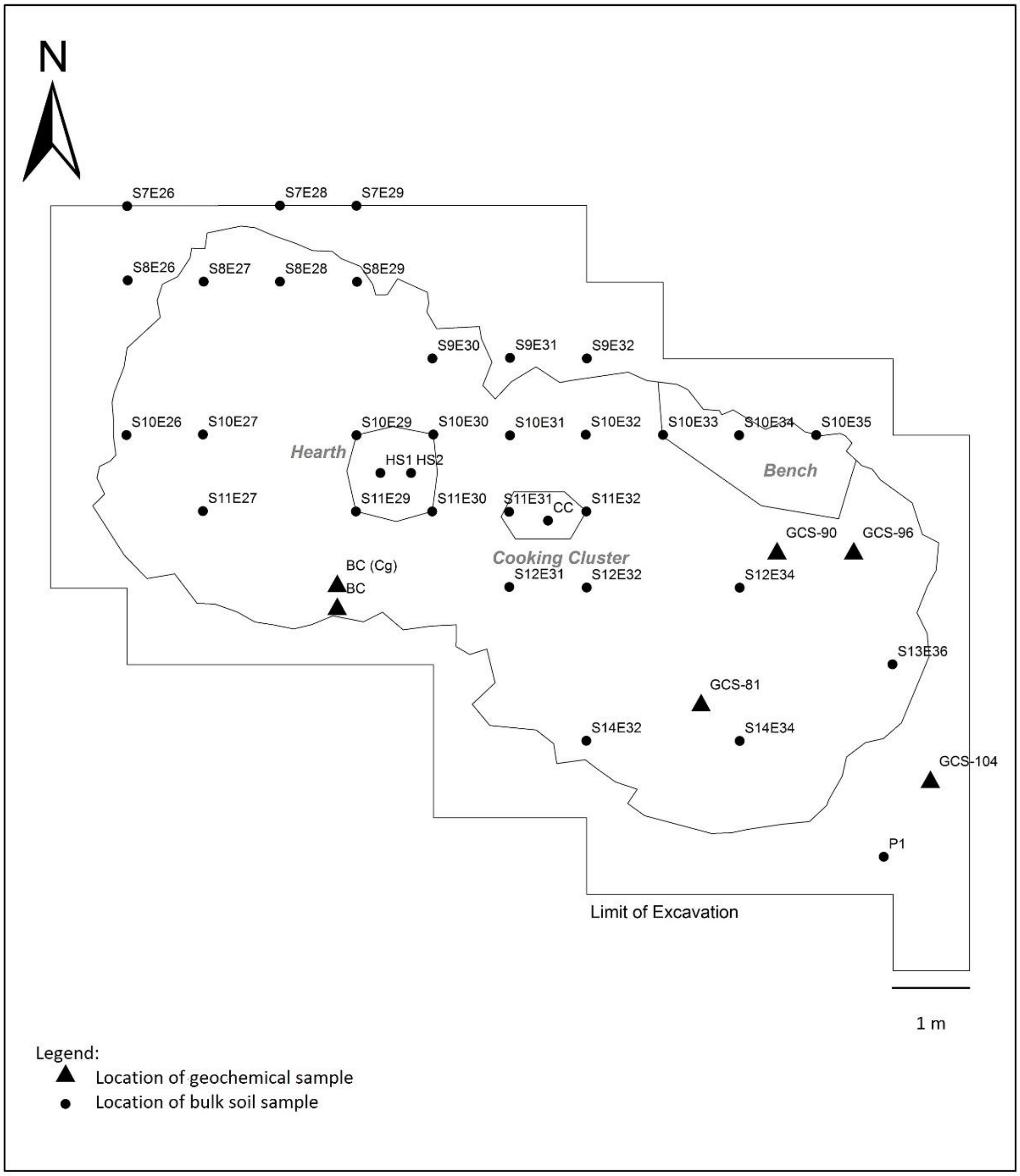

Figure 11. Paleoethnobotanical and chemical samples collected from Tent Ring 1.

spaces, close to what would have been the skin walls, and sections immediately outside the hold-down rocks, where debris may have become deposited during the dismantling of the camp.

The sampling procedure applied on the tent floors is based on the ethnographic review presented in Chapter 4. There are only three known tent structures used by Inuit including the ridge-pole tent, the conical skin tent, and the teepee-style tent, used by inland groups in Nunavut. In Labrador, only the ridge-pole tent and conical skin tent have been described and photographed;

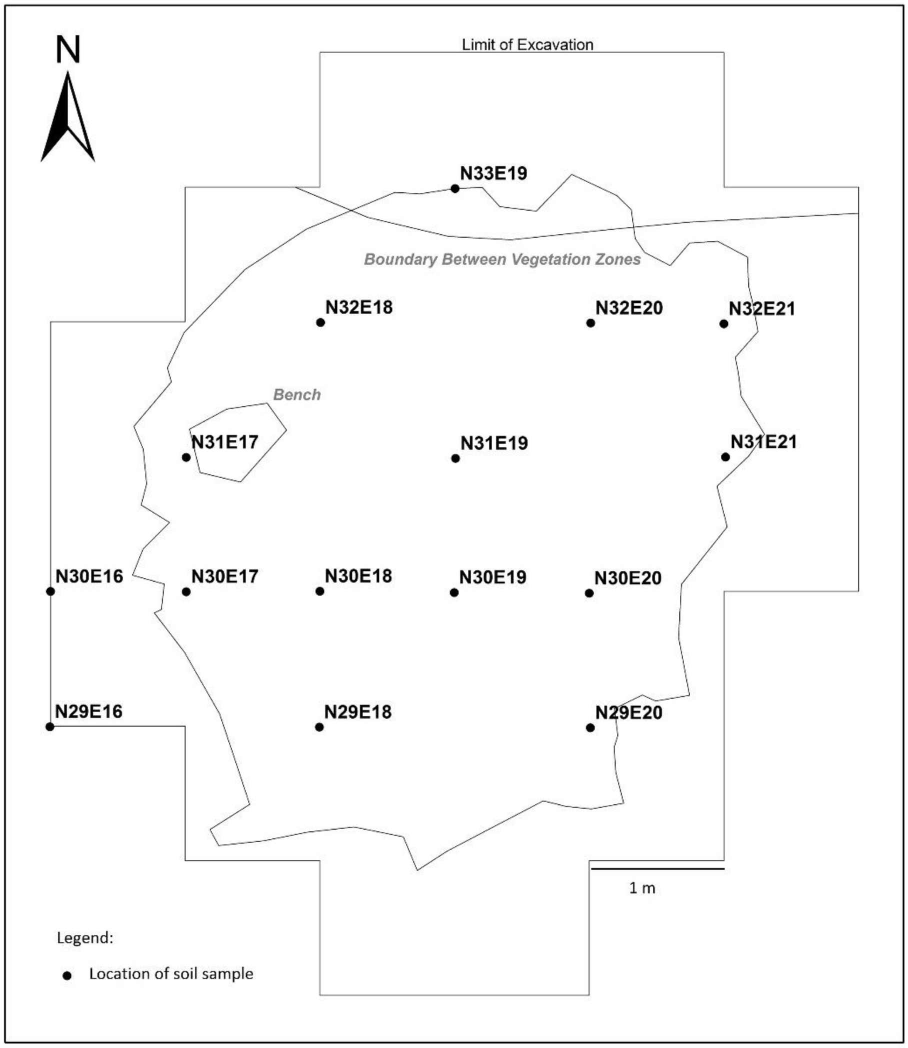

Figure 12. Paleoethnobotanical and chemical samples collected from Tent Ring 4.

although, ethnographic sources are admittedly poor. The use of different tent forms is important because the frame will determine the shape of the hold-down rocks arrangement. The ridge-pole tent has an apsidal floor plan and the conical tent a rounded to subrounded plan.

The interior arrangement of these tent structures is similar to the inside of winter dwellings, with a sleeping platform typically located against the back and side walls and symbolically separated by a row of rocks or a pole placed on the ground. These partitions may have been more than symbolic. Interior hold-down rock arrangements may have been used to hang skin partitions from the ceiling, as was sometimes done inside winter houses (Murphy 2011: 29). The type of structure further influences the location of the hearth. The hearth was placed at the entrance of conical tents and in the front section

Table 2. Soil samples collected from Tent Ring 1 west and east.

Sample	Prov.	Description	W (g)	V (l)	Flot W (g)	Coarse W (g)	Method	Sample pH
S10E27	TR1-West	Floor	595	2.1	74.3	102.5	PBOT/chem	5.2
S8E26	TR1-West	Outside/wall; +100 mustard seeds	586	1.8	45.9	112.7	PBOT/chem	4.8
S8E28	TR1-West	Floor	597	1.5	48.6	128.9	PBOT/chem	5.3
S8E29	TR1-West	Floor	651	1.3	40.5	122.5	PBOT/chem	5.6
S10E29	TR1-West	Hearth	445	1.4	97.8	54.1	PBOT/chem	5.6
H1 (C_g)	TR1-West	Hearth	518	0.7	N/A	373.7	PBOT/chem	5.8
H2 (C_g)	TR1-West	Hearth	313	0.4	N/A	236.6	PBOT/chem	6.0
S11E30	TR1-West	Hearth	595	1.5	4.4	135.9	PBOT/chem	5.5
S7E28	TR1-West	Outside/ wall	538	1.1	16.3	99.6	PBOT/chem	5.5
S11E27	TR1-West	Floor	676	1.7	14.4	185.9	PBOT/chem	5.3
BC	TR1-West	Bone cluster; Floor	80		N/A	N/A	chem	5.5
BC(C_g)	TR1-West	Bone cluster; Floor	80		N/A	N/A	chem	6
S10E26	TR1-West	Floor	611	2	133.5	172.1	PBOT/chem	5.2
S9E30	TR1-West	Floor	605	1.9	14.8	95.9	PBOT/chem	4.9
S8E27	TR1-West	Floor	596	1.4	7.9	68.2	PBOT/chem	4.9
S7E26	TR1-West	Outside/ wall	591	1.4	N/A	71.1	PBOT/chem	5.3
S11E29	TR1-West	Hearth	523	1.6	95.1	62.8	PBOT/chem	5.7
S10E30	TR1-West	Hearth	653	1.9	61.1	93.2	PBOT/chem	5.7
S7E29	TR1-West	Outside/ wall	601	1.6	N/A	104.8	PBOT/chem	5.2
S14E32	TR1-East	Floor	602	1.3	31.6	71.6	PBOT/chem	5.2
S14E34	TR1-East	Floor	913	2	57.5	226.8	PBOT/chem	5.4
S13E36	TR1-East	Floor	1154	2	22.4	532.8	PBOT/chem	5.5
S12E34	TR1-East	Floor	648	1.4	11.6	119.9	PBOT/chem	5.8
S12E32	TR1-East	Floor	587	1.4	61.2	148.5	PBOT/chem	5.1
S12E31	TR1-East	Floor	614	1.7	85.1	72.1	PBOT/chem	5.1
S11E32	TR1-East	Cooking cluster	621	1.2	12.1	146.3	PBOT/chem	5.6
S10E32	TR1-East	Floor	690	1.4	33.8	242.8	PBOT/chem	5.2
S10E33	TR1-East	Workbench	655	1.9	73.9	132.6	PBOT/chem	5.1
S10E34	TR1-East	Workbench	657	1.7	26.8	88.8	PBOT/chem	5.2
S10E35	TR1-East	Workbench	635	1.5	43.3	104.5	PBOT/chem	4.8
P1	TR1-East	Post hole	437	0.5	N/A	337.8	PBOT/chem	6.8
S9E32	TR1-East	Outside/wall	617	1.3	21.1	90.8	PBOT/chem	5.8
S11E31	TR1-East	Cooking cluster	632	1.7	58.7	154.3	PBOT/chem	5.2
S10E31	TR1-East	Floor	621	1.6	36.5	223	PBOT/chem	5.3
S9E31	Indent	Outside/wall	643	1.5	51.9	108.6	PBOT/chem	5.1
CC	TR1-East	Cooking	653	0.6	23	334.2	PBOT/chem	5.7

		Cluster						
GCS 81	TR1-East	Floor	80		N/A	N/A	chem	5.5
GCS 90	TR1-East	Floor	80		N/A	N/A	chem	5.4
GCS 96	TR1-East	Floor	80		N/A	N/A	chem	5.5
GCS 104	TR1-East	Outside/wall	80		N/A	N/A	chem	5.2

(TR1-West = Tent Ring 1-West; TR1-East = Tent Ring 1-East; W = weight; V = volume; PBOT = paleoethnobotany; chem = soil chemistry)

Table 3. Soil samples collected from Tent Ring 4.

Sample	Prov.	Description	W (g)	V (l)	Flot W (g)	Coarse W (g)	Method	pH
N30E18	TR4	Workbench	500	1.2	20.3	96.3	PBOT/chem	6.4
N29E18	TR4	Floor	535	1.2	44.1	134.9	PBOT/chem	6.3
N31E17	TR4	Workbench	519	1.7	39.2	96.8	PBOT/chem	6.3
N29E20	TR4	+100 mustard	522	1.6	98.3	78.9	PBOT/chem	6.6
N32E21	TR4	Floor	510	1.5	31.7	82.4	PBOT/chem	6.4
N31E19	TR4	Floor	516	1.4	16	111.1	PBOT/chem	6.5
N30E16	TR4	Outside/wall	543	1.4	34	122.3	PBOT/chem	6.5
N30E20	TR4	Floor	502	1.6	80.2	100.4	PBOT/chem	6.5
N30E19	TR4	Floor	543	1.5	26	113.5	PBOT/chem	6.4
N30E17	TR4	Workbench	533	1.8	73.7	83.31	PBOT/chem	6.6
N31E21	TR4	Floor	519	1.6	89.6	50.4	PBOT/chem	6.7
N33E19	TR4	Floor	545	1.6	35.4	144.7	PBOT/chem	6.7
N29E16	TR4	Outside/wall +100 mustard	513	1.2	69.6	59.3	PBOT/chem	6.5
N32E20	TR4	Floor	511	1.3	30.1	114.4	PBOT/chem	6.3
N32E18	TR4	Floor	503	1.2	19.7	87.4	PBOT/chem	5.7

(TR4 = Tent Ring 4; W = weight; V = volume; PBOT = paleoethnobotany; chem = soil chemistry)

of ridge-pole tents. Teepee-style tents had an opening at the top, which functioned as a vent, and allowed the hearth to be placed in the middle of the floor. Hearths are thought to have been in use during the mid-summer months, when soapstone lamps were cached along with heavy winter goods to allow increased group mobility (Jenness 1922: 79). When multiple families camped together, various composite forms were obtained by conjoining tent walls or building shared entrances.

Tent Ring 1 appears to be the result of an overlap of multiple structures. It consists of two conjoined rock rings, consisting of boulders underlain by a shallow layer of soil, which indicates their anthropogenic provenience. The two rings that make up Tent Ring 1 were considered separately, because they may have been used at different times and were thus labeled Tent Ring 1-West and Tent

Ring 1-East respectively. Sample S9E31, located within the indent in the north wall of the feature, has been labeled 'indent' (Figure 11; Table 2), as it is difficult to assign to either side.

The western ring, Tent Ring 1-West, measures roughly 5 m by 5 m and is oval in shape (Figure 11). The eastern wall has an opening which could have functioned as the entranceway or a connective passage to Tent Ring 1-East. The remains of a hearth are located immediately inside the entranceway. The hearth consists of ashy grey sand, charred bones and plant remains, intruded less than 10 cm into the C_g layer. The surface is not demarcated by any structural elements and no remains were observed into the O_m horizon. This seems to suggest that the structure was reoccupied at least once and that the hearth was obscured by the subsequent occupation. Two samples have been taken from the hearth at 5 cm intervals in the C_g layer and have been labeled HS1 (C_g) and HS2 (C_g). Together with four other samples collected from the baulks located within the perimeter of the hearth, they represent the entire hearth feature (Figure 11; Table 2).

A cluster of burned bone was identified spanning the O_m and C_g horizons in the southeast corner of Tent Ring 1-West and was sampled for chemical analysis. Two samples were collected from each horizon and have been labeled BC and BC (C_g). The rest of the samples were collected from sections of floor against the western and northern wall, as well as immediately outside the hold down rocks in the northwestern section of the structure (Figure 11; Table 2).

Tent ring 1-East measures approximately 6 m by 6 m and is also oval in shape. This causes the entire feature to have somewhat of a rectangular aspect (Figure 11). Tent ring 1-East also appears to represent a structural overlap, with two potential entryways that suggest it may have been occupied on two occasions, with one of the occupations potentially taking place concomitant with that of Tent Ring 1-West. The southeastern section presents a gap in the rock arrangement which is associated with a small rock cluster, immediately outside the feature, intruded into the C_g horizon (Figure 11; Table 2).

This cluster may indicate either where the tent lashing was secured at the entrance into the tent, or where a pole was being held in place. This pole could represent the outer edge of a drying rack, attached to the rear bipod or arch of a tent. A photograph of a 1934 conical sealskin tent at Pangnirtung, Baffin Island, reveals such a drying rack, attached to the top of the back pole lashing, that would have had to be fastened into the ground with rocks (Bennett and Rowley 2004: 242). The small cluster was sampled from the C_g layer and labeled P1 (Figure 11; Table 2).

The western wall of Tent Ring 1-East exhibits a potential passageway to Tent Ring 1-West. Alternately, this could have represented an entryway, if the tents were not in use at the same time. This entryway was associated with a triangular cluster, consisting of three boulders comprising an area of ashy sand and occasional bone remains. This arrangement is similar to the tent lamp stands described by Mathiassen at Iglulik, consisting of three stones, three slabs or three sticks pushed into the ground to support the lamp, with a skin basket or bowl placed underneath to collect dripping blubber (Mathiassen 1976: 147). A similar arrangement was described by Jenness at the Inuinnait summer camp. The lamp is set up on the ground and the cooking pot is placed on top of it, secured by two stones on either side. This arrangement was also used with plant-based fires (Jenness 1922: 79). A total of three samples were collected from this cooking cluster, including a sample taken from the C_g layer, labeled CC, and two baulks (Figure 11; Table 2).

A flat stone located within the perimeter of the structure against the north wall of Tent Ring 1-East (Figure 11) sugested a potential bench area. A total of three samples were selected from the perimeter of this potential feature. The row of hold-down rocks also consisted of flat slabs in this section of the feature. Owing to the skin cover that would have been in place, the slabs would have been located outside the structure. Two samples were collected outside the perimeter of the floor in proximity to the rock slabs, because they might signal a potential activity area located on the outside of the structure. Additional samples were collected from the floor along the southeastern section and recorded as unassigned floor samples (Figure 11; Table 2).

During the excavation, several boulders were identified within the perimeter of the floor that contained slender underlying soil layers signaling their anthropogenic provenience, but they did not reveal any patterns. They may have been used to hold down skin partitions hanging from the roofs of the tents and may have been dispersed during the dismantling of the camp. Large clusters of wood fragments were also identified and are thought to be the remains of the wooden frame. They are randomly and evenly distributed in both tent rings and along the edges of the excavation.

Tent Ring 4 consists of a single rock ring measuring approximately 5 m by 4 m and has an oval shape (Figure 12). The southwestern extremity of this feature overlaps with the edge of Tent Ring 3, which was not excavated. The perimeter of the feature is delineated by a circular boulder arrangement, underlain by a shallow soil layer which signals its cultural provenience.

Based on structural elements, no more than one occupation is suggested for this structure. The eastern wall is sparser, indicating a potential entryway but a hearth was not identified. A large flat rock slab located against the western wall could represent a potential bench. Therefore, the area associated with it was assumed to be a potential activity area and three baulks within its perimeter were sampled for the analysis. Similar to Tent Ring 1, several boulders underlain by a thin soil layer were present on the floor of Tent Ring 4. They may have formed symbolic partitions on the tent floor or held down skin partitions hanging form the roof and were disturbed during the dismantling of the camp.

All the other samples collected from the floor of Tent Ring 4 were labeled as unassigned floor samples (Figure 12; Table 3). Sampling achieved a thorough coverage of the floor and of a section outside the hold down rocks in the southwestern corner of the feature. All soil samples were packaged in sterile plastic bags, and the litter was removed prior to packaging in order to minimize modern inclusions (Gobat et al. 2004: 192).

Collection of undisturbed cores targeted the O_m layer in Tent Ring 1 and the bottom of the O_f layer in Tent Ring 4, which contained all the artifacts recovered during the excavation and reflect the layers sampled for the chemical and paleoethnobotanical analyses. Collection, storage and transportation procedures followed Josephs and Bettis (2003). Cores were collected using modified plastic electric outlet boxes (Nutek, model WSW-UPC), measuring 50x75 mm, with a depth of 90 mm. The metal frames and the plastic flaps were removed before use (Figure 13).

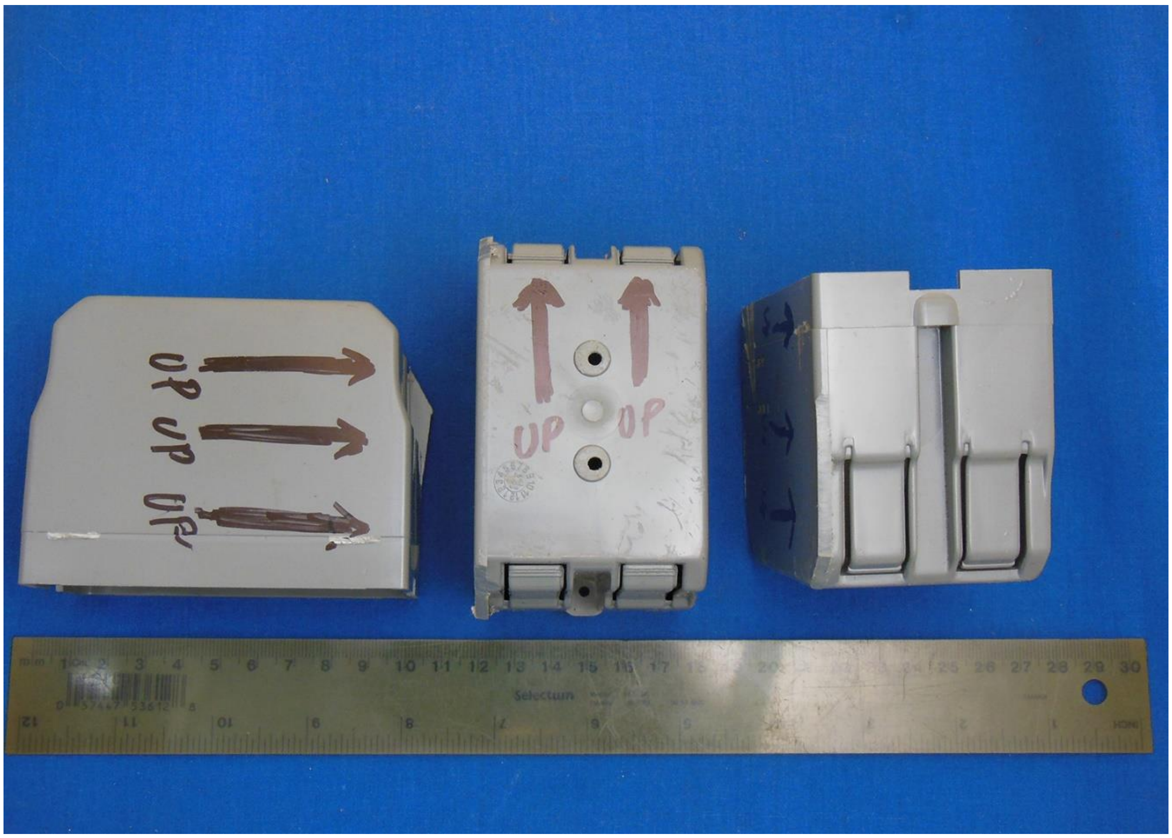

Figure 13. Modified electric outlet boxes used for the collection of undisturbed cores for the micromorphological analysis.

The undisturbed core samples are labeled with the initials MM and a number (Figures 14 and 15; Table 4). Sampling was undertaken to provide a thorough coverage of the floor, however, one section in the southeastern extremity of Tent Ring 1 could not be sampled. The soil layer in this section was too shallow and was underlain by coarse sediment that did not allow the insertion of cores. A total of 17 cores were collected for micromorphological analysis, nine cores were collected from Tent Ring

1, and six cores were collected from Tent Ring 4. Undisturbed cores for the development of control samples were collected from two known, recently disturbed contexts associated with the archaeological

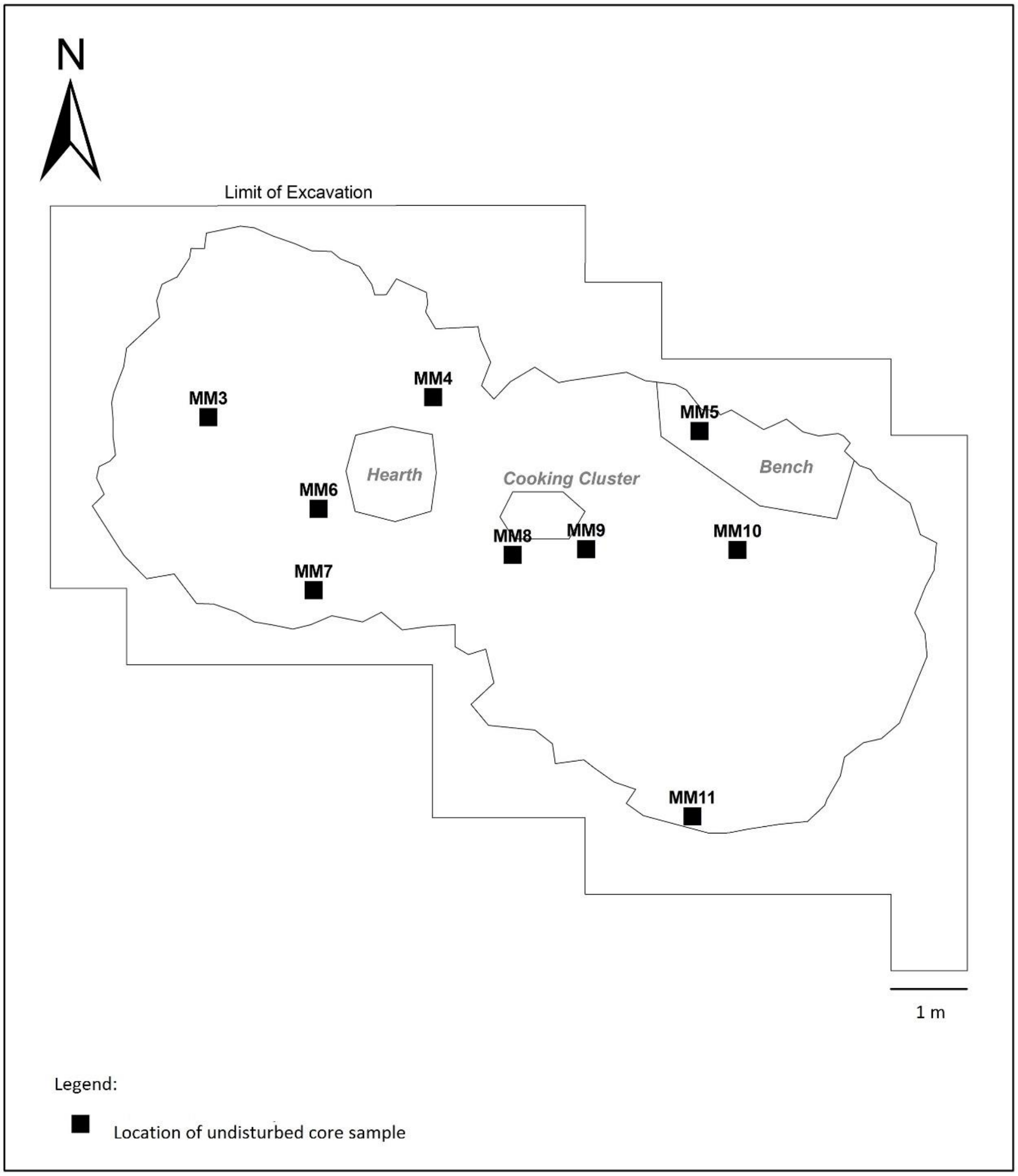

Figure 14. Micromorphological samples collected from Tent Ring 1.

excavations from recent years, consisting of a section of modern path and the backfill of the two year old test pit from Tent Ring 2 (Figure 10).

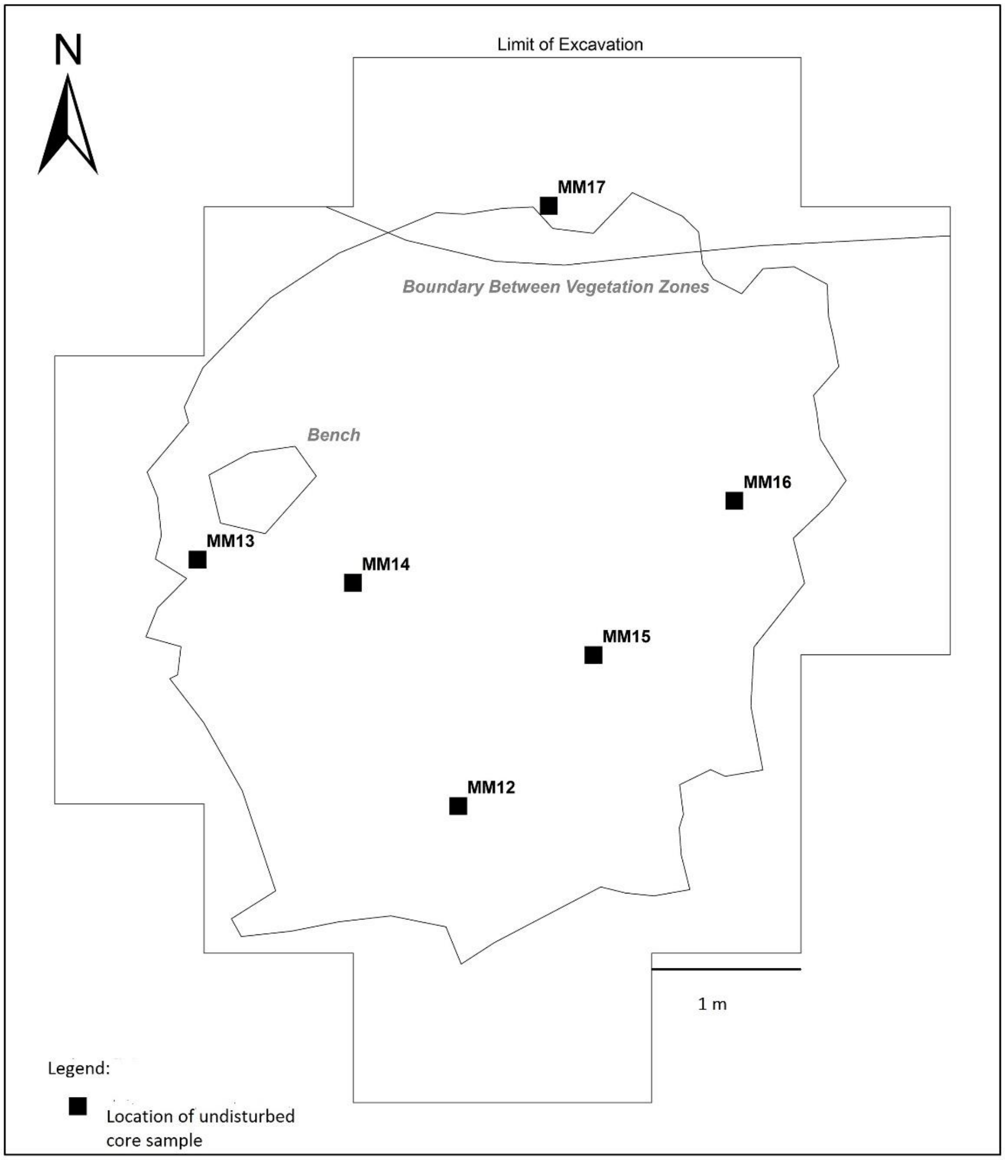

Figure 15. Micromorphological samples collected from Tent Ring 4.

Table 4. Micromorphological samples consisting of undisturbed cores collected from Indian Harbour, including Tent Ring 1, Tent Ring 4, and control sections.

Sample name	Provenience	Description
MM1	Path	Control sample
MM2	Backfill	Control sample
MM3	Tent Ring 1	
MM4	Tent Ring 1	
MM5	Tent Ring 1	

MM6	Tent Ring 1	
MM7	Tent Ring 1	
MM8	Tent Ring 1	
MM9	Tent Ring 1	
MM10	Tent Ring 1	
MM11	Tent Ring 1	
MM12	Tent Ring 4	
MM13	Tent Ring 4	
MM14	Tent Ring 4	
MM15	Tent Ring 4	
MM16	Tent Ring 4	
MM17	Tent Ring 4	

5.2.4. Other Modified Soil Contexts: House 2 and House 4 from the Winter Component of Huntingdon Island 5

Soil samples collected from two of the four sod houses excavated from the winter component of Huntingdon Island 5, House 2 (Figure 16) and House 4 (Figure 17), have been included to provide comparative data from built contexts. These structures are single season, winter occupations that took place in the 17th and 18th centuries at Huntingdon Island 5. All four sod houses have been discussed in Chapter 2. The following descriptions highlight relevant ecofactual data obtained from House 2 and House 4, which will be used to assess environmental and taphonomical aspects. Data has been gleaned from site reports (Rankin 2010; 2011b; 2012a), and the paleoentomological and paleoethnobotanical assessments performed on samples from each house (Cloutier – Gelinas 2011; Dobrota 2014; Dussault et al. 2011). The paleoethnobotanical datasets are reproduced in modified form from Dobrota (2014).

The winter houses dataset contains six samples linked to sod house structural features, the sleeping platform, the floor, and the inside and the outside of the entrance tunnels (Table 5). These samples have been collected during past excavation seasons. House 2 provided samples from the floor, the entrance tunnel and immediately outside the entrance tunnel. House 4 provided samples from the

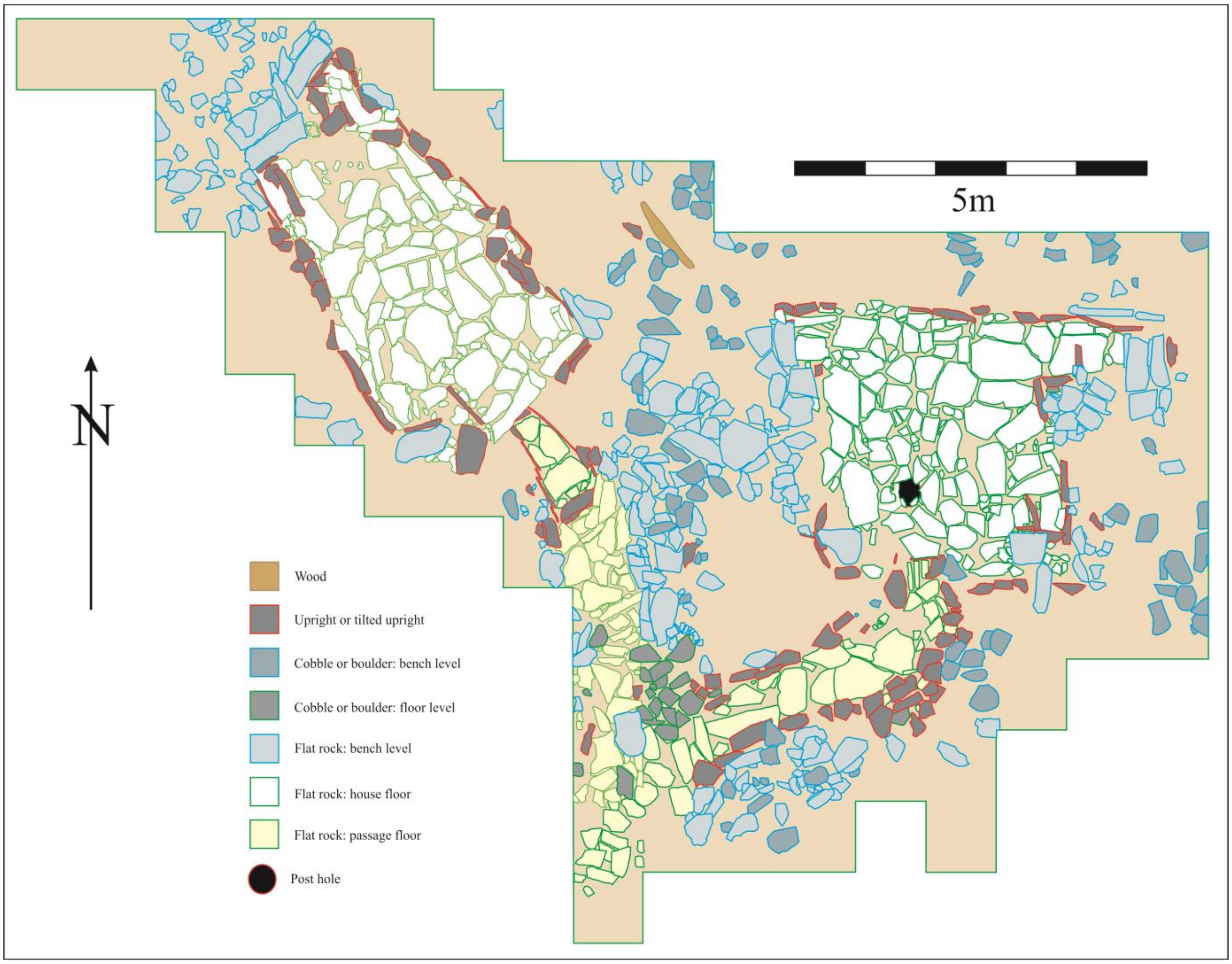

Figure 16. House 2, Huntingdon Island 5 (House 2, seen on the right, is depicted with House 1, with whom it shared an entrance tunnel; Reproduced with the permission of L. Rankin).

sleeping platform, the floor and the entrance tunnel. The collection of limited amounts of samples from different features limits the effectiveness of this dataset; however, these samples provide an invaluable comparative perspective for the analysis.

The faunal assemblage of House 2 consists of a total of 1856 remains. Almost 50% of the identifiable elements of this assemblage are seal bone (838 fragments), with ringed seals being the most prevalent. A relatively high frequency of dog bones were also present, as well as an abundance of mussel shells and a total of 13 fragments of whale bone (Rankin 2011).

Two samples have been processed for paleoentomological analysis, originating from the floor

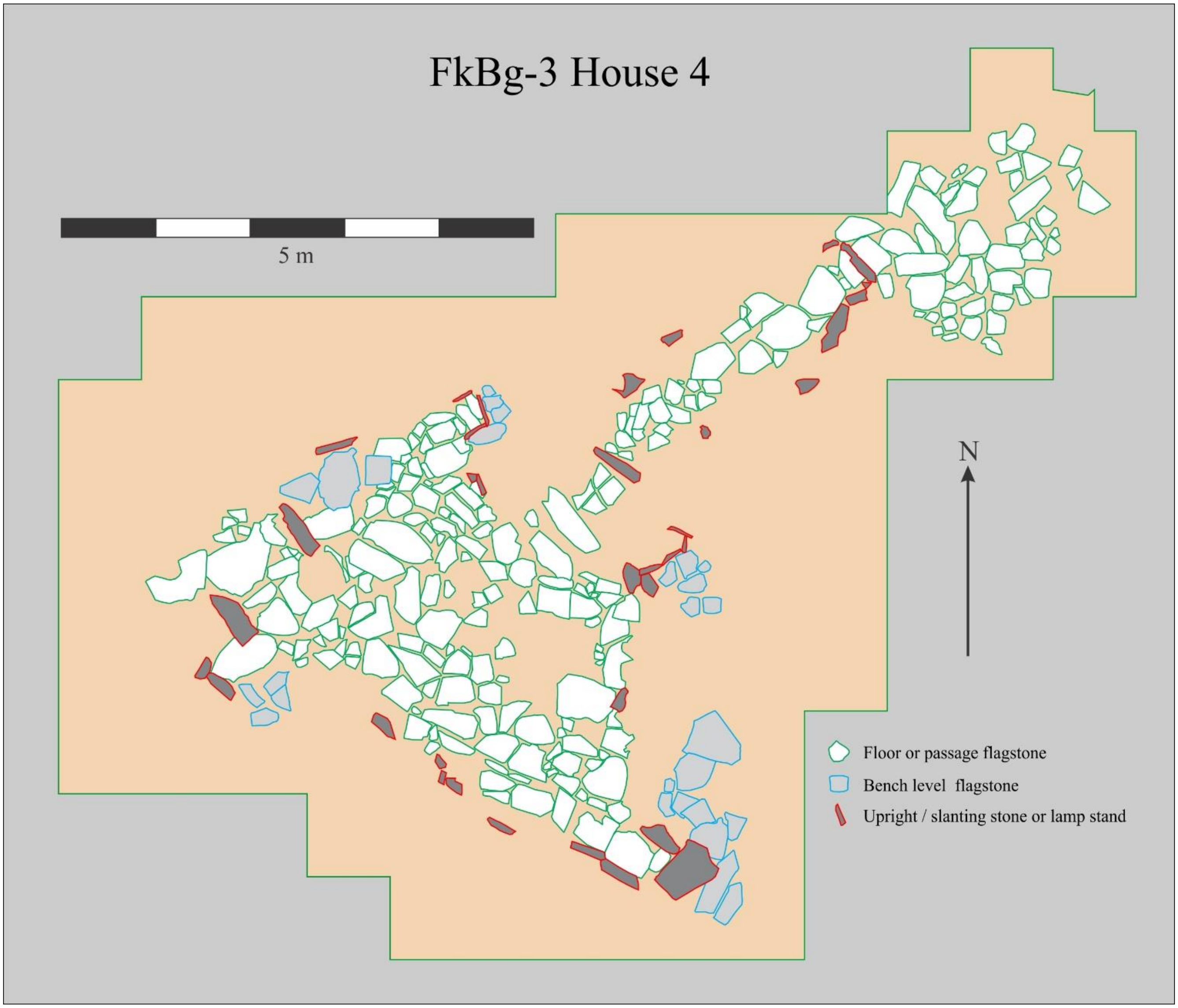

Figure 17. House 4, Huntingdon Island 5 (Reproduced with the permission of L. Rankin).

and the entrance tunnel. For the floor sample, the insect species identified, including *Henoticus serratus, Catops sp., Helophorus arcticus, Aphodius borealis, Staphylinidae* spp. and *Carabidae* spp., indicate the presence of an assortment of organic waste, associated with animal butchery and the disposal of plant based debris. The latter two are predatory species and their presence in large numbers suggests an infestation of insects. For the entrance tunnel sample, the prevalence of *Staphylinidae* and *Carabidae* spp. suggests a more serious infestation of insects. The presence of *Aphodius borealis* suggests the accumulation of mammal dung or offal, from the butchery of animals. The practice of

Table 5. Soil samples available from House 2 and House 4, Huntingdon Island 5.

Sample	Prov.	Description:	W (g)	V (l)	Flot W (g)	Coarse W (g)	Method:	pH:
N15E1	H2	Floor	1413	2.4	3.5	400.3	PBOT Chem	6
N12W3	H2	Entrance passage	2084	2.5	1.6	679.3	PBOT Chem	5
N9W4	H2	Outside entrance passage	1319	2.2	6.3	128.1	PBOT Chem	5.7
N31W29	H4	Sleeping Platform	1480	2	5.3	241.2	PBOT Chem	5.7
N34W27	H4	Floor	1960	2.7	67.3	960.6	PBOT Chem	5.4
N37W24	H4	Entrance passage	1420	2	6.3	397.7	PBOT Chem	5.3

(W = weight; V = volume; PBOT = paleoethnobotany; chem = soil chemistry)

keeping dogs in the entrance tunnel, and the accumulation of their droppings is also consistent with this find. The presence of *Hydrophilidae* spp. also suggests that both animal and plant based refuse accumulated in the entrance tunnel (Cloutier-Gelinas et al. 2011).

The faunal assemblage recovered from House 4 consists of 1910 faunal remains and is considerably more diverse than the faunal assemblage associated with House 2. Approximately 55% of the elements of this assemblage are seal bone (1066 fragments), 75% of which could not be identified to the species. The 25% of the elements identified are predominantly ringed seal, followed by harp seal. A large amount of fish bones was also recovered, which were predominantly Atlantic cod (55 fragments). The assemblage also contained small amounts of dog, caribou, fox, bear, whale, mussel, and bird (Rankin 2012: 9).

A total of three samples from the sleeping platform, floor and entrance tunnel were submitted for paleoentomological analysis, together with a background sample (Dussault et al. 2012). The analysis returned substantial numbers of insect remains, with the largest amounts of insect fragments coming from the entrance tunnel, followed by the sleeping platform, while the floor sample yielded the least amount. Insect species present in the entrance tunnel, such as *Aphodius borealis* and some

Staphilinidae spp., suggest the presence of organic refuse and dung as well as decaying wood, probably coming from wooden structural elements of the house. Insect species present in the sleeping platform, such as *Aphodius borealis* and *Oxytheles sp.,* may indicate the presence of organic refuse and decaying organic matter. The presence of *Lordithon* and *Cryptophagiae sp.* may indicate the presence of foods in poor storage conditions, causing the development of mold and fungi. The presence of *Elateridae* in conjunction with *Lordithon,* as well as *Eusthethus sp.*, which is a leaf dweller, most likely indicate that the sleeping platform was covered in plant based matting. The recovery of one *Pediculum humanum* shows that preservation conditions at the site of House 4 are excellent. Low amounts of insect fragments in the floor sample, and the absence of predatory species from its composition suggest that the floor may have been habitually cleaned. The presence of *Aphodius* in this sample as well, further suggests the presence of organic refuse in the form of dung or offal coming from animal butchery (Cloutier-Gelinas et al. 2011; Dussault et al. 2012). The control sample yielded no entomological specimens, demonstrating that insects are strongly associated with human environments and strongly representative of built human environments (Dussault et al. 2012: 11).

These data indicate that some similar practices were carried out in both houses, such as the keeping of dogs and accumulation of animal- and plant-based refuse in the tunnels, the use of plant-based matting on the sleeping platform and the storage of foods there. However, the paleo-entomological analysis concluded that House 4 exhibited better preservation conditions than House 2, possibly due to its more recent occupation date. The presence of predominantly chitinous elements was linked to their better preservation potential, but their modern appearance was linked primarily to the limited activity of microorganisms in soil, which requires further investigation (Cloutier-Gelinas et al. 2011).

There is very little information on the vegetation cover present over these contexts prior to excavation. Collection of this data is necessary due to the shallowness of the soil layer, which causes the active layer of plant growth to become interspersed with the archaeological layer and which also impacts soil chemistry at the site. Information was gleaned from photographs taken in the field and the data was compared to plant communities observed in backfilled areas from former sod house excavations on the island. Based on the analysis of vegetation patterns on the island, the sod house and backfill locations have been defined as vegetational microcontexts, delimited by the presence of seral plant communities that are different from the vegetation characteristic of undisturbed areas (Appendix A).

Pre-excavation photographs of the surface of House 4 have revealed a low-diversity vegetation cover, consisting of *Carex spp.* and *Cornus canadensis* growing uniformly over the entire surface of the house (Appendix A). *Carex spp.* occur in the transitional coast area, from where they migrate inland into disturbed contexts, and were also present in the backfilled areas, which represent seral communities formed within three years of the disturbance date. Based on their presence in early seral communities and their high-nitrogen requirements, *Carex spp.* have been ranked as early seral species. *Cornus canadensis* was observed growing on the southern edge of the wetland, on raised substrates with a 15% slope, in association with *Heracleum.* Based on its absence from the backfilled areas, and its status as a low-nitrogen indicator, it has been ranked as a late seral species.

Picea glauca were also observed growing out of the walls of the structures and were predominantly located along the back walls. Unlike the commonly stunted *Picea glauca krummoltz* present on the tundras of the Labrador coast, these trees had reached their full sizes, indicating favorable soil conditions, possibly due to the chemical eutrophication of archaeological soils and the creation of a thicker soil layer (Appendix A).

5.3. Summary and Conclusions

This chapter has provided detailed descriptions of field investigations, consisting of a soil and vegetation survey, and sampling procedures undertaken at Huntingdon Island 5, as well as a range of data available on the winter component of the site. The entire dataset consists of 81 bulk soil samples, including control and background samples and 17 undisturbed cores that were processed into thin sections for micromorphological analysis. The following three chapters, Chapters 6, 7 and 8, present the results of each segment of the analysis. According to the guidelines established by Kooistra and Kooistra (2003), individual segments of the analysis have been conducted separately and will be discussed in individual chapters, which will be followed by an integrated perspective.

Chapter 6. Micromorphological Analysis of Thin Sections from Tent Ring 1, Tent Ring 4 and Other Modified Soil Contexts from Huntingdon Island 5

6.1. Introduction

Micromorphology is the microscopic study of undisturbed soil sections with the purpose of identifying and describing soil fabrics and components, and the relationships between them (Bullock et al. 1985). Although this approach is rapidly gaining in popularity, it has had a minimal application on arctic and subarctic archaeological sites in Canada so far (Bunting and Fedoroff 1973; Harris and Ellis 1980; Todisco and Bhiry 2008).

In the context of this study, micromorphological analysis of thin sections MM3 to MM11 from Tent Ring 1 and MM12 to MM17 from Tent Ring 4 (see Table 4) has been undertaken to support the soil classification, to identify the main pedogenic processes active in soil and to provide an understanding of the taphonomy of the site. This section of the analysis provides a detailed description of soils with a focus on processes that impact the preservation of plant remains and the chemistry of the soil. Holo-organic inclusions are described with emphasis placed on species that do not grow on the terrace feature and are likely the result of human activities in the past. Control samples from two known recently disturbed contexts, consisting of a compacted section of a modern path at the edge of Tent Ring 2 (MM1) and the backfill of a two years old test pit within the perimeter of the same feature (MM2) (Feature 10), are also described and will provide support to the interpretation. The contexts of Tent Ring 1 and Tent Ring 4 are contrasted and sources of error in the subsequent steps of the analysis are identified. Pedogenic, geogenic and anthropogenic impacts on soil are identified and discussed.

6.2. Laboratory methods

Following collection in the field, undisturbed cores were forwarded to Vancouver Petrographics LTD where they were processed into 50 x 75 mm thin sections, with a thickness of 30 μm. Thin section analysis was carried out in the petrographic laboratory of the Earth Sciences department at Memorial

University using a Nikon H 550 S petrographic microscope with magnifications between 20 to 400x. Observations were made in plane polarized (PPL) and cross-polarized light (XPL) (Nesse 2000: 114 – 120). Description of soils was carried out using the guidelines for soil and regolith description outlined by Bullock et al. (1985) and Stoops (2003).

All the horizons identified in the field (Appendix B), including two organic horizons, O_f and O_m, and a mineralic C_g horizon, were observed on thin sections. As discussed above, an O_m horizon is only present in thin sections coming from the terrace and the constrained section of the shore (Figures 10 and 14). In the western section of the shore, an O_m designation could not be attributed to the organic horizon present, based on the coarseness of organic inclusions (Appendix B). At the microscopic level, the boundary between O_f and O_m is irregular, with alternating pockets of decomposing organic inclusions, whereas the boundary between O_f or O_m and C_g is sharply demarcated due to the distinct composition of these horizons (Figures 18, 19 and 20).

6.3. Results and Discussion

The results of the micromorphological analysis are listed in Tables 6, 7, 8 and 9. Data has been qualitatively assessed, based on visual estimates of abundance or percentage surface area covered by a micromorphological feature. All observed micromorphological features are illustrated in photomicrographs. More detailed descriptions are provided in Appendix C, together with reproductions of each thin section. Wood tissues have been identified to the genus level based on their cellular structure (see Figures 19, 20 and 21 for examples of wood layers identified in thin section) (Maryland Historical Trust 2012; Schoch et al. 2004). A total of five organic layers consisting of wood fragments have been identified and have been labeled W, followed by a numerical designation. A single textural pedofeature has been identified in thin section MM4 from Tent Ring 1 and has been labeled s1 (Appendix C).

Figure 18. Thin section MM9, from Tent Ring 1, depicting the sharp boundary between the brown to dark brown O_m horizon, located at the top of the thin section and the grey to white C_g horizon, located at the bottom of the thin section. An *Abies* fragment (a) is visible to the left in the O_m horizon and wood layer W3, interspersed with multiple charcoal fragments, is visible across the upper section of the C_g horizon.

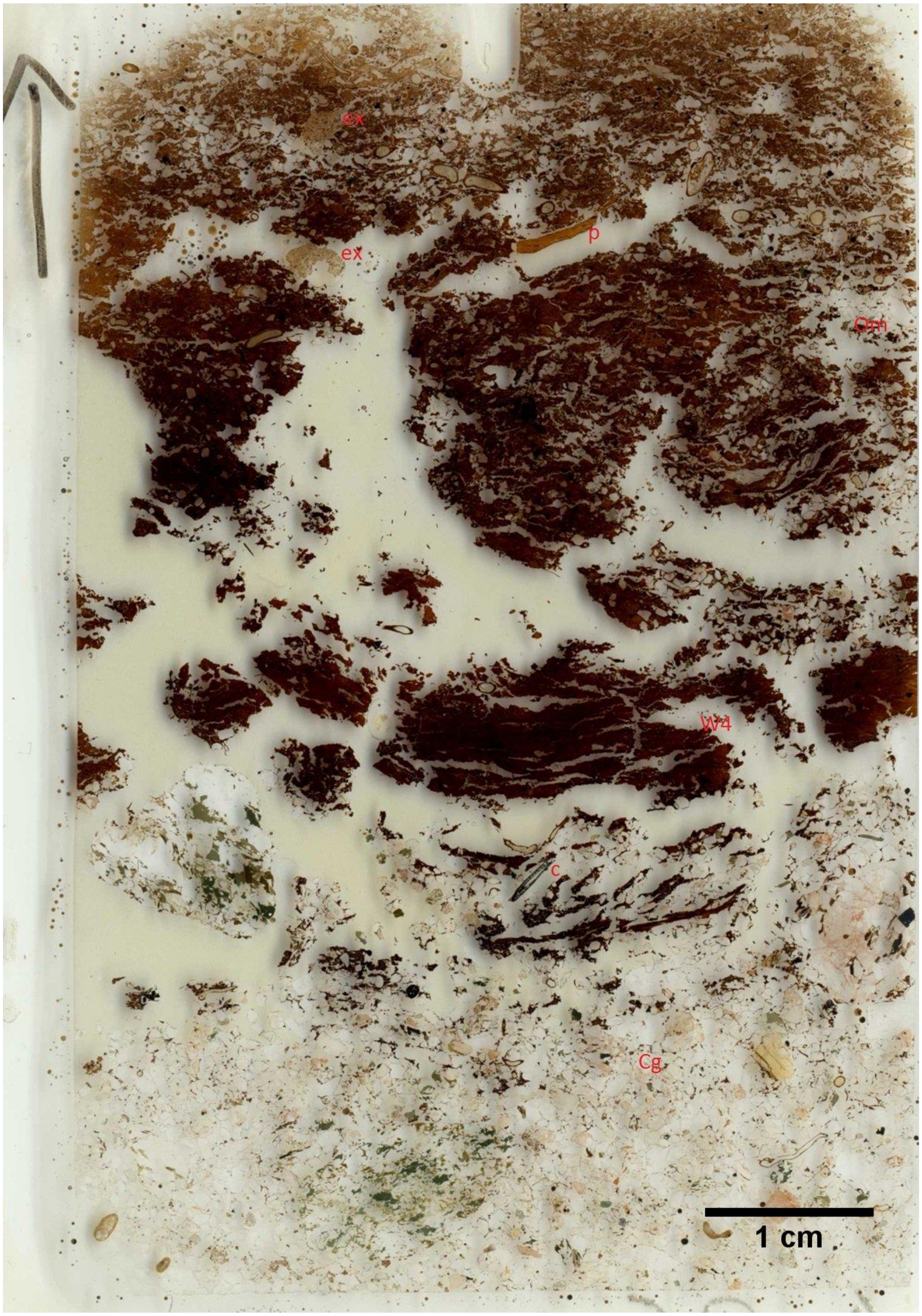

Figure 19. Thin section MM10, from Tent Ring 1, depicting the sharp boundary between the O_m and C_g horizons. The O_m horizon contains two coalescences of Enchytraeid droppings (ex) and a *Picea* fragment (p). Wood layer W4 is located at the upper boundary of the C_g horizon, and is underlain by one charcoal fragment (C).

Figure 20. Thin section MM15, from Tent Ring 4, consisting entirely the Of horizon, composed of coarse holo-organic inclusions, minimal amounts of soil organic matter and wood layer W5, visible across the middle of the thin section.

Table 6. Summary of micromorphological characteristics and degree of expression, development or abundance (C_g horizon).

MM1 C	MM2 C	MM3 TR1	MM4 TR1	MM5 TR1	MM6 TR1	MM7 TR1	MM8 TR1	MM9 TR1		C_g
***		***			**			***	>500 µm	Mineral fraction$_{63\ \mu m}$
**		**			**			***	500 – 250 µm	
									250 – 125 µm	
*		**			**			**	Organic	Fine fraction
****		****			****			**	Undifferentiated	b-fabric
E		E			E			E		c/f$_{63\ \mu m}$
*								*	Vascular plant components	Organic components
								*	Charcoal	
*								**	Monomorphic	Fine organic mass
****					****			****	Polymorphic	
								*	Layers	Basic Distribution Patterns (organics)
		*								Fungal components
**		*			*			*	Hypocoatings (organic)	Pedofeatures
									Micropan	
		*						**	Cappings (including link)	
*		*			*			*	Fe/Mn nodules	Redox features
									Fe/Mn hypocoatings	
**		**			**			**	Simple packing voids	Voids
		**			**			**	Complex packing voids	
									Chamber	
								*	Planar	
								*	Subangular blocky	Microstructure
								*	Platy	

(* - few/poorly expressed/ developed; **- few to medium/ poorly to moderately expressed/ developed *** - moderate/ moderately expressed/developed; **** - moderate to abundant/ moderately to well expressed/developed; ***** - abundant/ well expressed/ developed; E – enaulic; P – porphyric;)

Table 7. Summary of micromorphological characteristics and degree of expression, development or abundance (O_f/O_m horizon)

MM1 C	MM2 C	MM3 TR1	MM4 TR1	MM5 TR1	MM6 TR1	MM7 TR1	MM8 TR1	MM9 TR1		O_f/O_m
	*	*	*	**	*		*	*	>500 µm	Mineral fraction$_{63\ \mu m}$
*	*	*	*	**	*	*		*	500 – 250 µm	
*	*								250 – 125 µm	
***	**	***	***	**	***	***	***	***	Organic	Fine fraction
****	*****	*****	*****	*****	*****	*****	*****	*****	Undifferentiated	b-fabric
			*	*					Banding	Basic related distributions (mineral fraction)
E	E	E	E,P	E,P	E	E	E	E		c/f$_{63\ \mu m}$
**	***	****	**	**	***	***	***	*	Vascular plant components	Organic components
	**								Lichen components	
	**			*					Moss components	
****	****	****	****	****	****	****	****	****	Amorphous organic components	
**	*	*	*	*	*	*	**	*	Organic pigment	
	*		*		*				Charcoal	

		*			*				Layers	Basic distribution patterns (organics)
**	***	**	**	**	***	**	***	***		Fungal components
	*								Monomorphic	Organic fine mass
*****	****	*****	*****	*****	*****	*****	****	*****	Polymorphic	
										$c/f_{10\ cellls}$
									Simple packing	Voids
**		**	**	***	***	**	***		Complex packing	
									Compound packing	
**			*	***	**	***	**	*	Vughs	
*	***	***			**		*	****	Planar	
*			***			*			Channel	
*		*							Chamber	
*			*	*	**	**	**	*	Spheroidal/ radial	Microstructure
*			*		**	***	***	*	Vughy	
**		*	**	****	***	***	**		Spongy	
									Crumb	
*			***						Channel	
*	***				**		*	*	Angular/subangular blocky	
	*	***						***	Platy	
			***						Textural pedofeatures	Pedofeatures
*	*	*	*	*	*	*	*	*	Organic hypocoatings	
			*						Organic internal coatings	
									Capping/ link capping	
		*							Micropan	
	*	**	**						Soil fauna droppings	
*	*	*	*	*	**	*	*	*	Fe/Mn nodules	Redox features
									Fe/Mn hypocoatings	

(* - few/poorly expressed/ developed; **- few to medium/ poorly to moderately expressed/ developed *** - moderate/ moderately expressed/developed; **** - moderate to abundant/ moderately to well expressed/developed; ***** - abundant/ well expressed/ developed; E – enaulic; P – porphyric;)

Table 8. Summary of micromorphological characteristics and degree of expression, development or abundance (C_g horizon), continued.

MM10 TR1	MM11 TR1	MM12 TR4	MM13 TR4	MM14 TR4	MM15 TR4	MM16 TR4	MM17 TR4		C_g
**	**			***				>500 µm	Mineral fraction$_{63\ \mu m}$
***	***			***				500 – 250 µm	
								250 – 125 µm	
**	*			**				Organic	Fine fraction
*****	*****			*****				Undifferentiated	b-fabric
E	E			E					$c/f_{63\ \mu m}$
*				*				Vascular plant components	Organic components
								Charcoal	
*								Layers	Basic distribution patterns (organics)
**								Monomorphic	Fine organic mass
*	*****			*****				Polymorphic	
*									Fungal components
*	*			*				Organic hypo-coatings (minerals)	Pedofeatures
**								Cappings (including link)	

**								Micropan	
*	*							Fe/Mn nodules	Redox features
*								Fe/Mn hypocoatings	
**	***			****				Simple packing voids	Voids
**								Complex packing voids	
								Chamber	
**								Planar	
								Subangular blocky	Microstructure
**								Platy	

Table 9. Summary of micromorphological characteristics and degree of expression, development or abundance (O_f horizon), continued.

MM10 TR1	MM11 TR1	MM12 TR4	MM13 TR4	MM14 TR4	MM15 TR4	MM16 TR4	MM17 TR4		O_f
**	*	*	*	*		*	*	>500 µm	Mineral fraction$_{63\ \mu m}$
	*	*	*	*	*	*		500 – 250 µm	
								250 – 125 µm	
***	***	**	*	**	***	***	**	Organic:	Fine fraction
*****	*****	*****	*****	*****	*****	*****	*****	Undifferentiated	b-fabric
		*	*	*			*	Banding	Basic related distribution
E	E	E	E,P	E	E	E	E		c/f$_{63\ \mu m}$
*	**	***	***	***	***	**	**	Vascular plant components	Organic components
								Lichen components	
			*	*				Moss components	
****	****	****	****	****	****	****	****	Amorphous organic components	
*	*	**	*	**	*	*	***	Organic pigment	
								Charcoal	
			*					Layers	Basic distribution patterns (organics)
**	***	***	***	***	***	***	***		Fungal components
**								Monomorphic	Organic fine mass
***	*****	*****	*****	*****	*****	*****	*****	Polymorphic	
			E	E,P					c/f$_{10\ cellls}$
								Simple packing	Voids
**	***	***	****	***	**	***	**	Complex packing	
							**	Compound packing	
**	*	*	*	**	**	**		Vughs	
***	***	*			**	*		Planar	
								Channel	
								Chamber	
	*	**	*	*	*	*	**	Spheroidal/ radial	Microstructure
**	*	*						Vughy	
	*	***	****	****	***	***	***	Spongy	
							**	Crumb	
								Channel	
		*			**	*		Angular/subangular blocky	
***	***							Platy	
								Textural pedofeatures	Pedofeatures
*	*	*	*	*	*	*	*	Organic hypocoatings	
					*			Organic internal coatings	
**								Capping (including link)	
*								Micropan	

*		**	*	*	**		*	Soil fauna droppings	
**	**	*						Fe/Mn nodules	Redox. features
								Fe/Mn hypocoatings	

6.3.1. Mineral Components

Mineral components are concentrated in the C_g horizon, which is present in thin sections MM3, MM6, MM9, MM10, MM11 from Tent Ring 1, thin section MM14 from Tent Ring 4 and thin section MM1 from the compacted section of the modern walking path. Little variation has been noted in the C_g horizon (Tables 6 and 8). The mineral fraction consists of unoriented, mostly moderately sorted, angular and subangular mono- and polymineralic grains of quartz, K-feldspars, plagioclase feldspars, hornblende, augite, muscovite, biotite, sandstone fragments and opaques nodules. Grain sizes range between medium and coarse sized sand (>500 μm, 500 – 250 μm), with occasional pebble and cobble inclusions. Coarse sand is the most prevalent grain size in all contexts sampled (Tables 6 and 8).

C/f related distribution patterns are predominantly enaulic (Tables 6 and 8). These distributions are created by the translocation of fine organic material from overlying organic layers and are consistent with minimal weathering, as microporosity and the presence of cappings indicate an absence of clay. Minimal weathering is attributed to the mineral substrate, which consists of minerals classified as highly to moderately resistant but is also due to the young age of the terrain feature. Biotite, the least resistant mineral present, exhibits incipient phases of weathering with very few fragments undergoing interlayer oxidation of iron (Figures 21, 22 and 23) (Gilkes et al. 1972; Stoops et al. 2010: 18-19).

The predominance of undifferentiated b-fabrics (Tables 6 and 8) also suggests an absence of clay. Although some staining with organic pigment has taken place, it is not substantial enough to completely mask the distinctive anisotropism of clay domains, if clays were present. Additionally, the predominance of dark reddish brown and dark brown colors in the fine organic fraction suggest that it is dominated by organic fine mass.

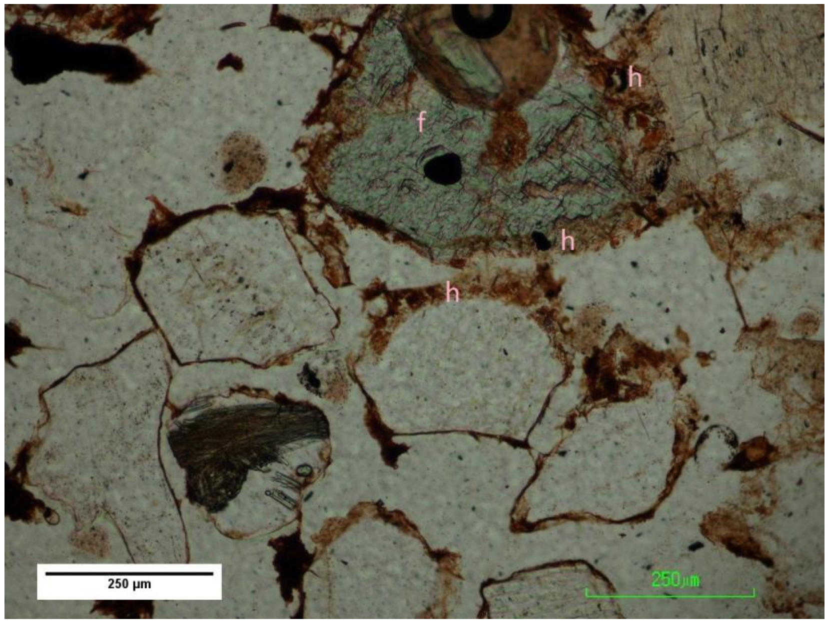

Figure 21. Quartz and feldspar (f) particles coated by polymorphic organic mass hypocoatings (h) with a single spaced fine enaulic C/F distribution, thin section MM11 (control sample).

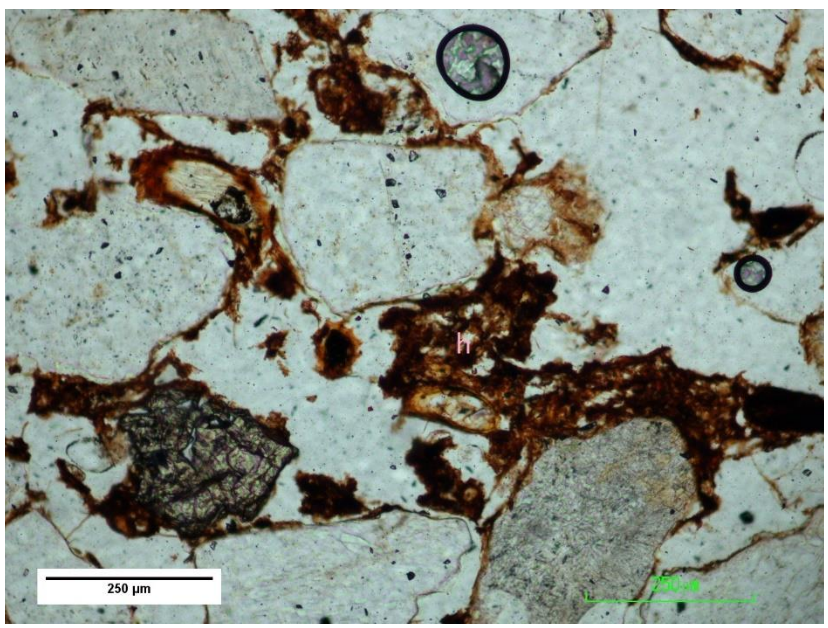

Figure 22. Quartz grains coated by polymorphic organic mass hypocoatings (h) with a close enaulic C/F distribution, thin section MM11 (control sample).

There is minimal mixing between the organic and mineralic fraction in the organic horizons, consistent with low soil faunal activity. Very few grains are present in the O_m and O_f horizons and where present, banding has been observed, suggesting a different pedogenic source. Banding has been observed in thin sections MM4 and MM5 coming both from Tent Ring 1, and MM12, MM13, MM14 and MM17 from Tent Ring 4 (Tables 7 and 9).

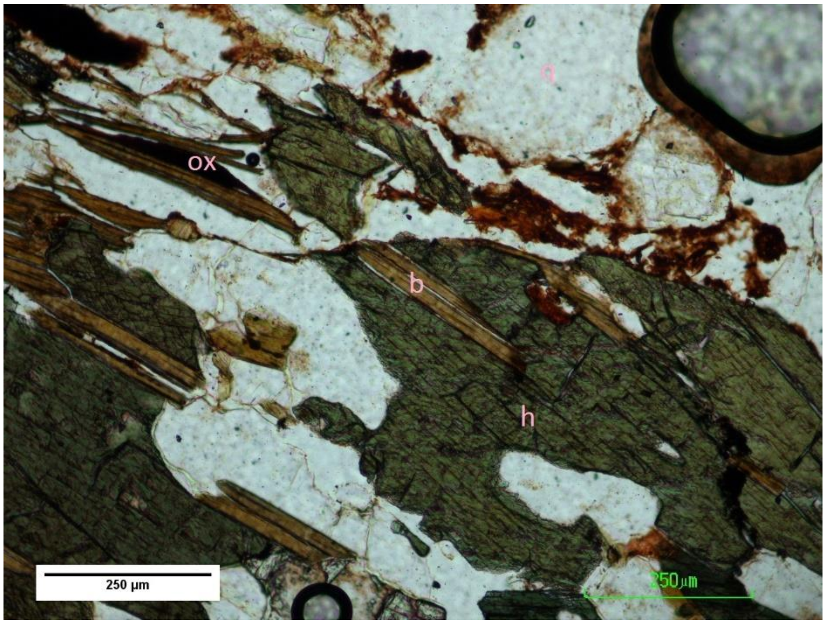

Figure 23. Polymineralic grain composed of hornblende (h), quartz (q) and biotite mica (b). The fragment in the upper left corner is undergoing slight interlayer oxidation of iron (ox), thin section MM11 (Tent Ring 1).

In Tent Ring 1, thin sections MM4 and MM5 exhibit subhoriozontal bands a few millimeters in thickness at the bottom of the O_m horizon that are compositionally identical to the underlying C_g horizon. In thin section MM4, a single band is associated with charcoal and a fragment of wood, identified as *Abies,* located immediately underneath the textural pedofeature s1, which consists of well decomposed organic fabrics. In thin section MM5, two bands are present, underlying and overlying a fragment of buried moss, strongly stained by organic pigment and somewhat horizontally compressed (Tables 7 and 9). These features may represent fragments of the original living floors. As the hearth and the cooking clusters were excavated into the C_g horizon, exposed mineral grains may have been trampled onto the tent floor by its inhabitants. The presence of charcoal fragments such as those identified in thin section MM4, is characteristic of living floor layers. The presence of an *Abies* fragment with an intact cellular structure may, however, suggest a recent age for the feature.

Banding in the context of Tent Ring 4 is qualitatively distinct. Thin bands, approximately 1 or 2 mm thick, are present in thin sections MM12, MM13, MM14 and MM17 (Table 9). The bands consist of widely spaced, medium sand sized mineralic grains, some of which lack organic hypocoatings. This type of banding may be caused by the rising water table during spring thaw, which jacks up the smaller mineralic grains (Van Vliet-Lanoe 2010: 88). This process is likely active in the context of Tent Ring 4 due to the increased porosity of the organic horizon associated with this context.

6.3.2 Organic Components

6.3.2.1. Plant Remains

Organic inclusions are the dominant soil component in horizons O_m and O_f and have been classified according to size, tissue type and number of tissues present. Coarse inclusions have been defined as fragments containing more than ten interconnected cells. When only one tissue type is present, these inclusions have been classified as tissue fragments. When two or more types of tissue are present, inclusions have been classified as organ fragments.

The most frequent organic inclusions are the subterranean organs of vascular plants, moss and lichen residues, consistent with the current vegetation cover. Additions of softwood tissues from species that do not grow on the terrace feature, some of which had identifiable cellular structures, have also been noted. These tissues have been deposited in organic layers predominantly found at the confluence of the Om and C_g horizons in Tent Ring 1 and at the bottom of the O_f horizon in Tent Ring 4. These organic layers are visible in thin sections MM3, MM6, MM9 and MM10 from Tent Ring 1, and MM13 and MM15 from Tent Ring 4 (Figures C.3, C.6, C.9, C.10, C.13, and C.15 Appendix C).

Vascular plant tissues are distinguished based on the structural components of cell walls and their optical properties. Cellulose and hemicellulose are the most conspicuous components of the cell wall in tissues of the pith and cortex of vascular plants. Cellulose is a long polymeric carbohydrate composed of unbranched chains that appears pale to bright yellow in PPL. Decomposing cellulose in cell walls can also develop high chromas and interference colors in XPL, appearing bright yellow to gold. Hemicelluloses are a heterogeneous group of polysaccharides with a similar appearance to cellulose. Both components are readily decomposable by soil bacteria and fungi and will break down rapidly in soil (Figures 24 and 25) (Dickson 2000: 16 – 18).

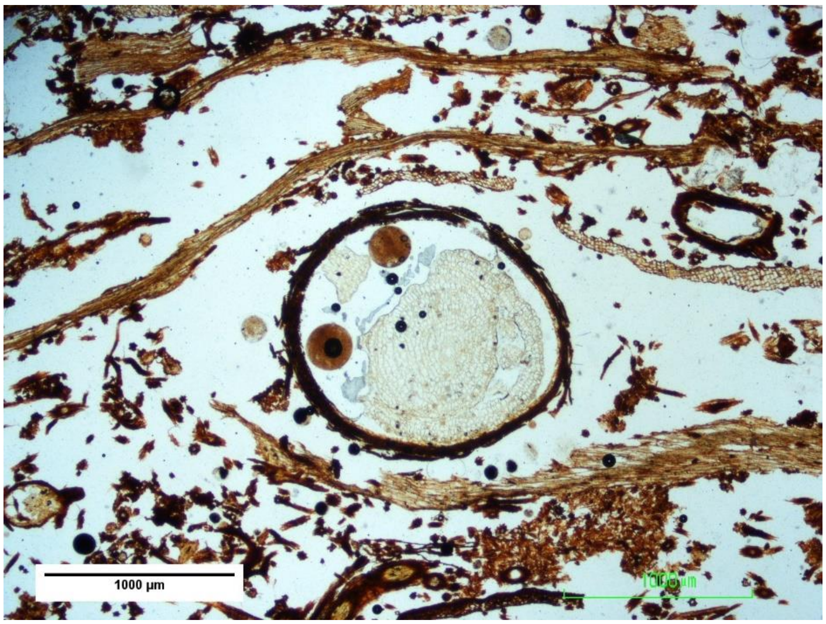

Figure 24. Decomposing root cavity with intact epidermal tissue in thin section MM12 (Tent Ring 4).

Lignin is a phenolic polymer that provides structural resistance in wood tissues and is highly resistant to decay. Lignin fills the spaces between cellulose fibers in plant cell walls and appears opaque in XPL. A large amount of lignin is also present in the vascular bundles of plant tissue for the purpose of strengthening and making the xylem vessels more water resistant (Dickson 2000: 26 – 27; Tan 2000: 132 – 134). This often ensures the differential survival of the pith area in partially decomposed root cavities (Figure 26).

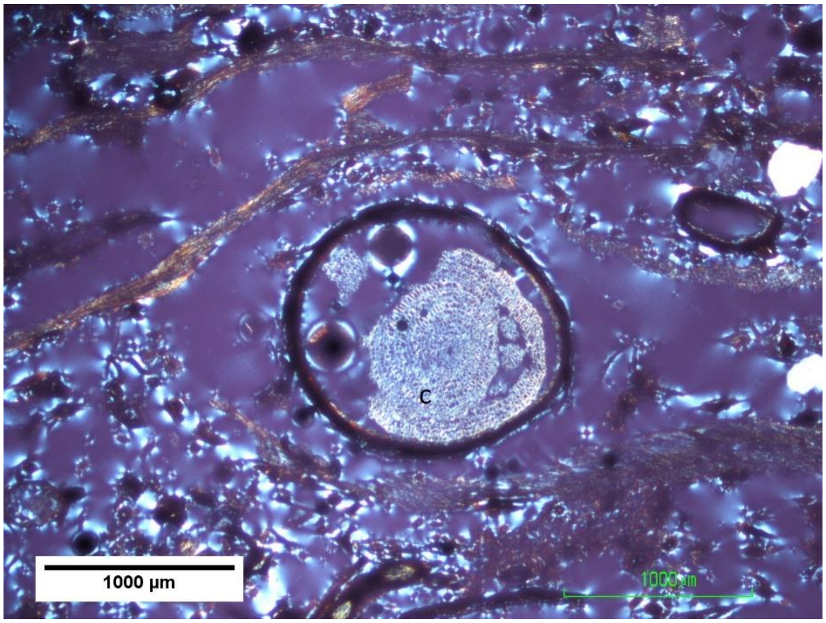

Figure 25. Cross-polarized view of organic remains depicted in Figure 24; when viewed in cross-polarized light, the cellulose (c) in the tissue of the cortex and pith exhibits high chromas and birefringence.

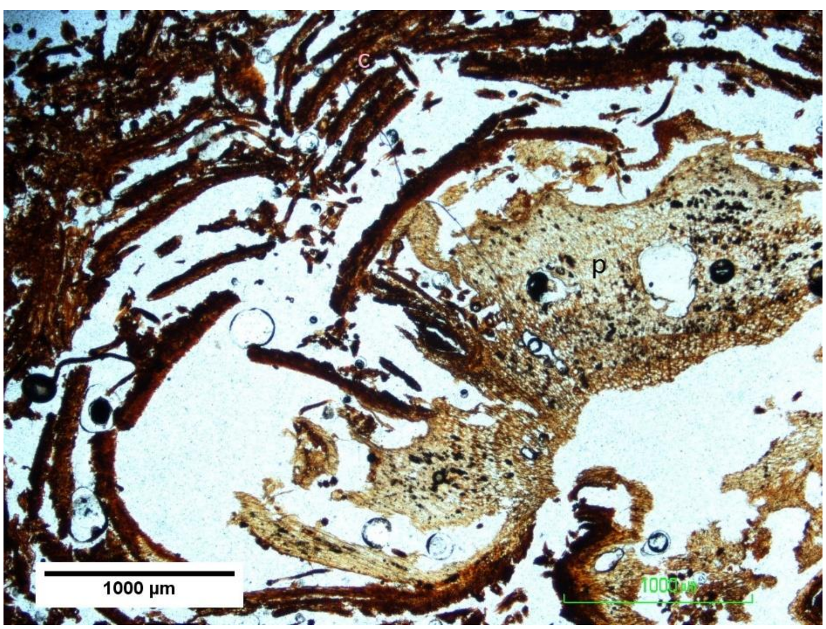

Figure 26. Surviving pith (p) inside a spheroidal structure resulted from the decomposition of organic tissue, thin section MM6 (Tent Ring 1), with specific pattern of strips of epidermal tissue (or cork) (c) and voids.

Tannins are the most conspicuous components of epidermal tissues. Phlobaphene is a product of the oxidation and polymerisation of tannins. Present only in primary and secondary epidermal tissue (Bullock et al. 1985; Stolt and Lindbo 2010: 373), it has a strong reddish brown to dark brown appearance in PPL. Decomposing phlobaphene-containing cells can develop high chromas and interference colors in XPL, with some tissues developing bright red and orange hews. Prolonged exposure to organic pigment in soil, however, renders them opaque. These cells are highly resistant to decay; therefore, the epidermal lining of decomposing organic structures will remain intact long after the pith and cortex have decomposed. As these linings eventually become fractured, strips of phlobaphene-containing cells will become embedded in the fine organic fraction, which determines its polymorphic appearance (Figure 24, 25 and 26).

The differential decomposition of cellulosic tissue inside the root cavities of vascular plants produces characteristic spheroidal microstructures, consisting of circular or elliptical arrangements of epidermal layers and voids (Figure 26) (Stoops 2003: 68). Decomposing organic structures can become comminuted by soil fauna, colonized by fungi or modified by chemical processes in soil (Gobat et al. 2004: 105). These processes lead to increased porosity in horizons defined by a high amount of organic inclusions and are a defining factor for the microstructure of the O_f horizon. Thin sections MM13 and MM14, from Tent Ring 4 are defined by a high density of coarse organic inclusions in association with decomposing structures and poor soil organic matter development (Figures 27, and C.13 and C.14, Appendix). A c/f related distribution with a limit of ten interconnected cells has been employed to better describe these fabrics (Table 9).

Moss residues are characteristically porous. Moss fragments become buried following seasonal litter deposition but may also be indicative of disturbed soil layers. Older buried fragments incur infilling of void spaces with soil organic matter and staining with organic pigment, which obscures tissue structure (Figure 28; Tables 7 and 9).

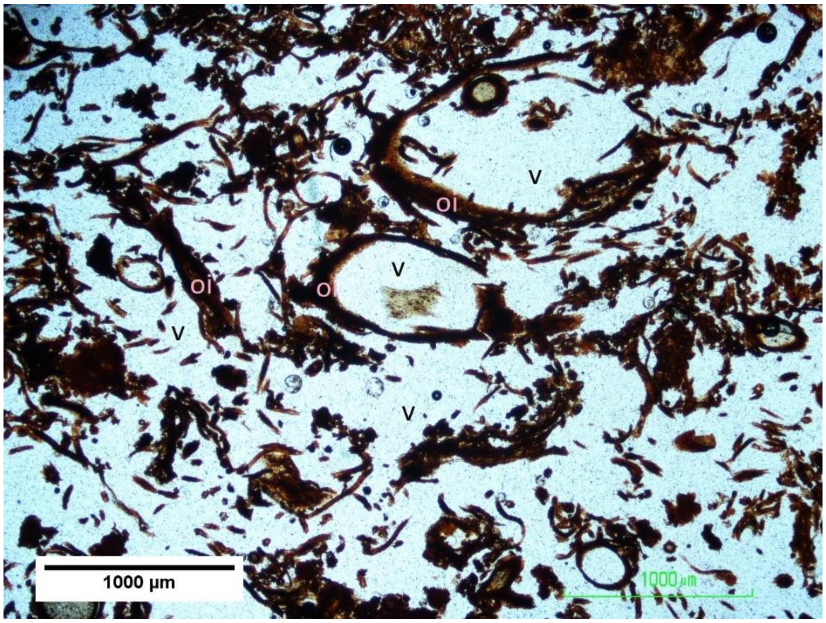

Figure 27. Aspect of O_f horizon, thin section MM17 (Tent Ring 4), exhibiting a poorly developed soil organic matter characterized by coarse organic inclusions (oi) surrounded by voids (v).

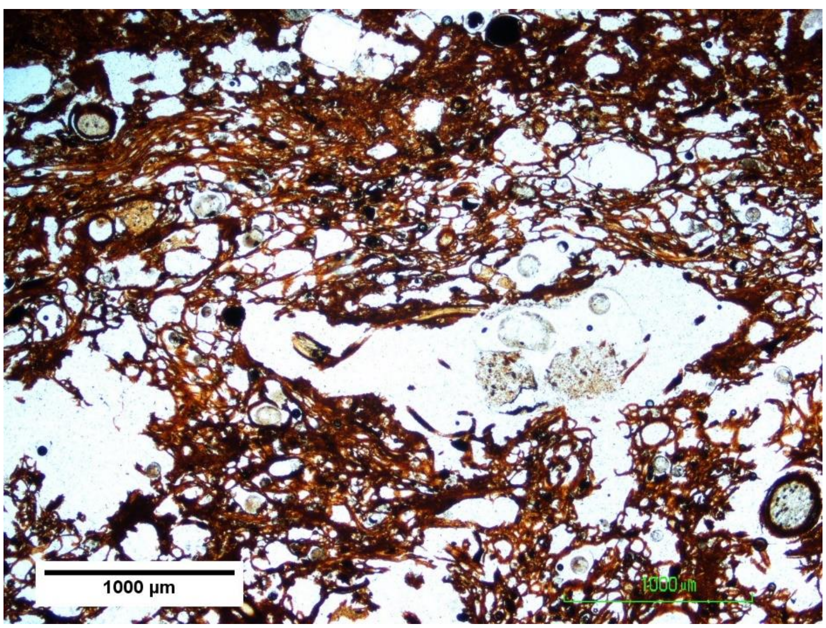

Figure 28. Characteristic fabric of a buried moss fragment, thin section MM5 (Tent Ring 1).

The only lichen component identified was *C. rangiferina* (Figure 29) (Asta et al. 2001). Sections of the algal and chondroid layers have been identified in the control section MM2 (Figure C.2, Appendix C). In their detailed investigation of the soil-lichen interface, Asta et al. (2001) found that decomposing chondroid tissue leads to the release of coalesced fungal hyphae into the soil. Coalescences with morphological similarities have been recorded in thin sections MM1, MM6, MM7 and MM12, from the sampled path section, Tent Ring 1 and Tent Ring 4 (Tables 7 and 9). These coalescences may be a result of the decomposition process.

Wood tissues can appear as isolated fragments in the soil but are more commonly deposited in organic layers, several centimetres thick (Tables 6, 7, 8 and 9). All layers identified consist of a single

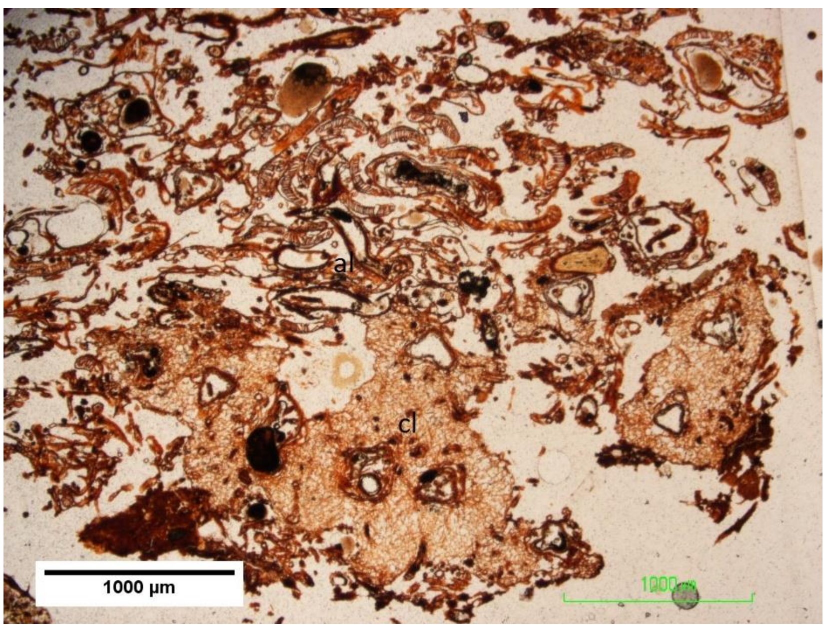

Figure 29. Decomposing fragment of *C. rangiferina*, including fragments of the algal (al) and chondroid layers (cl). The condroid layer consists of densely packed coalescencences of fungal hyphae, thin section MM2 (control sample).

Species of wood tissue fragments, identified based on cellular structure as either *Abies* or *Picea* (Figure 30). Where decomposition has rendered the tissue structure unidentifiable, it has been noted as an unidentified wood layer.

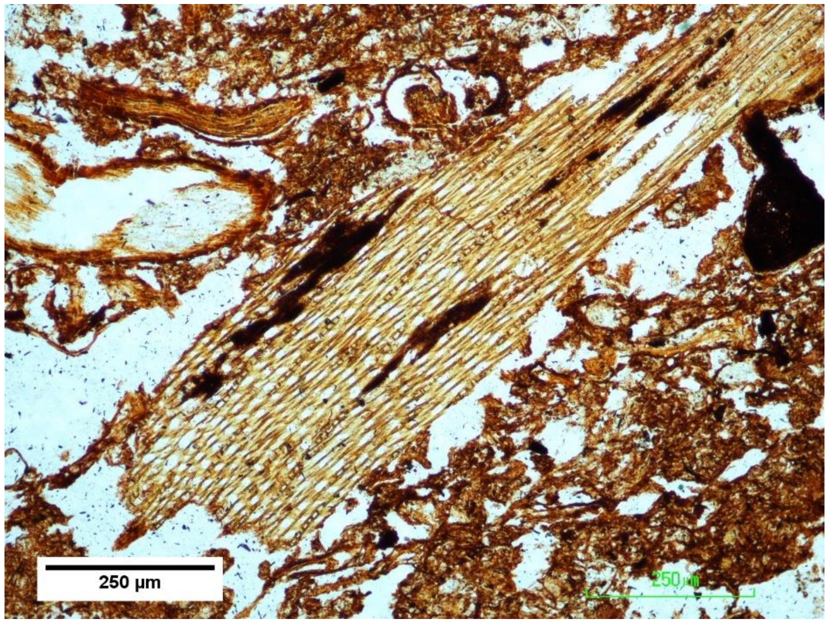

Figure 30. *Abies* stemwood fragment, from thin section MM4 (Tent Ring 1); the intact cellular structure permits identification.

Layer W1, in thin section MM3 from Tent Ring 1 (Figure C.3, Appendix C) is a transversal view through a fragment of *Picea* stemwood with visible growth rings. One of the fragments is superficially charred. Wood tissue is undergoing decomposition by *Oribatid* mites and soil organic matter infillings are advancing through inter-growth ring spaces (Figure 31).

Layer W2, in thin section MM6 from Tent Ring 1 (Figure C.6, Appendix C), appears to be in a more advanced state of decomposition. It is characterized by two distinctive fabrics arranged in a concentric pattern, which exhibit different degrees of fungal decomposition and different microstructures (Figures 32, 33, 34 and 35). Both W1 and W2 likely represent recent additions to the soil.

The wood layers W3 and W4, identified in sections MM9 and MM10 from Tent Ring 1 (Figures 18 and 19), are characterized by an amorphous, dark reddish brown to dark brown fabric, with distinctive subangular blocky and platy microstructures (Figures 36 and 37). They likely represent a continuous wood layer on the floor of Tent Ring 1 that may date back to the occupation of the tent.

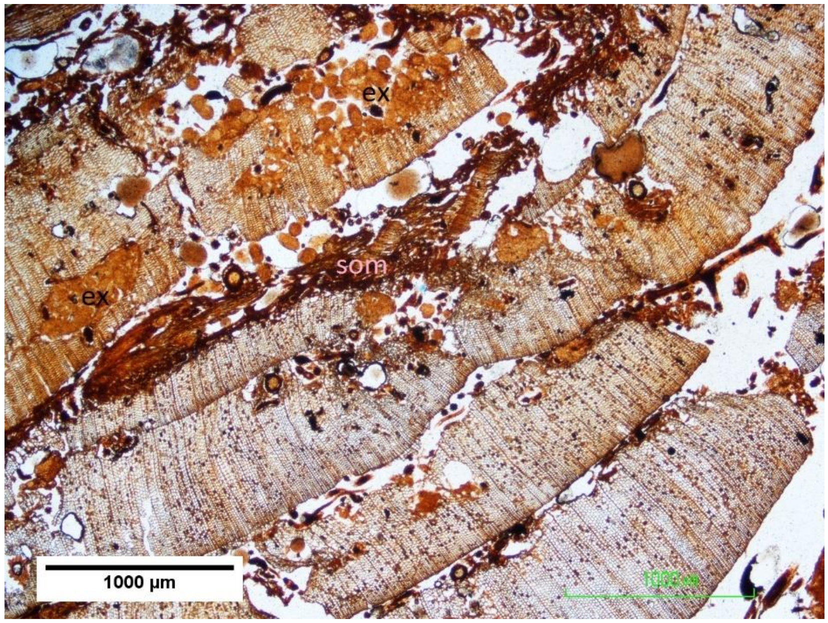

Figure 31. Organic layer W1, from the top of section MM3, *Picea* stemwood with visible growth rings. Inter-growth ring spaces are becoming filled in with soil organic matter (som). Some of the rings exhibit comminution by *Oribatid* mites and infillings of coalesced fecal matter (ex). The fecal pellets exhibit some staining with organic pigment, but the intactness of the cellular structure suggests it is a recent addition to the soil.

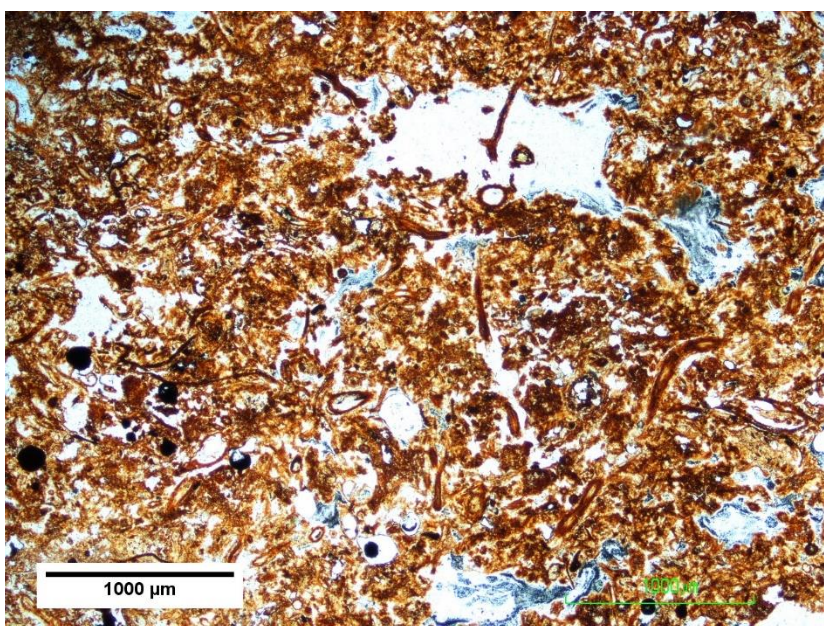

Figure 32. First of two characteristic fabrics present in organic layer W2, thin section MM6 (Tent Ring 1). Solubilized decomposing organic tissue impregnates the surrounding matrix and eventually becomes stained by soil organic pigments.

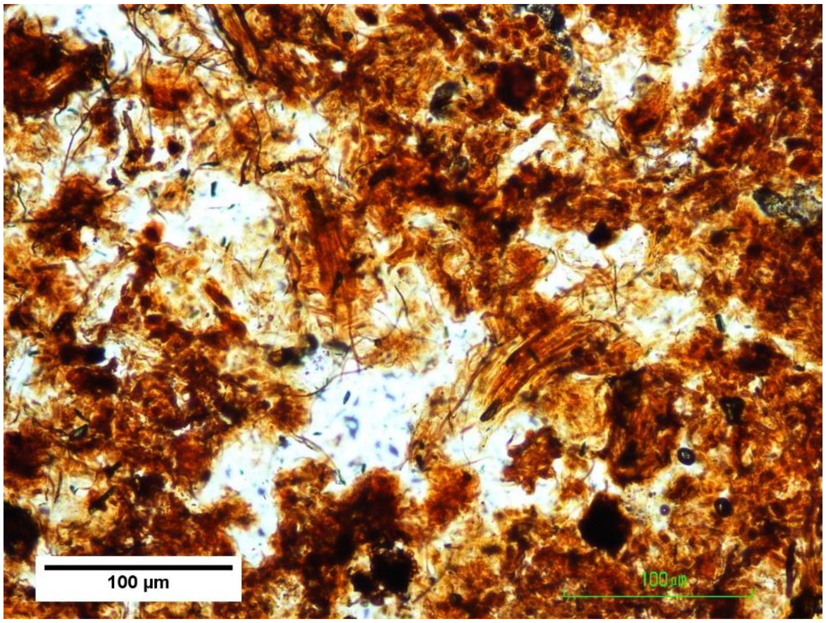

Figure 33. Close up of fabric depicted in Figure 32, thin section MM6 (Tent Ring 1). The fabric appears limpid yellow and is impregnated by fungal hyphae. Some of it is coating amorphous dark-reddish brown phlobaphene-containing organic material.

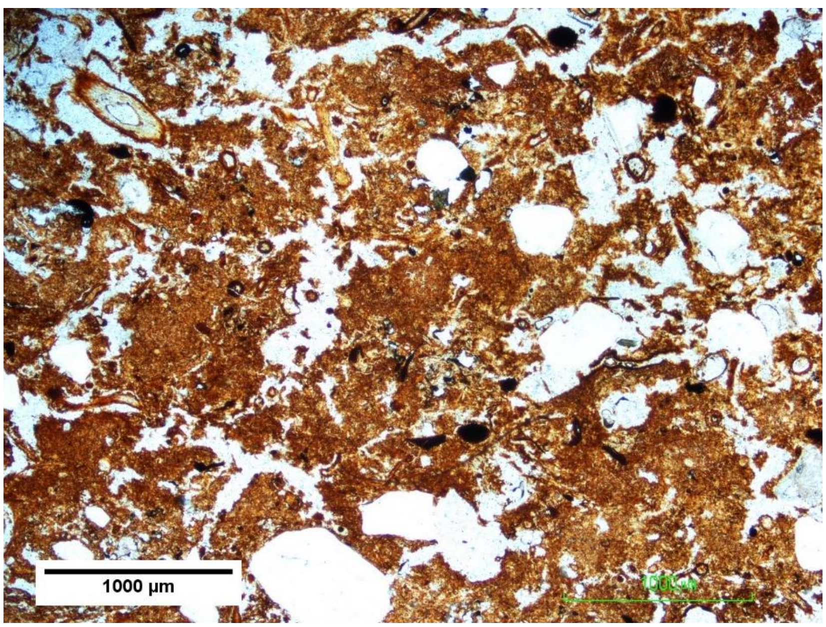

Figure 34. Second of two characteristic fabrics present in organic layer W2, thin section MM6 (Tent Ring 1), with occasional medium and coarse sand-sized quartz grains appearing white in PPL.

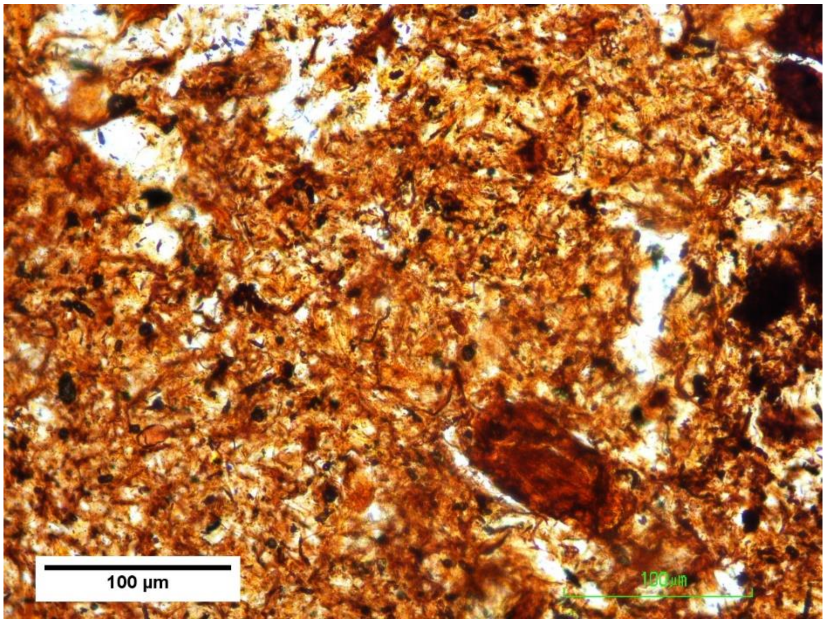

Figure 35. Close up of the fabric depicted in Figure 34, from organic layer W2, thin section MM6 (Tent Ring 1). Fungal hyphae are less abundant.

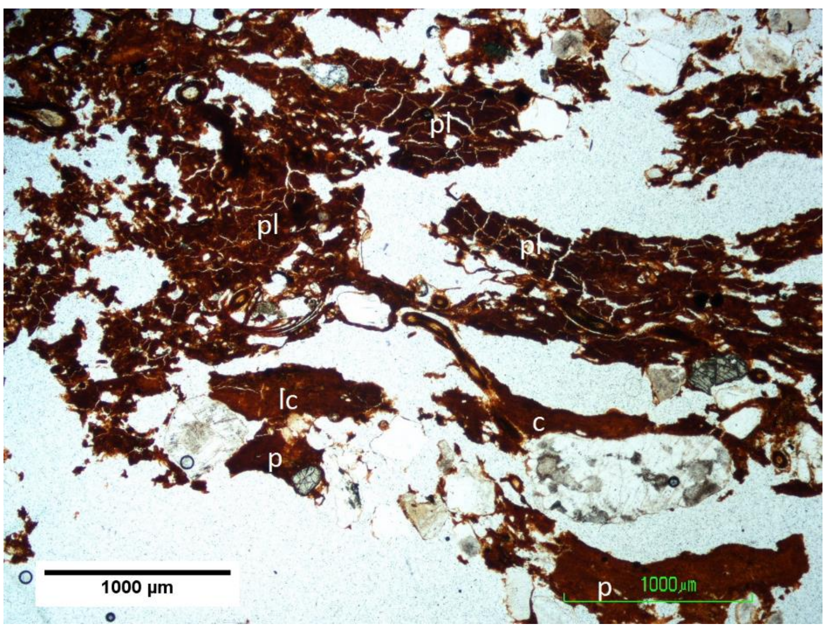

Figure 36. Aspect of organic layer W3, thin section MM9 (Tent Ring 1), revealing an amorphous organic tissue with a subangular blocky microstructure. The planar voids (pl) are likely crack patterns resulting from repeated freezing and thawing. Some of the organic fabric forms cappings (c), link cappings (lc) and pendants (p) on surrounding mineral grains.

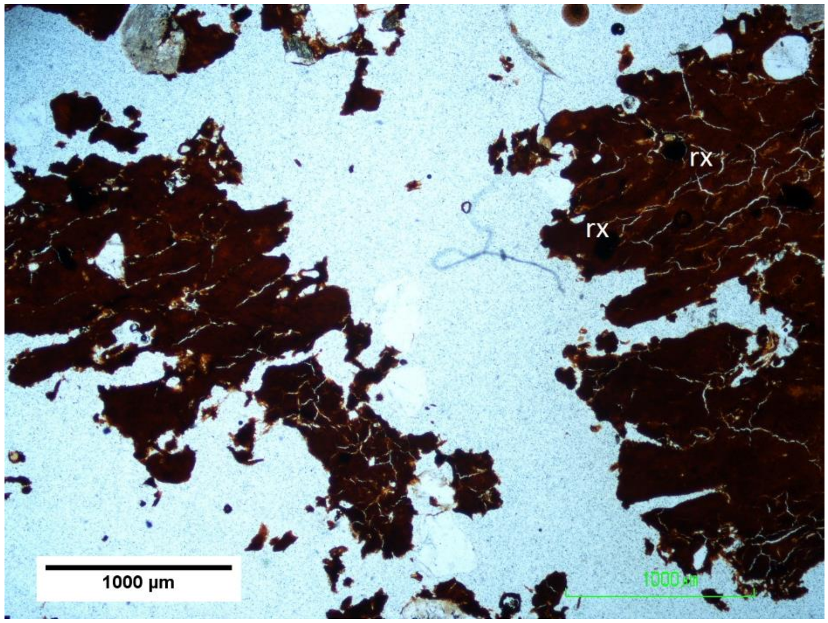

Figure 37. Aspect of organic layer W4, thin section MM10 (Tent Ring 1), likely a continuation of organic layer W3 present in thin section MM9 (Tent Ring 1). The layer exhibits a similar amorphous organic tissue with a subangular blocky microstructure. Impregnative redox features (rx) are highly visible and some of them have also acquired fractures.

Two discontinuous layers, W5, thin section MM13, from Tent Ring 4 and W6, thin section MM14, From Tent Ring 4 (Figures C.13 and C.14, Appendix C) consist of fragments of *Abies* and *Picea* respectively. Both were undergoing comminution by *Oribatid* mites and fungal decomposition at the time of collection; however, the tissue structure was sufficiently intact to allow identification. This indicates that both layers are too recent to be associated with the occupations of Tent Ring 4 but may instead indicate the recent age of soil constituents in the O_f horizon (Figures 38 and 39).

A subrounded coalescence of poorly decomposed organic inclusions, visible as an area of differential fabric in section MM4 from Tent Ring 1 (Figure C.4, Appendix C), has been identified as textural pedofeature s1 (Figure 40). The feature is bound by soil matrix on all sides. It is characterized by increased fungal activity and the presence of multiple clusters of fecal pellets of soil fauna, which exhibit internal coatings developed by staining with organic pigments and fracture patterns consistent

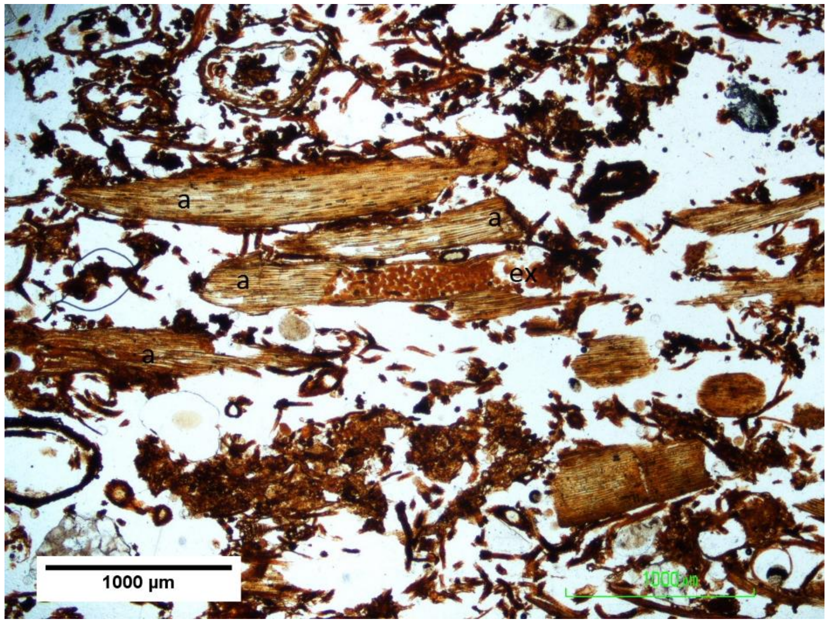

Figure 38. Aspect of organic layer W5, thin section MM13 (Tent Ring 4), consisting of fragments of *Abies* (a) with infillings of coalesced fecal pellets of *Oribatida* (ex). The edges of the fragments and the fecal pellets are stained by organic pigment, but the intactness of the tissues suggests it is a recent addition to the soil.

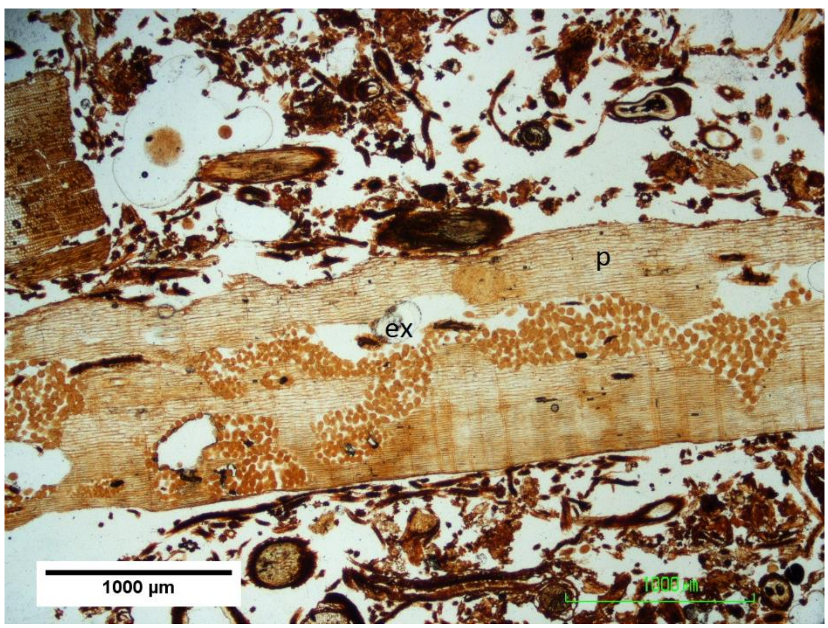

Figure 39. Aspect of organic layer W6, thin section MM14 (Tent Ring 4), consisting of fragments of *Picea* (p) with infillings of fecal pellets of *Oribatida* (ex). Sections of tissue exhibit some loss of cellular structure due to fungal activity.

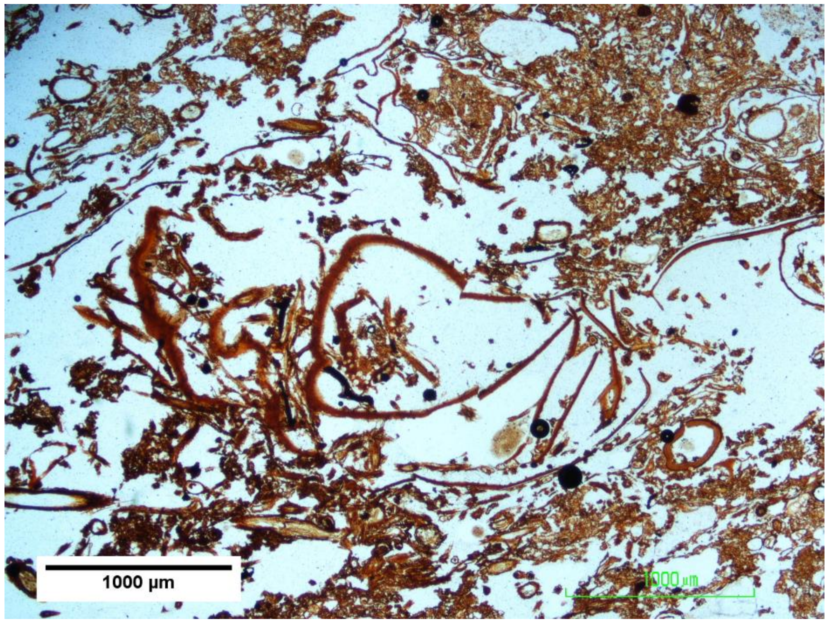

Figure 40. Fabric characteristic of textural pedofeature s1, thin section MM4 (Tent Ring 1).

with frost-shatter. This textural pedofeature represents a discontinuity in the soil horizon, which may indicate a section where the soil has been removed or where plant-based debris has been deposited. However, this interpretation remains tentative.

6.3.2.2. Fungal Activity

The most prevalent fungal components are hyphae. These are the branched filaments of the mycelium, the vegetative apparatus of fungi (Gobat et al. 2004: 37). Fungal activity has been detected predominantly in association with decomposing organic matter, but hyphae and fungal debris are also major components of the organic fraction of soil. Fungal hyphae have been predominantly observed colonizing organic tissues with a high cellulose content. Fungal activity has also been noted to a lesser extent in cork tissue (Figures 41, 42 and 43).

Fungal components of the organic fraction are likely humus inhabiting saprophytic fungi (Duchaufour 1982: 33). Hyphae density increases with the coarseness of organic inclusions and the amount of pore space present. Hyphae are prevalent in sections with high amounts of coarse, poorly

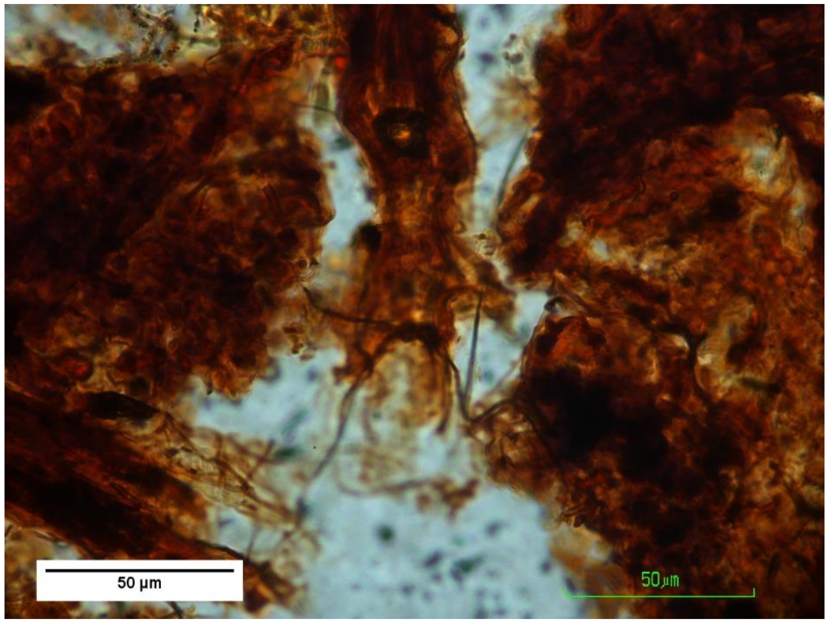

Figure 41. Fungal hyphae associated with dark reddish brown organic fine mass, thin section MM8 (Tent Ring 1). The hyphae are moderately concentrated around organic mass consisting of amorphous organic debris.

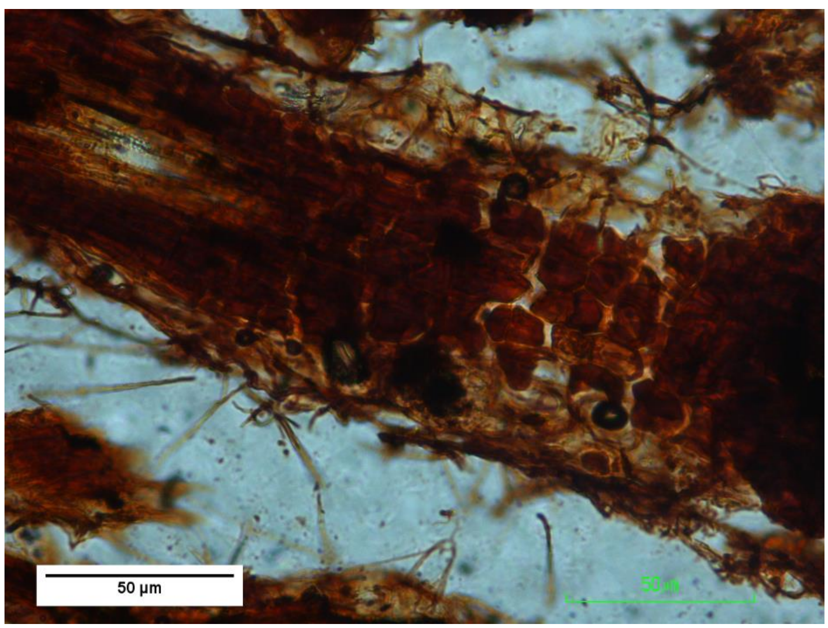

Figure 42. Fungal hyphae penetrating phlobaphene containing organic tissue and dislodging cells, thin section MM11 (Tent Ring 1).

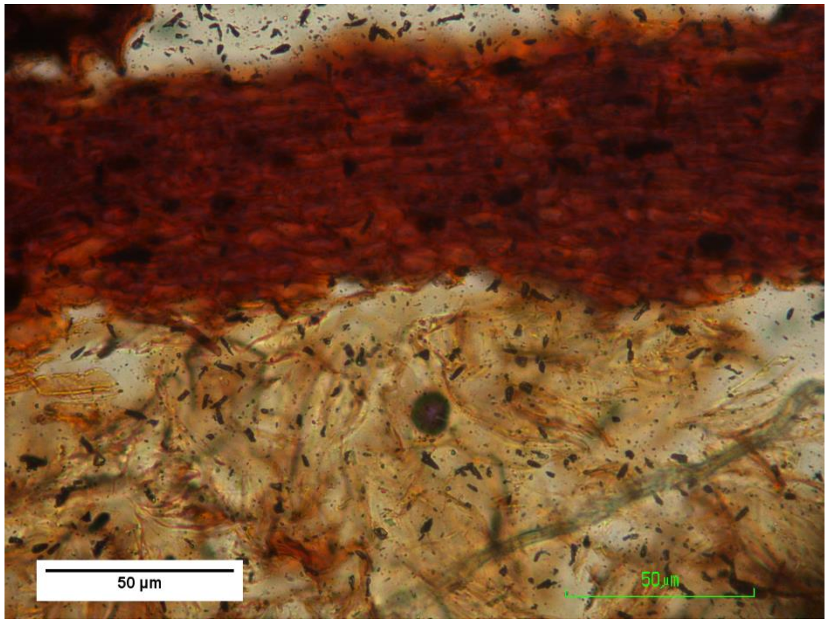

Figure 43. Close up of cellulose-based tissue colonized by fungi, leading to solubilization of organic matter and leaching in soil, thin section MM6 (Tent Ring 1).

decomposed organic material. Within well decomposed organic matter with a high amount of amorphous elements and decomposed organic debris, hyphae density is low to moderate, whereas amorphous tissues, such as those of thoroughly decomposed wood layers, have been observed to be completely devoid of hyphae.

An additional aspect that has been noted to positively influence the density of hyphae associated with soil organic matter is soil porosity. Hyphae are more prevalent in the O_f horizon and in the vicinity of large decomposing organic structures that boost soil porosity, suggesting that poor oxygen levels or anoxic conditions are unfavorable. Overall, more fungal activity has been noted in thin sections collected from the context of Tent Ring 4 (Tables 7 and 9), where soils are considerably more porous. Fungal activity is positively associated with crumb, spongy and vughy microstructures and poorly expressed or absent in platy, subangular and angular blocky microstructures, where the organic fraction generally exhibits a more through level of decomposition, finer organic inclusions and reduced porosity (Tables 7 and 9).

Fungal components associated with decomposing organic structures, and particularly wood tissues, are likely Basidiomycetes. These are wood-inhabiting saprophytic fungi also known as white rot and brown rot. They colonize woody tissues and break down the cellulose, hemicellulose and lignin from cell walls. Brown rots and some selective white rots decay cellulose and hemicellulose, but not lignin, leaving some of the cellular tissue intact. Non-selective white rots, or simultaneous white rots, remove lignin and all structural carbohydrates at a similar rate, resulting in the homogeneous decay of cell walls and a complete obliteration of cellular structure (Duchaufour 1982: 33; Pandey and Pitman 2003).

Early stages of this process are characterized by the visible penetration of organic tissue by fungal hyphae along cell walls. Later stages of decomposition often involve the solubilization of organic matter. A limpid, speckled fabric impregnates the soil matrix adjacent to decomposing organic structures, consisting of cellular debris and fungal hyphae (Figure 44). Fungal hyphae will also decay fecal pellets of *Oribatid* mites that have been feeding on wood cellulose, suggesting that the decay sequence of organic tissues begins with comminution by soil fauna, followed by fungal dissolution (Figure 45).

Sclerotia, the reproductive structures of mycorrhizal fungi, have also been noted (Figure 46). These fungi are symbiotic species that facilitate the uptake of nitrogen by tree roots (McWeeney 1989). Isolated occurrences of inactive sclerotia have only been noted in the C_g horizon. It is likely that they are additions to the soil, associated with the storage of harvested wood or wooden structural elements of the tents, as soil conditions on the terrace were unsuitable to support tree growth at any time in their history (see Appendix A).

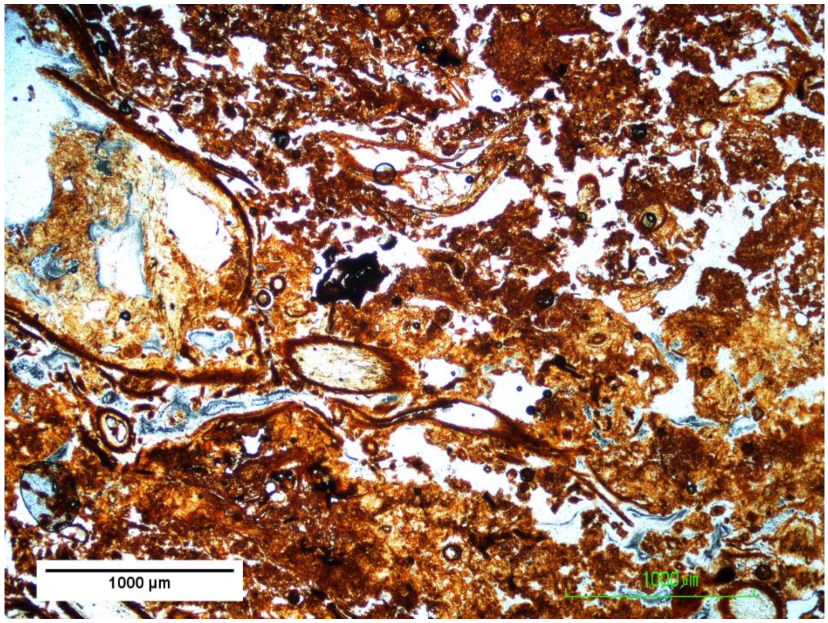

Figure 44. Fungal activity inside the cavity of a decomposing vascular plant structure leading to the solubilization of decomposing organic matter and impregnation of adjacent soil matrix; visible as a yellow-brown fabric impregnating the dark-reddish brown soil organic matter, thin section MM8 (Tent Ring 1).

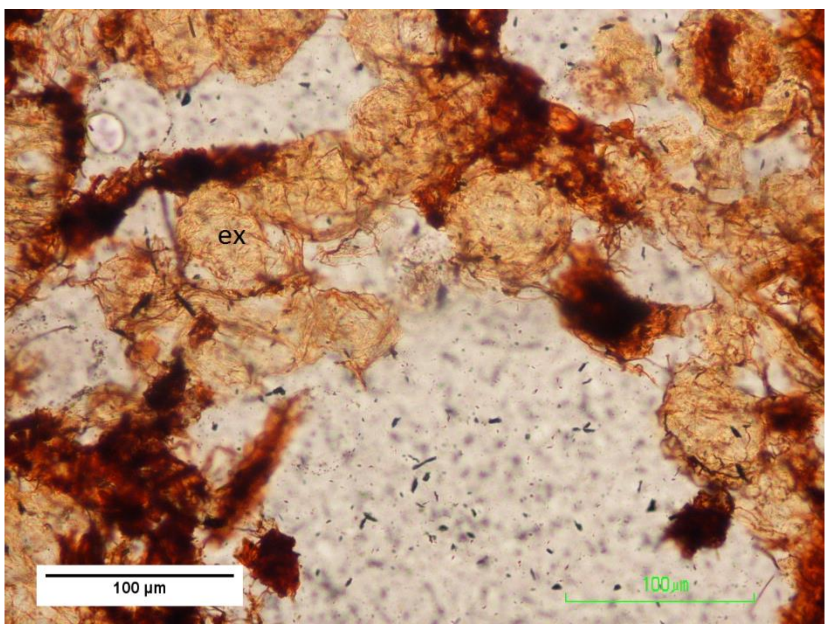

Figure 45. *Oribatid* mite fecal pellets (ex) embedded with fungal hyphae inside a comminution cavity in an organic tissue fragment, thin section MM2 (control sample).

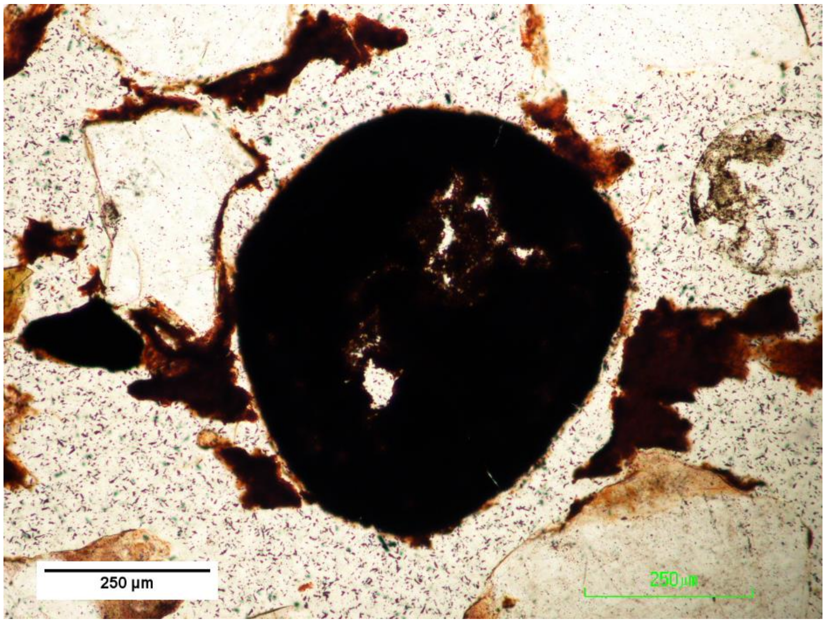

Figure 46. Sclerotium of *C. graniforme*, embedded in the C_g horizon, thin section MM 10 (Tent Ring 1).

6.3.2.3. Organic Fine Mass

All organic fine mass has been classified as polymorphic (Tables 6, 7, 8 and 9) and consists of amorphous organic residues, stained with organic pigment, poorly decomposed single or interconnected phlobaphene-containing cells and cell debris and fungal components (Figure 41). However, the amount and degree of development of organic fine mass varies within and between contexts.

Organic fine mass is generally well developed, albeit discontinuous, in the O_m horizon. The overall shallowness of the soil profile is likely the most significant factor that influences the degree of organic fine mass development. Dense pockets of decomposing holo-organic inclusions, associated with spongy and vughy microstructures, where organic matter is less abundant, are interspersed with sections of subangular blocky and platy microstructures in which fine organic mass development is more consistent (Tables 7 and 9; Figure 47). However, some individual organic inclusions are still recognizable, suggesting an incomplete level of decomposition and poor humification, consistent with a mor humus designation (Gobat et al. 2004: 226).

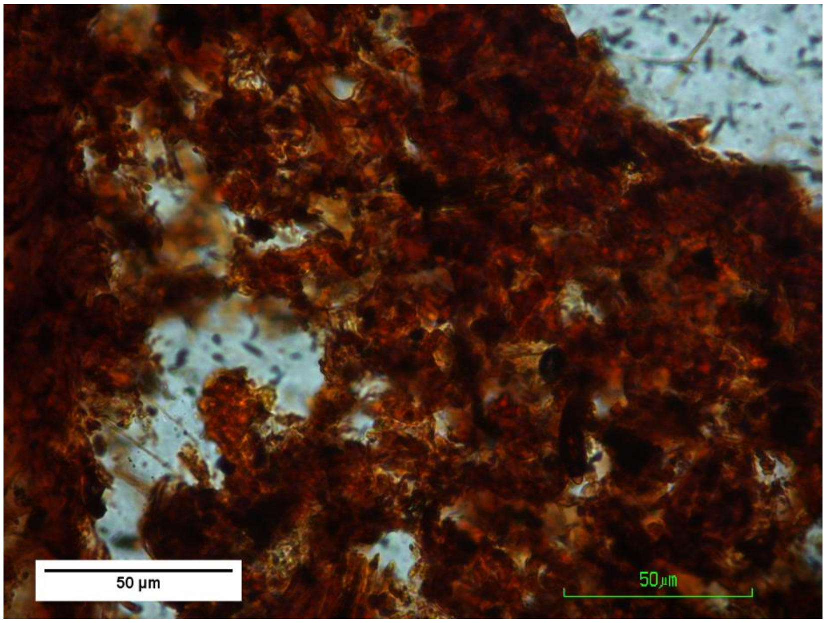

Figure 47. Well decomposed, amorphous soil organic matter from the O_m horizon, thin section MM8.

O_f horizons are characterized by a high ratio of coarse organics to fine organic mass (Table 9; Figure 27), characteristic of litter mats. Where present, fine organic mass is less well developed with characteristically coarser inclusions and abundant fungal hyphae (Figure 48).

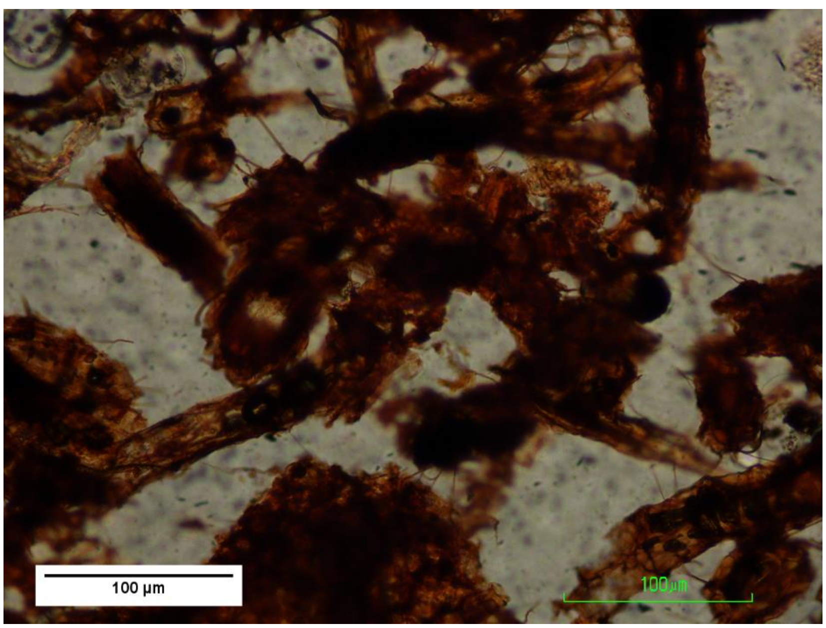

Figure 48. Fabric characteristic of soil organic matter from the O_f horizon, thin section MM12.

As previously discussed, a small amount of the fine organic mass becomes translocated into the C_g horizon, where it appears as hypocoatings on some of the mineralic grains and intergrain aggregates (Figures C.1, C.3, C.6, and C.11, Appendix C and 18 and 19; Tables 6 and 8). This may also be accompanied by the differential down-profile movement of aluminum and iron (Wilson and Righi 2010: 251 – 257). However, this process is in an incipient stage, indicated by the poor development of coatings (Figures 21 and 22) and the increased porosity of the C_g horizon.

6.3.3. Soil Faunal Activity

Very localized occurrences of features associated with soil fauna activity have been noted, suggesting that soil conditions are adverse to their development. Soil fauna related features have been noted particularly in relation to the input of large woody fragments, which seem to create ameliorating conditions (Tables 7 and 9). Fecal pellets are mainly located in primary contexts, inside channel features, such as in thin sections MM3 and MM4 from Tent Ring 1, or inside comminuted organic fragments, such as in thin section MM12 from Tent Ring 4 (Appendix C). Soil fauna fecal matter has a minimal contribution to soil organic matter. They become slightly more abundant in thin sections from Tent Ring 4 (Table 7 and 9).

A small number of occurrences of *Enchytraeid* fecal pellets were noted (Figure 19), predominantly in thin sections coming from Tent Ring 1 (Table 7). Fecal matter appears either as pellets, within primary context, as infillings of channels, or as coalescences embedded in soil matrix. *Enchytraeid* fecal pellets and coalescences have been associated with the textural pedofeature s1, from section MM4, Tent Ring 1 (Figure C.4, Appendix C) associated with a distinctive channel microstructure, strongly indicative of soil faunal activity. Isolated coalescences of *Enchytraeid* fecal matter were also identified in thin section MM10 from Tent Ring 1 (Figure 19), where it was embedded into the soil matrix. A single coalescence was noted in thin section MM12 from Tent Ring 4 (Figure

C.12, Appendix C). However, *Enchytraeid* activity is not substantial, which is evidenced by the minimal amount of mixing of soil organic matter and the intactness of organic inclusions.

Oribatid mite activity is strongly associated with organic inclusions and with recent organic layers (Figures 31, 38, 39 and 45; Tables 7 and 9). In sections from Tent Ring 1, *Oribatid* mite fecal pellets have only been identified in two contexts, in thin sections MM3 and MM4, where additions of organic inclusions seem to create ameliorating conditions (Table 7). A substantial amount of droppings are present within the surrounding matrix in organic layer W1, thin section MM3 from Tent Ring 1 (Figure C.3, Appendix C, see also Figure 31) where they are a main component of the soil fabric. Several coalescences of various ages, as indicated by differential staining with soil organic pigment and the development of fracture patterns on some of the pellets, are present in the textural pedofeature s1, identified in thin section MM4, from Tent Ring 4 (Figure C.4, Appendix C). Within thin sections from Tent Ring 4, *Oribatid* mite droppings are commonly associated with decomposing vascular plant structures and organic layers, particularly recent organic layers, with intact cell structures (Table 9).

6.3.4. Humus Classification

The poor humification of the organic horizons, accumulation of holo-organic inclusions, low levels of soil faunal activity and the presence of fungi are consistent with a mor humus designation. This is determined by the presence of *Ericaceous* vegetation, which supplies an acidifying litter, poor in nitrogen and enriched in phenolic acids and tannins (Gobat et al. 2004: 226 – 227). In thin section, this is confirmed by the abundance of phlobaphene-containing cells and cell residue in soil organic matter. Soil faunal activity is limited due to the presence of these toxic substances, which also inhibit bacterial activity and humification. This prevents mixing and has led to the preservation of intact wood layers.

Control section MM2, taken from the backfill (Figure C.2, Appendix C), contains organic inclusions that were buried for a known period of two years. Buried fragments of moss and lichen are the result of the mechanical mixing of soil layers when the pit was backfilled. After a burial period of two years, tissue structure is unaltered, and minimal deformation and infilling of void spaces with soil organic matter has occurred, which suggests that these processes take place very slowly, due to the constraining effect of climatic conditions.

6.3.5. Redoximorphic Features

Impregnative redoximorphic features consist of few to moderate opaque subangular and subrounded nodules and very few impregnations of Fe-Mn (ferro-manganese) oxyde and/or hydroxide (Figures 49 and 50). These features are a result of the reduction and oxidation of iron and manganese in soil after water saturation and desaturation, respectively. Iron and manganese are reduced and then oxidized in voids with remaining oxygen, where they precipitate and form nodules. An opaque appearance indicates that manganese is present with the iron (Lindbo et al. 2010; Tan 2000: 49).

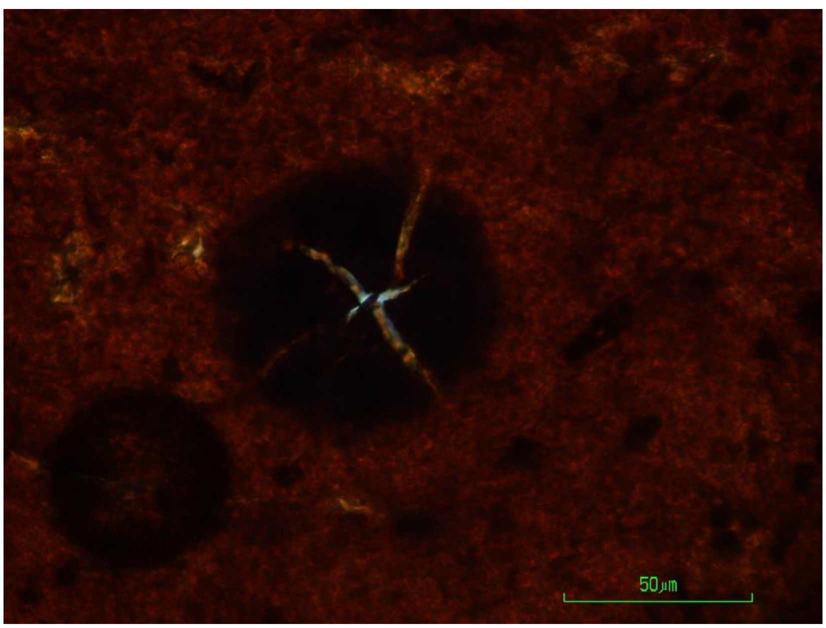

Figure 49. Close up of the fabric of W4, MM10 (Tent Ring 1), exhibiting a Fe/Mn oxide nodule with a star-shaped crack pattern.

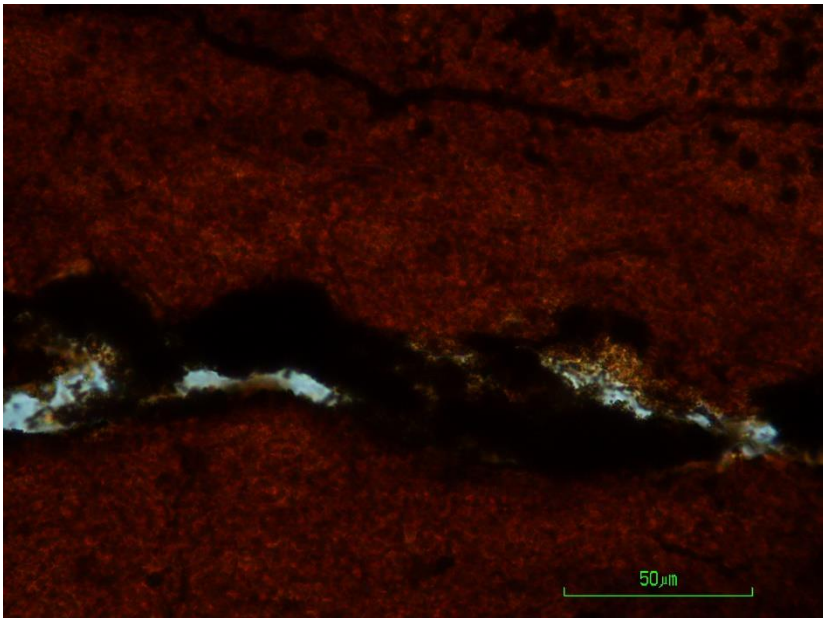

Figure 50. Close up of the fabric of W4, thin section MM10 (Tent Ring 1), exhibiting a Fe/Mn oxide hypocoating on the wall of a channel void.

Intermittent periods of saturation, no longer than a few weeks at a time, are likely to be responsible, as longer periods of saturation are required for to the formation of iron nodules poor in manganese, with a distinctive reddish hue (Lindbo et al. 2010: 129; Stoops et al. 2010: 30). These are likely the result of saturation of the soil with melt water during spring and summer months, leading to the depletion of oxygen in soil (Duchaufour 1982: 70). None of them have been coalesced into aggregates, suggesting minimal disturbance and transport, likely due to the level surface on which the feature was located.

Redox features are predominant at the bottom of the O_m horizon, on sections coming from Tent Ring 1, likely due to the increased water holding capacity of organic matter (Tables 6 and 7). Nodules are less frequent in the upper sections of the C_g horizon. No redox features have been observed in sections coming from Tent Ring 4, likely due to the increased porosity of the soil and less abundant organic fine mass, which affects the water holding capacity of the soil. However, this does not presuppose that reduction and oxidation processes are not taking place, but that these processes are not strong enough to be expressed.

6.3.6. Cryogenic Features

Some slight deformations of horizontal layers have been attributed to the formation of ice lenses in sections with predominantly lenticular platy microstructures, characteristic of frost-affected surface horizons (Figures 18 and 19). A wavy aspect has also been observed on soil profiles in the field. However, the expression of cryogenic features is minimal due to the absence of clay in the soil profile, which prevents the formation of characteristic isoband microstructures and lamellar coatings and infillings on grains and void surfaces (Todisco and Bhiry 2008: 13; Van Vliet-Lanoe 2010: 96).

Frost-shattering of organic layers, in thin sections MM9 and MM10, from Tent Ring 1 (Figures 18 and 19) caused by their high moisture retention capacity, leads to subangular blocky microstructures, consistent with frost cracks. Frost cracks are also present on the Fe-Mn nodules that impregnate these layers (Figures 49 and 50) (Van Vliet-Lanoe 2010: 94).

6.3.7. Anthropogenic Impact

Soil components of anthropogenic provenience are present in limited amounts, consisting of charcoal fragments and wood layers. None of the sections contained bone or shell, which may suggest that bone is poorly preserved in the soil or may be related to the small amount of bone present. During the excavation, bone fragments were only identified in the hearth feature, embedded in the C_g horizon and in a small cluster against the southwestern wall of Tent Ring 1-West (Figure 11).

Compacted horizons are characteristic of archaeological floors, even those of a short occupation (Macphail 2008: 2070). It is likely that compacted soil rebounds due to the shallowness of the profile and coarseness of both the mineral and organic fraction. Control section MM1, collected from a section of a path (Figure C.1, Appendix C) with a highly compacted appearance in the field exhibited only moderate compaction in thin section. Since faunal activity is low, however, mixing of soil horizons is more likely to be indicative of human activity. A limited amount of mixing and trampling of soil horizons is consistent with the banded distribution of the mineral fraction in thin sections MM4 and MM5 from the floor of Tent Ring 1 (Table 7).

Charcoal fragments are predominant in the upper section of the C_g horizon and lower section of the O_m horizon. A total of 11 fragments have been identified, with sizes between 2.35 and 0.25 mm. Charcoal fragments are associated with the organic layers W3 and W4, in thin sections MM9 and MM10 from Tent Ring 1 (Figures 18 and 19), where they are embedded in the matrix of the C_g horizon. Charcoal associated with a recent *Abies* fragment has also been found in association with the banded mineralic distribution identified in thin section MM4 from Tent Ring 1 (Table 7).

The presence of wood layers was also noted during the soil survey portion of the analysis (Appendix B). The widely differing stages of decomposition in which these layers are found suggests that they belong to different episodes of deposition. Based on their similar fabric, microstructure and their proximity on the tent floor, layers W3 and W4 from sections MM9 and MM10 Tent Ring 1 (Figures 18 and 19), are likely a singular continuous wood layer. The amorphous aspect of the layers, with a complete obliteration of cellular structure, as well as the presence of multiple impregnative redox features in the fabric, some of which have been fractured during repeated freeze-thaw cycles, suggest that these are the oldest wood layers present and may be associated with the occupation of Tent Ring 1.

6.4. Conclusions

Micromorphological investigations confirm the presence of a young soil, in an incipient stage of pedogenesis, with a shallow profile consisting of an organic top layer which incurs low levels of mineral mixing and poor humification and a mineral substrate consisting of largely unweathered mineralic grains, with minimal down-profile movement of organic matter. This is due to the young age of the substrate, but also due to the limiting effect of climatic conditions and the vegetation cover.

From a taphonomical perspective, the toxicity of the *Ericaceous* litter appears the be the main constraining factor for the activity of soil fauna and bacteria, evidenced by the large amount of tannic residues in fine organic matter, which likely led to the modern appearance of entomological specimens noted by the paleoentomological assessment (Cloutier-Gelinas et al. 2011). However, this does not preclude fungal activity, which has occasionally been observed to have a substantial impact on organic inclusions.

Fungal activity appears more pronounced in sections from Tent Ring 4, most likely due to the increased porosity of the soil and poor soil organic matter development in the O_f horizon. The increased water retaining capacity of soil organic matter, suggested by the presence of Fe-Mn nodules and coatings on void walls, successfully limit fungal activity in the O_m horizon, leading to an increased preservation of organic inclusions in Tent Ring 1.

Cryoturbation has a low impact. Horizons exhibited a slightly wavy aspect in the field, suggesting minimal deformation from the pressure of ice lenses. Ice lenses likely produced the wavy, bow-shaped and subhorizontal appearance of layers in thin section, but no substantial mechanical displacement or mixing of particles has been noted. A low impact is also suggested by the high ratio of plant organ fragments to tissue fragments and the minimal disturbance of fragmented organic structures.

Soil complexity constitutes one of the main sources of uncertainty in soil chemical studies. From a chemical perspective, young soils with well separated organic and mineralic horizons and poor humification preclude the formation of organomineral complexes that can incorporate and occlude soil chemicals (Duchaufour 1982: 183), particularly phosphorus. However, this does not preclude occlusion of phosphorous by aluminum and iron hydrous oxides (Holliday 2004: 344).

The minimal weathering of the underlying mineral substrate prevents the release of geogenic chemicals in soil. The weathering of feldspars, muscovite and biotite from the underlying mineral substrate have the potential to contribute significant amounts of potassium, calcium, aluminum and iron to the soil which would obscure anthropogenic inputs (Oonk et al. 2009b; Tan 2000: 35 – 41). However, the limited weathering of biotite, the least resistant mineral present, confirms that this is not a significant source of bias for the chemical analysis.

The predominance of enaulic distributions in the top section of the C_g horizon suggests minimal translocation of soil organic matter and consequently limited leaching of aluminium and iron. However, seasonal saturation of the soil with water does impact iron and manganese, which are reduced in soil and form nodules at the bottom of the O_m horizon. The sequence of reduction of elements in saturated soils always occurs in a given order, depending on the length of the period of saturation. The sequence starts with oxygen and nitrate nitrogen, followed by manganese, iron and finally by sulfate. The presence of Fe-Mn redox nodules, discussed under redox features, indicates that nitrate nitrogen is strongly impacted, even though this does not produce any morphological signatures (Lindbo et al. 2010: 130 – 131).

Evidence of human activity is limited and association with the occupation of the tent floors is tentative. All the wood layers are likely anthropogenic additions to the soil but seem to have occurred at different times. While two of the layers identified, W3 and W4 from thin sections MM9 and MM10, likely consist of wood that was a part of the tent frame, the rest are unconnected to the occupations. Additions of wood appear to have an ameliorating effect on the soil, boosting faunal and fungal activity and the development of soil organic matter. It is likely that human activity is one of the main factors of soil formation on the island.

A small amount of charcoal fragments and the limited intermixture of soil horizons in the vicinity of the hearth and cooking cluster areas are likely remnants of the original tent floor. The absence of structures associated with compacted soils may suggest that the tents were only occupied for brief amounts of time, but it may also be due to the influence of root activity on soil microstructure.

Chapter 7. Soil Chemical Analysis of Samples from Tent Ring 1, Tent Ring 4 and Associated Contexts from Huntingdon Island 5

7.1. Introduction

The soil chemistry section of the analysis assesses the chemical impact of tent camp sites on soil and whether soils samples collected from features identified during the excavation of Tent Ring 1 and Tent Ring 4, such as the hearth, cooking cluster and bench areas, as well as sections of unassigned floor space, are defined by differential chemical signatures, thus obtaining a measure of the patterning of different activities on the tent floors. Chemical analysis is undertaken in an ecological framework, in which the plant-available form of soil chemical elements is studied in relation to plant and local fauna activity. A sample associated with the contemporary kitchen tent in use during the excavation season was provided as a proxy for the impact of modern activities on soil.

Domestic activities cause a localized enrichment of soil chemicals known as euthrophication (Butler 2008: 17). This is the result of additions of domestic waste to the soil, including vegetal and animal refuse and waste. The differential patterning of values at occupation sites represents their chemical signature, which provides a link to the *taskscape* associated with the settlement and also represent a leading cause of vegetational change at these sites. These vegetational changes can consist of qualitative and quantitative changes in the amount and types of plant species available at the site (Butler 2008; Derry et al. 1999; Duchaufour 1982: 140; Gobat et al. 2004: 245, 249). Therefore, the perspective offered by environmental chemistry (Tan 1996; Tan 2000) offers a close link to the paleoethnobotanical section of the analysis.

A recent study of Yup'ik fishing camps in the Yukon-Kuskokwim Delta (Knudson et al. 2004), similarly focused on readings of the plant-available form of soil chemical elements, has revealed that such analyses are particularly successful in arctic regions. The study showed that even after a single season of use, a contemporary fish processing site retained high loads of ambient soil chemicals that differentiated it from surrounding conditions. The results of this study are particularly promising as one of the study sites was located in similar conditions, with shallow, poorly developed soils, characteristically poor in clays and covered by a crowberry heath (Knudson et al. 2004: 449). The study concluded that these types of soils are particularly well suited to preserve signatures of ephemeral camps and that activity patterns as well as the length of occupation of a site can be ascertained based on chemical loads alone (Knudson et al. 2004: 454).

Based on field investigations and the results of the micromorphological analysis, low levels of mineral mixing, minimal chemical weathering of underlying sediment, resulting in low levels of geogenic chemical inputs, and an overall slowing down of pedogenetic processes as a result of climatic constraints, are the main factors that determine the effectiveness of chemical analyses in arctic and subarctic conditions. This overturns the common belief that only substantial human activities can be captured by chemical readings (Holliday 2004: 290) and strengthens the necessity of applying chemical analyses in broad soil science frameworks in which the complexity of soils can be studied from multiple perspectives.

7.2. Laboratory Methods

Samples collected for chemical analysis were dried and sieved through geological sieves (mesh sizes 1.7 mm, 500 µm and 250 µm) and coarse organic inclusions were removed from the sample before processing. Samples were taken from the O_m horizon in Tent Ring 1 and the O_f horizon in Tent Ring 4. This is consistent with the average depth of artifacts recovered in each tent ring. For samples collected from the C_g horizon, such as HS1 and HS2, collected from the hearth, BC (C_g), collected from the bone cluster, CC, collected from the cooking cluster, and P1, collected from the presumed entranceway in Tent Ring 1-East, the influence of the mineral fraction on sample chemistry will be considered in the discussion.

Sample processing was carried out in the prehistory laboratory at Memorial University, using a La Motte soil fertility kit, model STH-14. The kit is based on the Mehlich I extraction procedure, which is equivalent to procedures established by the Ontario Soil Management Committee (Carter 1993). Values obtained are based on colorimetric scale readings. This soil kit provides data on soil chemical components in their macronutrient form, as they are available to plants. Testing was undertaken for nitrate nitrogen, phosphorus, potassium, calcium, iron, aluminum, magnesium and manganese. PH measurements were performed with a Hydrofarm HM Digital HMDPH200 pH probe.

7.3. Results and Discussion

Results are listed in Tables D.1, D.2, D.3 and D.4 from Appendix D. All readings reported are for 100 mg of dry soil. Values are assigned based on colorimetric scales with pre-determined value ranges, which limits the precision of the instrument. Discussion is subsumed under each chemical element. The analysis uses the modern kitchen sample described in Chapter 5 as a measure of the impact of modern activities. Results are contrasted with values obtained from the background samples collected from relevant vegetation zones and samples collected from House 2 and House 4 from the winter component of Huntingdon Island 5.

7.3.1. PH

The degree of acidity or alkalinity in soils, also known as soil reaction, is determined by hydrogen ion (H^+) concentrations in the soil solution. The pH is expressed by values between 1 and 14, with a range between 4 and 5 representing a strongly acidic soil, a range between 5 and 6 a moderately acidic soil, a range between 6 and 7 a slightly acidic soil, and a range between 7 and 8 a slightly alkaline soil. Recording pH levels is important because the solubility of some soil chemicals, especially iron and aluminum, is impacted by soil pH. In soils that are too alkaline, some chemicals become unavailable because they are insoluble (Tan 1996: 98).

In soil, pH values are impacted by vegetation growth and human activity. Vegetation type can have an ameliorating (alkalizing) or acidifying effect on the soil horizon, depending on plant nitrogen content, the cellulose to lignin ratio and the presence of other toxic constituents in the plant tissue. *Ericaceous* vegetation will have an acidifying effect on the soil horizon by releasing lignin, tannins, phenols and other organic acids through its decomposing litter. This will inhibit bacterial activity at these vegetation sites (Derry et al. 1999: 210; Gobat et al. 2004: 23).

The pH value can also be an indicator of human activity. Derry et al. (1999) noted that pH values decrease on human habitation sites as opposed to an undisturbed context. This signal may be obscured at Huntingdon Island 5, however, due to the shallowness of the soil and the proximity of the area of root growth to the archaeological layer, because root activity can also significantly impact pH values. PH values can drop by as much as two points in the active layer of root growth (Gobat et al. 2004: 24).

Samples from the vegetation zones reveal an upward trend towards the beach, with terrace samples clustering between 5.1 and 5.2 within the moderately acidic range, samples from the rocky shore clustering between 5.5 and 6.6 in the moderately to slightly acidic range, and the sample from the transitional coast area yielding a value of 7.2, in the slightly alkaline range. This is consistent with the patterning of acidifying to ameliorating vegetation on the terrace feature. The modern kitchen sample did not diverge from this pattern; it yielded a reading of 6.6, similar to the rocky shore samples with which it is spatially associated. Samples from the winter houses dataset yielded a range of values between 5 and 6 in the moderately to slightly acidic range. This does not diverge significantly from surrounding soil conditions but may reflect the effect of plant roots (Appendix D).

On the floor of Tent Ring 1, pH values ranged between 4.8 and 6.8, denoting strongly acidic to slightly acidic soil conditions (Figure 51). Most samples are located in the moderately acidic range with values between 5 and 6. The hearth feature seemed to register slightly higher values than the surrounding samples, including the cooking cluster, but these increases are in the decimal range. A more obvious vertical patterning of values was noted when comparing samples taken from the C_g horizon to those collected from the O_m horizon. PH values tend to increase with depth. In the hearth feature, for example, surface values taken from the O_m horizon clustered between 5.1 and 5.7, whereas HS1, taken from the upper spit in the C_g horizon, yielded 5.8 and HS2, taken from the lower spit in the C_g horizon, yielded 6. In the bone cluster area, the BC sample taken from the C_g horizon yielded 5.5, whereas the BC (C_g) sample yielded 6 and the P1 sample, also taken from the C_g horizon, yielded 6.8. This represents a notable increase relative to the surrounding surface values, which range between 5.2 and 5.8. The CC sample collected from the cooking cluster is the only sample that did not register a

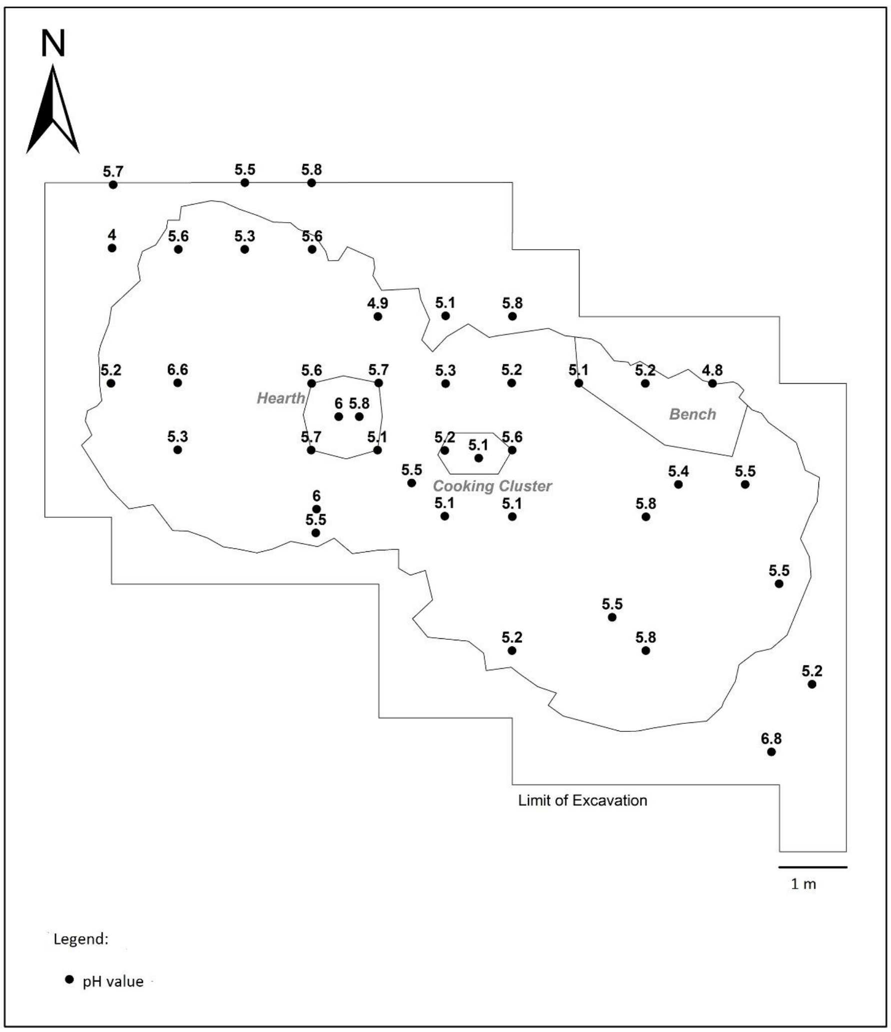

Figure 51. Distribution of pH values recorded in Tent Ring 1.

similar increase in pH with depth, relative to surrounding surface values. These distributions confirm the acidifying effect of the *Ericaceous* vegetation cover.

On the floor of Tent Ring 4, pH values ranged between 5.7 and 6.7, similar to the rocky shore samples (Figure 52). The majority of samples ranged between 6.3 and 6.7 in the slightly acidic range,

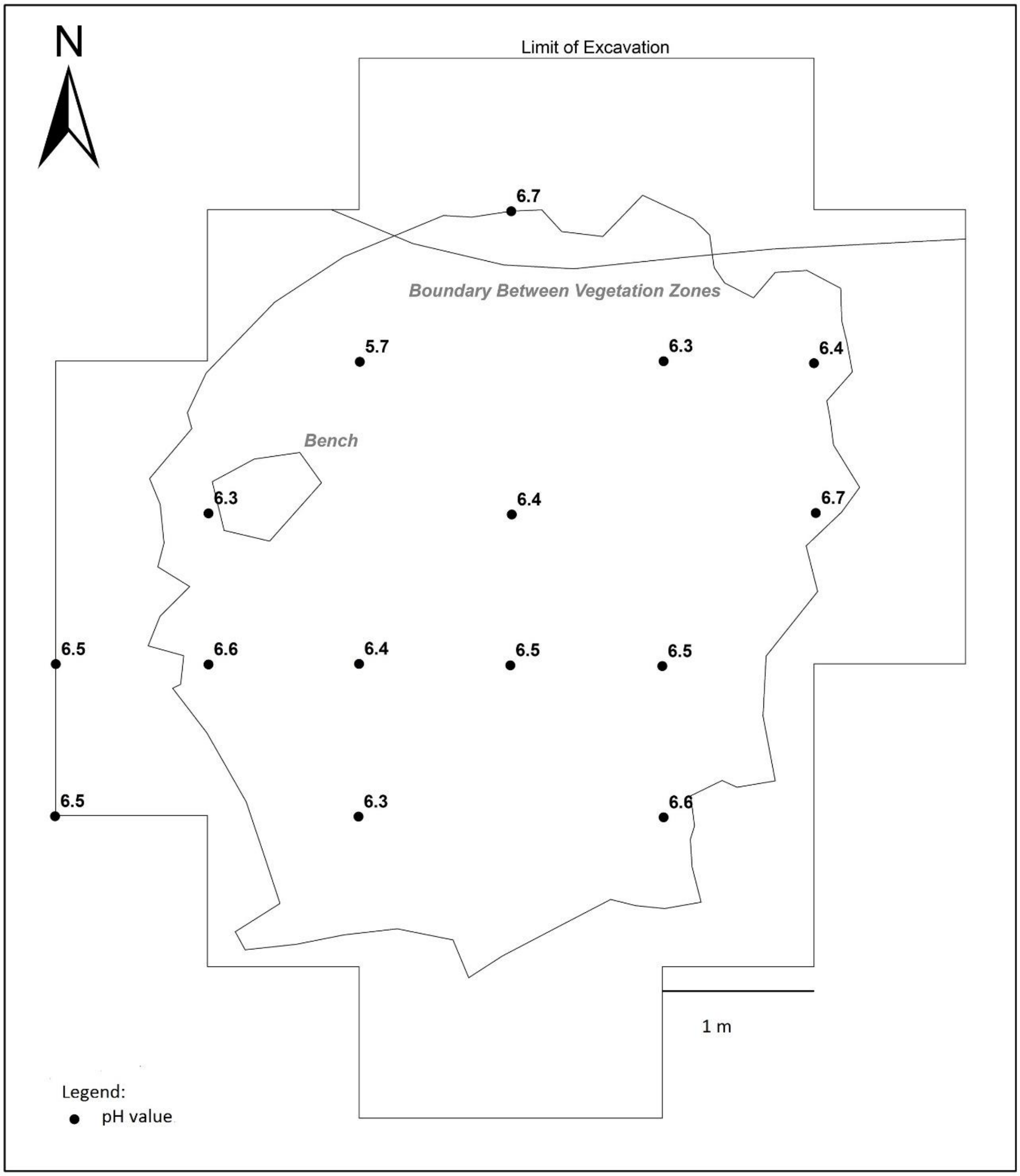

Figure 52. Distribution of pH values recorded in Tent Ring 4.

consistent with increasing amounts of non-*Ericaceous* vegetation.

7.3.2. Nitrogen

Nitrogen readings are provided for the nitrate nitrogen (NO_3^-) form, which is the end product of the nitrogen soil cycle and requires bacterial or plant activity to be fixed in soil. Nitrogen is a very mobile element that passes through multiple states during the nitrogen soil cycle, including a gas state, and can therefore have a variety of sources, including the atmosphere. This is likely to obscure the amounts of nitrogen contributed by human activity (Tan 2000: 114 – 120).

Nitrogen in nitrate form (NO_3^-) has been shown to be high at recent historical sites, owing to its abundance in human and animal waste (Holliday 2004: 300 – 301). However, this is likely also related to plant growth. Nitrogen additions have been shown to increase plant growth and once stimulated, plant activity will limit leaching by continually cycling the nitrogen, thus maintaining the high levels (Derry et al. 1999: 205). This depends on the type of vegetation cover, as *Ericaceous* species prevent nitrogen fixation (Duchaufour 1982: 45; Gobat et al. 2004: 23). Therefore, nitrogen values are expected to be highest in anthropogenic contexts defined by a non-*Ericaceous* vegetation cover.

Nitrate nitrogen (NO_3^-) values range between 125 (very low), 250 (low), 500 (low to moderate), 750 (moderate), 1250 (moderate to high) and 1875 (high) ppm. The lowest value recorded for nitrate nitrogen is 0 and the highest is 1250 ppm. The mode for nitrate nitrogen is 125 ppm.

On the floor of Tent Ring 1-West, values ranged between 0 and 1250 ppm (Figure 53; Table 10). Out of 19 samples tested, 11 ranked very low (125 ppm), one ranked moderate (750 ppm) and one ranked moderate to high (1250 ppm), whereas four samples provided a 0 reading (Figure 53). The highest values came from the hearth, from samples HS1 and HS2, both collected from the C_g horizon. Out of the two bone cluster samples, BC (C_g) ranked low and BC read 0. Two samples that ranked low (250 ppm) are located against the hold-down rocks in the north section of the floor and immediately outside the wall in the northwestern section of the feature. The indent sample, spatially associated with the latter, yielded low (250 ppm) as well.

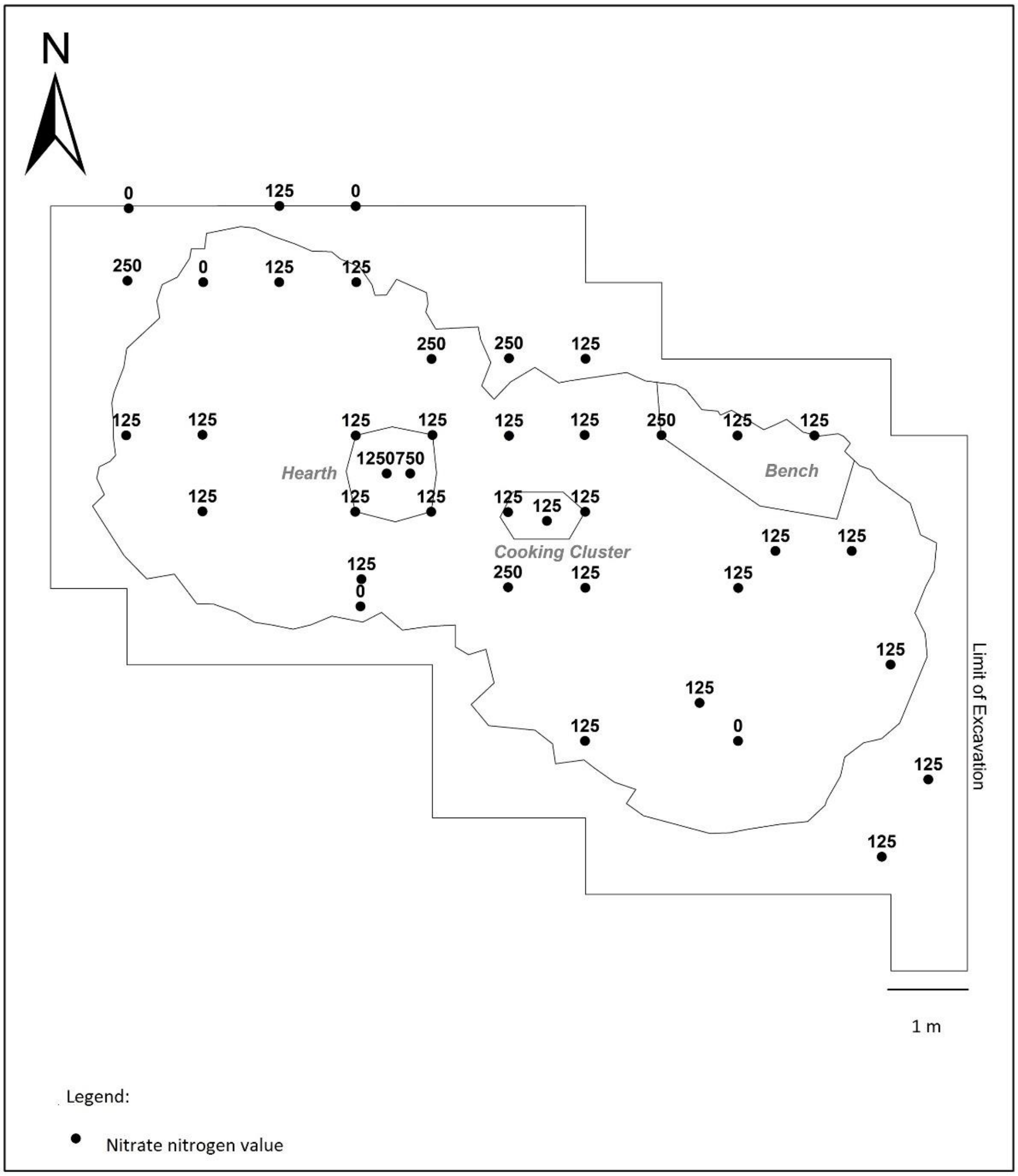

Figure 53. Distribution of nitrate nitrogen values recorded in Tent Ring 1.

On the floor of Tent Ring 1-East, values ranged between 0 and 250 ppm (Figure 53; Table 10). Out of 20 samples tested, 17 ranked very low (125 ppm), one sample ranked 0 and two ranked low (250 ppm). One of the two samples ranked low comes from within the perimeter of the bench feature, and the other is spatially associated with the cooking cluster. One sample in an unassigned floor area in proximity to the southern boundary of the tent floor registered 0.

Table 10. Distribution of nitrogen values in soil samples from Huntingdon Island 5.

(ppm)	Number of samples/ value range								
	TR1-W	TR1-E	TR4	TERR	Shore	Trans.	H2	H4	Modern kitchen
0	4	1							1
125 (very low)	11	17	14	3	2	1	1		
250 (low)	2	2	1	1					
500 (low to mod)								1	
750 (mod)	1								
1250 (mod to high)	1						1	1	
1875 (high)							1	1	
	/19	/20	/15	/4	/2	/1	/3	/3	/1

(TR1-W = Tent Ring 1-West; TR1-E = Tent Ring 1-East; TR4 = Tent Ring 4; Shore = rocky shore samples; TERR = terrace samples; Trans. = Transitional Coast Area;)

On the floor of Tent Ring 4, values ranged between 125 ppm and 250 ppm. Out of 15 samples, 14 ranked very low (125 ppm) and a single sample located against the northern boundary of the feature, ranked low (250 ppm) (Figure 54; Table 10).

Table 10 compares values obtained from the tent features, vegetation zones and the control samples coming from the modern kitchen and House 2 and House 4. Nitrate nitrogen readings yielded very uniform values. The majority of samples coming from the tents ranked very low (125 ppm) with very few samples ranking low (250 ppm) and some samples yielding 0. Samples from the vegetation zones uniformly ranked very low (125 ppm) with a single outlier ranking low (250 ppm), which indicates that low levels of nitrate nitrogen are a characteristic of the soils on the terrace. This is consistent with the prevailing vegetation type (Duchaufour 1982: 45; Gobat et al. 2004: 23). Of note is the fact that areas of differential vegetation, such as the transitional coast area, did not rank differently, which indicates that nitrogen is also strongly leached from the soil. This has also been confirmed by the micromorphological analysis.

A single sample from outside the entrance of House 2 ranked similar to most tent samples, whereas all other house samples ranked between low to moderate (500 ppm) and high (1875 ppm) which is consistent with the herbaceous vegetation cover associated with these contexts (Gobat et al.

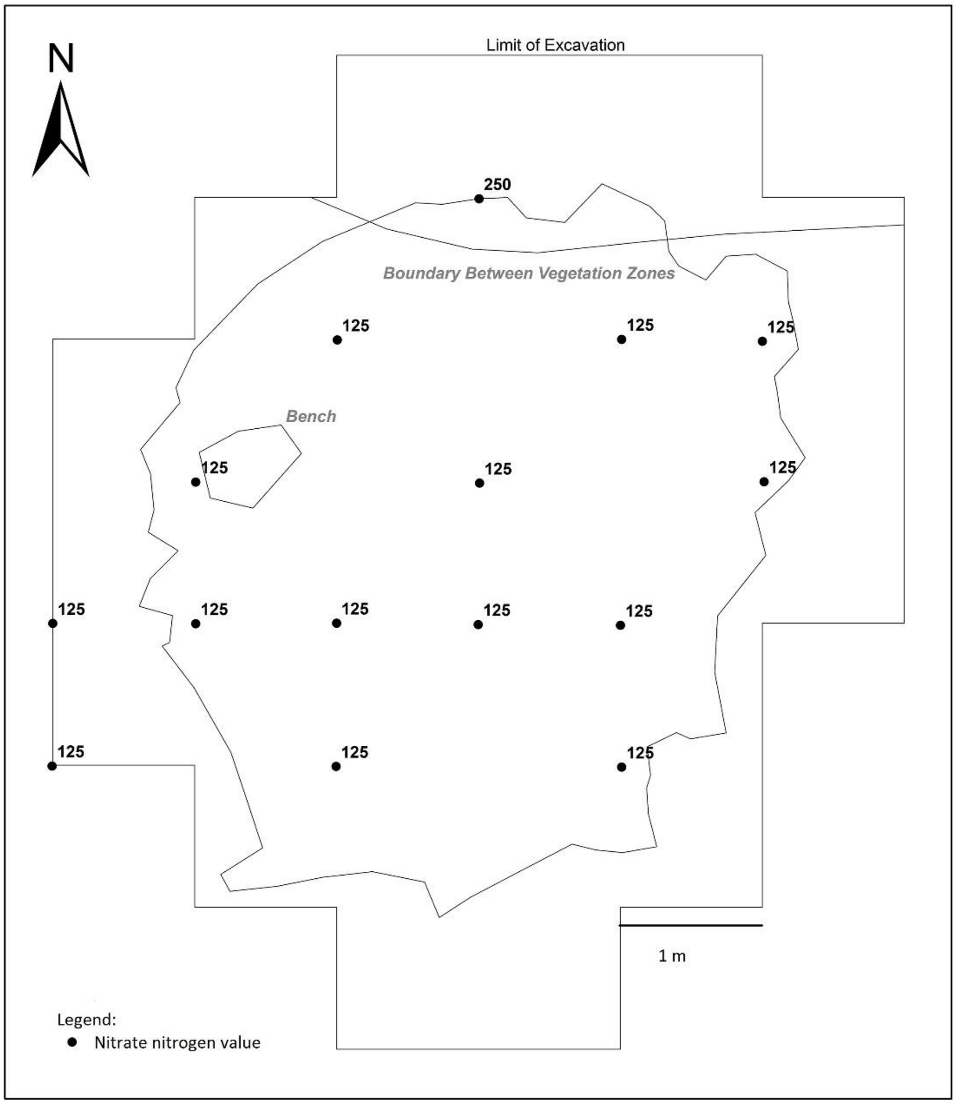

Figure 54. Distribution of nitrate nitrogen values recorded in Tent Ring 4.

2004: 23). From House 2, the highest value (1875 ppm) came from the entrance tunnel, followed by the floor (1250 ppm) and the lowest value came from outside the entrance passage. From House 4, the highest value came from the floor (1875 ppm), followed by the entrance tunnel (1250 ppm), while the sleeping platform ranked the lowest.

Interestingly, the modern kitchen sample also yielded a 0 reading. This may indicate that the modern nitrogen addition was at a different step in the nitrogen cycle, which also raises a question about all the other 0 readings obtained. More detailed investigations are required to confirm this.

Overall, nitrate nitrogen readings indicated uniform, very low to low levels across all vegetation zones, consistent with an *Ericaceous* vegetation cover and strong leaching of nitrogen in soil. Most tent samples ranked within this range but the test was able to positively discriminate against samples coming from the sod houses and the hearth of Tent Ring 1-West. Based on Holliday's findings (2004: 300 – 301), and the known instability of nitrogen in soil, it is likely that this is due to the recent age of the hearth feature, and therefore a recent use episode that occurred in Tent Ring 1-West. Since this is not the case for Tent Ring 1-East, it is likely that more time has elapsed since nitrogen inputs consistent with domestic activities took place in this feature. Another potential explanation is a significant difference in the length of occupation between Tent Ring 1-West and Tent Ring 1-East, which has already been disproved by the micromorphological analysis but will be further investigated in the paleoethnobotanical analysis section. Unfortunately, these values cannot be compared to the sod houses, as further information on the provenience of these samples was not available.

7.3.3. Phosphorus

Phosphorus occurs in soils in organic and inorganic form, both responsible for the amount of phosphorus in plant-available form. The inorganic fraction is generally higher than the organic fraction in any soil. In solution, only inorganic phosphorus is present in a phosphate form, predominantly as $H_2PO_4^-$ or HPO_4^{2-}. In acidic soils, $H_2PO_4^-$ will be dominant over HPO_4^{2-}, and in alkali soils HPO_4^{2-} will be dominant together with some PO_4^{3-} (Tan 1996: 153- 154). The availability of soil phosphorus depends on a large amount of factors, including soil pH, decomposition rates of organic matter, and microbial activity.

Phosphorus levels are generally high everywhere on a human site, and predominantly in pits, middens, areas associated with human and domestic animal waste and the insides of houses (Dore and Varela 2010: 285 – 286; Oonk et al 2009a: 38; Wilson et al. 2008: 418). Phosphorus is indicative of a broad range of human activities, as almost all domestic activities lead to phosphorus enrichment (Holliday 2004: 301). Similar to nitrogen, phosphorus inputs are known to increase plant productivity, but unlike nitrogen, phosphorus is a very stable element in soil and very resistant to leaching. Therefore, phosphorus values are considered the most reliable indicators of human activity (Derry et al. 1999: 205; Holliday 2004: 305).

Phosphorus values range between 125 (very low), 312.5 (low), 625 (low to moderate), 937.5 (moderate), 1250 (moderate to high), 1875 (high) and 2500 (very high) (ppm). The highest reading coming from the tent samples is 1875 ppm (high) and the lowest is 125 ppm (very low). The mode is 937.5 (moderate).

On the floor of Tent Ring 1-West, the highest reading ranked moderate to high (1875 ppm), and the lowest ranked moderate (937.5 ppm) (Figure 55; Table 11). Out of 19 samples for feature Tent Ring 1-West, eight ranked high (1875 ppm), eight ranked moderate to high (1250 ppm) and three ranked moderate (937.5 ppm); however, no strong pattern emerged relative to the features identified on the tent floor. The distribution of samples with high values (1875 ppm) is somewhat consistent with the interstitial spaces on the floor, against the hold-down rocks, and the perimeter of the hearth. Two of the samples are located in the perimeter of the hearth, one of which is HS2 (C_g), which was taken from the bottom spit. Four samples come from the unassigned floor space, one of which is BC (C_g), taken from the bottom of the bone cluster against the southeastern wall and two come from outside the

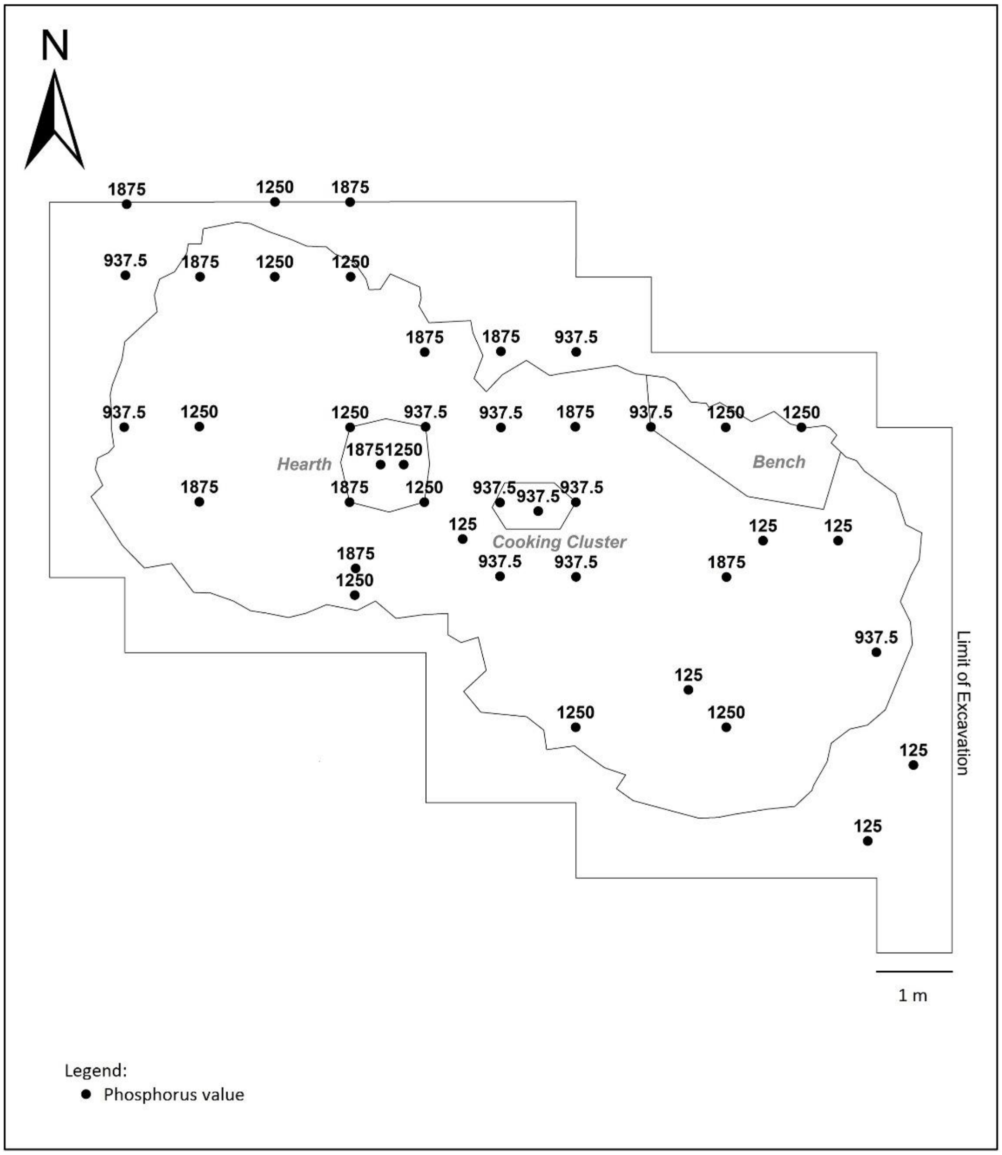

Figure 55. Distribution of phosphorus values recorded in Tent Ring 1.

feature, against the northwestern wall. The indent sample, which is spatially proximate to these samples, also ranked high (1875 ppm). The distribution of samples with moderate to high values (1250 ppm) is somewhat consistent with the hearth perimeter and less so with the interstitial spaces of the floor against the hold-down rocks. Three of the samples are located inside the perimeter of the hearth, one of which is HS1, collected from the upper spit in the C_g horizon. One of the samples comes from the O_m horizon of the bone cluster against the southeastern wall, three samples come from the floor, one of which is closer to the middle of the floor space, and one sample comes from outside the feature, against the northwestern wall. The three samples that yielded moderate values (937.5 ppm) were collected from one corner of the hearth, the floor space against the western wall of the feature, and the outside of the feature, against the northwestern wall.

Table 11. Distribution of phosphorus values in soil samples from Huntingdon Island 5.

(ppm)	Number of samples/ value range								
	TR1-W	TR1-E	TR4	TERR	Shore	Transitional	H2	H4	Modern
125 (very low)		5	1	1					
625 (low)				1					
937.5 (mod)	3	9	8	1	2			1	
1250 (mod to high)	8	4	4	1				1	
1875 (high)	8	2	2			1	1	1	
2500 (very high)							2		1
Total samples	/19	/20	/15	/4	/2	/1	/3	/3	/1

(TR1-W = Tent Ring 1-West; TR1-E = Tent Ring 1-East; TR4 = Tent Ring 4; Shore = rocky shore samples; TERR = terrace samples; Trans. = Transitional Coast Area;)

On the floor of Tent Ring 1-East, the lowest reading ranked very low (125 ppm), the highest ranked high (1875 ppm) and the mode was 937.5 ppm (moderate) (Figure 55; Table 11). Out of 20 samples, five ranked low (125 ppm), nine ranked moderate (937.5 ppm), four ranked moderate to high (1250 ppm) and two ranked high (1875 ppm). No strong pattern emerged relative to the features identified. The samples ranked high (1875 ppm) are not spatially associated. One sample comes from the centre of the floor and one from an interstitial space of the floor, close to the hold-down rocks. The samples ranked moderate to high (1250 ppm) are distributed against the north and south walls, two of them coming from within the perimeter of the workbench, which suggests that the perimeter of the workbench does not rank differentially to unassigned floor space. Most samples that ranked moderate (937.5 ppm) were clustered in the western section of Tent Ring 1-East in association with the cooking cluster, and a single sample comes from the eastern boundary of the feature, in an area that was interpreted as a potential entranceway. The lowest values come from the eastern extremity of the feature, near the presumed entranceway.

On the floor of Tent Ring 4, the lowest reading ranked 125 ppm (very low), and the highest ranked 1875 ppm (high). The mode was 937.5 ppm (moderate) (Figure 56; Table 11). Out of 15 samples, two ranked high (1875 ppm), four ranged moderate to high (1250 ppm), eight ranked moderate (937.5 ppm), and one ranked low (125 ppm). Values from the moderate to high and high range (1250 and 1875 ppm) cluster in the southern half of the feature with one outlier in the northwest

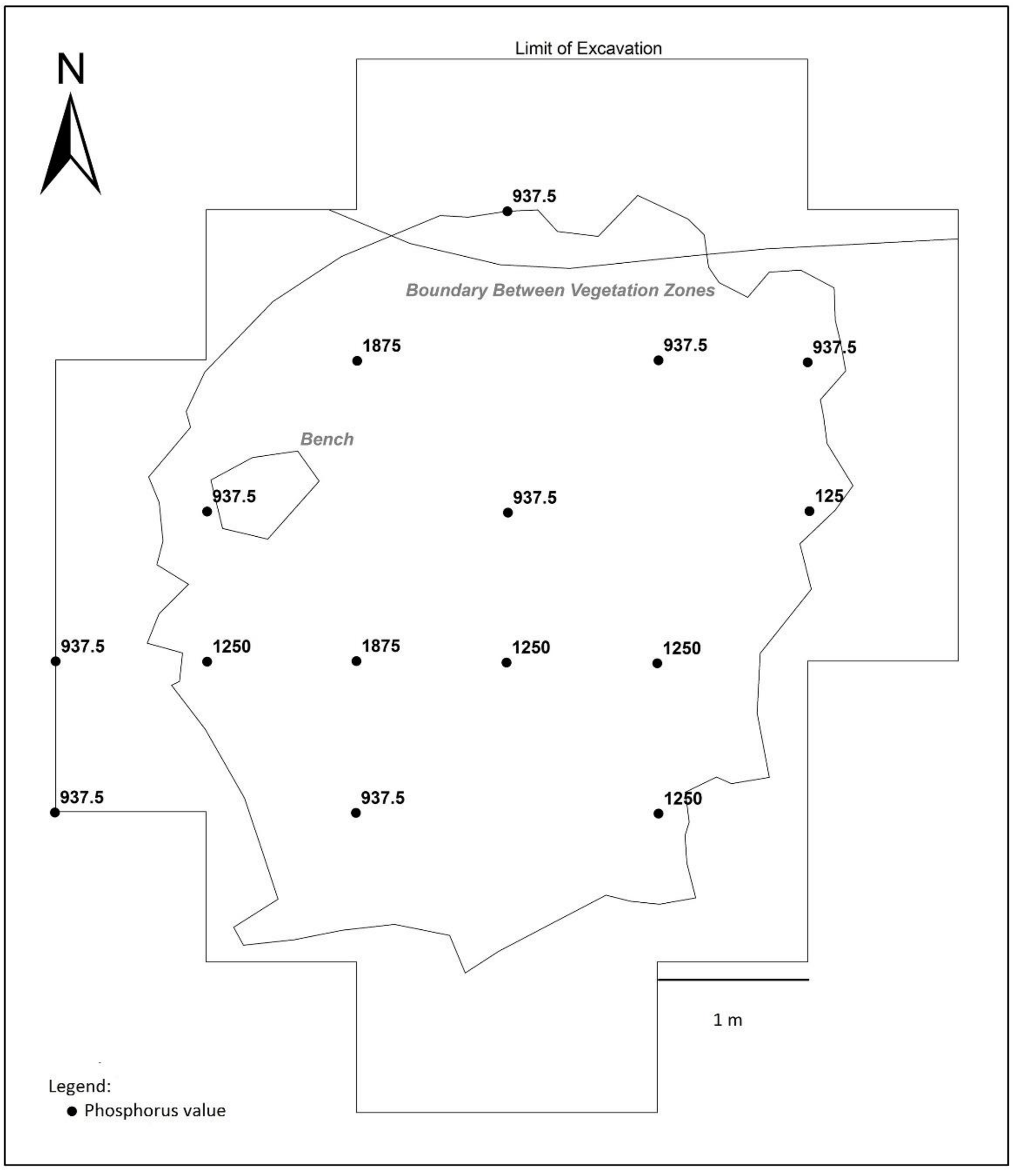

Figure 56. Distribution of phosphorus values recorded in Tent Ring 4.

corner against the hold-down rocks. Samples from outside the feature, in the southwest corner, yielded moderate values (937.5 ppm). This section overlaps with the floor of Tent Ring 3 (Figure 56; Table 11).

Table 11 compares values obtained from the tent features, the vegetation zones, the control samples from House 2 and House 4 and the modern kitchen sample. The background samples indicate that phosphorus levels vary with the vegetation zone, forming a gradient pattern with increasing values towards the beach. This upwards trend is determined by increasing amounts of decomposing organic matter coming from driftwood. The terrace unit yielded a broad range of very low, low to moderate, moderate and moderate to high values. This likely has to do with the recent disturbance associated with the archaeological excavations. The influence of modern activities on phosphorus levels is confirmed by the modern kitchen sample, which ranked very high at 2500 ppm. House 2 samples ranked high to very high, with two samples from the floor and outside the entrance yielding 2500 ppm, and one passageway sample yielding 1875 ppm. House 4 samples had a broader range, between moderate and high. The entrance passage yielded the highest value (1875 ppm), followed by the floor sample (1250 ppm), while the sleeping platform ranked moderate (937.5 ppm). Tent ring 1-West yielded the most values in the moderate to high and high ranges (1250 to 1875 ppm). Tent ring 1-East values concentrate in the moderate range (937.5 ppm), with some samples exhibiting very low values (125 ppm) and others ranking in the moderate to high and high range (1250 to 1875 ppm). Tent Ring 4 values concentrate in the moderate range with few values in the moderate to high and high range, very similar to Tent Ring 1-East.

7.3.4. Potassium

Potassium is available in soil as K^+. When K^+ is not used by plants, it will be rapidly leached from the soil (Tan 1996: 170). Potassium can be incorporated into soils from anthropogenic sources. It comes from decomposing animal remains and wood ash and is therefore associated with burning (Oonk et al. 2009a: 38). Potassium is a useful indicator of human activity, especially at recent sites. High levels of potassium are characteristic of middens and pits, whereas low levels of potassium suggest that burning did not take place (Holliday 2004: 300). Potassium can also have a geogenic source. The K-feldspar present in the underlying C_g layer is a considerable source of potassium, which is released during the weathering process, but the micromorphological investigations have shown that mineral grains in this horizon are minimally weathered (Tan 2000: 38).

Potassium is measured against a scale on a test tube. Values range between 1250 and 5000 ppm. Almost all samples ranked 0 on this reading, which is likely due to unfavorable soil and vegetation conditions. Only five samples yielded values between 1250 and 1500 ppm, most of which came from House 2 and House 4. A single value of 1500 ppm was obtained from the floor of House 2 and two readings of 1250 ppm came from the floor and sleeping platform of House 4. A single reading of 1250 ppm came from the edge of the hearth feature in Tent Ring 1-West and from the northeastern boundary of Tent Ring 4, from a floor sample located in proximity to the hold-down rocks. Vegetation zones do not differ based on potassium readings. This pattern likely reflects the effect of leaching in soil, but also more substantial inputs associated with the sod houses.

7.3.5. Aluminum

Aluminum is the most abundant metallic element in rocks and minerals, and released upon their weathering (Oonk et al. 2009b: 1219). It is very active chemically, therefore it will seldom occur by itself in nature. In soils, it occurs as Al^{3+}. Aluminum plays an important role in producing soil acidity, and reacts with phosphorus to form insoluble compounds. This causes a decrease in the available phosphorus in soil (Tan 1996: 189). Aluminum is often enriched at human habitations as a result of phosphorus enrichment; therefore, it is an indirect indicator of human activity (Butler 2008; Holliday 2004: 300).

Aluminum values range between 125 (very low), 250 (low), 750 (moderate), 2000 (high) and 3125 (very high) ppm. The highest reading obtained was 2000 ppm and the lowest 125 ppm. The mode is 125 ppm (Table 12).

Most samples ranked very low (125 ppm), including all of the background samples, the entire floor of Tent Ring 4, and most of the samples coming from House 2, House 4, and Tent Ring 1 (Figure 57; Table 12). The vegetation zones uniformly ranked very low (125 ppm), as well as the modern kitchen sample. Inside the houses, the entrance passage of House 2 and the sleeping platform of House 4 are the only samples that ranked above 125 ppm. Both of them ranked high (2000 ppm).

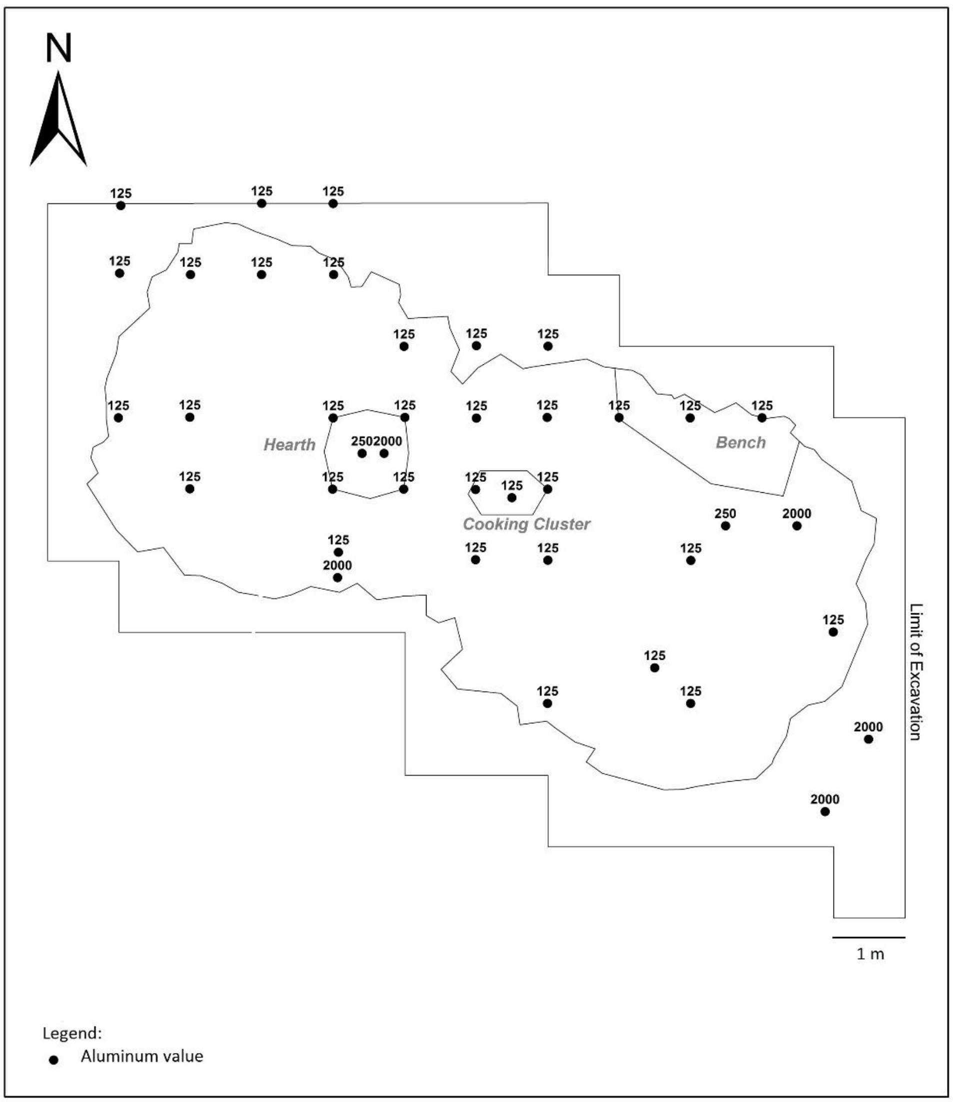

Figure 57. Distribution of aluminum values recorded in Tent Ring 1.

On the floor of Tent Ring 1-West, 15 samples ranked very low (125 ppm), similar to surrounding soil conditions; however, the test was able to discriminate against the hearth and the bone cluster (Figure 57; Table 12). HS2 ranked low (250 ppm) and sample HS1 ranked high (2000 ppm). Sample BC, taken from the bone cluster in the O_m horizon also ranked high (2000 ppm).

On the floor of Tent Ring 1-East, 17 samples ranked very low (125 ppm) (Figure 57; Table 12). Tree samples ranked high (2000 ppm) and one sample ranked low (250 ppm) cluster in the eastern extremity, on the floor and in the area immediately outside the feature, at the presumed entranceway. This area is roughly consistent with low readings of phosphorus which may suggest a residual or so-called old phosphorus effect, caused by initial high inputs of phosphorus which have become occluded inside insoluble compounds with time, thus becoming insoluble to a basic fertility kit (Oonk et al. 2009a: 40; Oonk et al. 2009b: 1220). This would be consistent with the interpretation of nitrogen values recovered from Tent Ring 1; however, although this old phosphorus effect has also been noted by Oonk et al. (2009a; 2009b), their study was conducted on house plans dating to the Late Bronze Age and the Early Roman Period, and it is unclear whether this process is consistent with the recent arrival of Inuit to southern Labrador or the young age of the terrace unit.

Table 12. Distribution of aluminum values in soil samples from Huntingdon Island 5.

(ppm)	Number of samples/ value range								
	TR1-W	TR1-E	TR4	TERR	Shore	Trans.	H2	H4	Modern
125 (very low)	15	17	15	4	2	1	2	2	1
250 (low)	1	1							
750 (mod)									
2000 (high)	2	3					1	1	
3125 (very high)									
Total samples	/19	/20	/15	/4	/2	/1	/3	/3	/1

(TR1-W = Tent Ring 1-West; TR1-E = Tent Ring 1-East; TR4 = Tent Ring 4; Shore = rocky shore samples; TERR = terrace samples; Trans. = Transitional Coast Area;)

7.3.6. Calcium

The analysis tests for plant available calcium, in the Ca^{2+} form. Calcium is a significant indicator of human activity because of its association with bone, wood charcoal and manure (Oonk et al. 2009b: 1217; Wilson et al. 2008: 418). On archaeological sites, calcium readings are always high in cooking areas and trash pits where bones have been processed and disposed of (Wilson et al. 2005: 1098). In addition, calcium, as well as aluminum and iron, may be enriched in anthropogenic soils because of their tendency to bind with phosphorus, and therefore functions also as an indirect indicator of human activity (Holliday 2004: 300).

Calcium values range on a broad scale, between 3750 (low), 8750 (moderate), 17500, 25000, 35000 (high) and 70000 (very high) ppm. The lowest reading obtained was 0 and the highest was 35000 ppm. The mode was 3750 ppm (low). Most samples uniformly ranked low (3750 ppm), including samples from all the vegetation zones, most of the samples from House 2 and House 4 and the modern sample. The floor samples from both houses ranked moderate (8750 ppm) (Figures 58 and 59; Table 13). Low calcium levels are also consistent with the vegetation cover (Bell and Tallis 1979; Taylor 1971).

Table 13. Distribution of calcium values in soil samples from Huntingdon Island 5.

(ppm)	Number of samples/ value range								
	TR1-W	TR1-E	TR4	TERR	Shore	Trans.	H2	H4	Modern
0		2							
3750 (low)	11	10	5	4	1	1	2	2	1
8750 (mod)	6	7	7				1	1	
17500 (high)	2								
25000 (high)			1						
35000 (high)		1	1						
70000 (very high)									
Total samples	/19	/20	/15	/4	/2	/1	/3	/3	/1

(TR1-W = Tent Ring 1-West; TR1-E = Tent Ring 1-East; TR4 = Tent Ring 4; Shore = rocky shore samples; TERR = terrace samples; Trans. = Transitional Coast Area;)

On the floor of Tent Ring 1-West, 11 of the samples ranked low (3750 ppm), six samples ranked moderate (8750 ppm) and two samples ranked high (17500 ppm) (Figure 58; Table 13). Higher amounts of calcium have been recorded in areas roughly consistent with the interstitial spaces of the floor and immediately outside the boundaries of the tent floor. One sample ranked high (17500 ppm) is located against the western boundary of the feature and another one immediately outside, in the northwestern section. Two samples ranked moderate (8750 ppm) are located on the northern edge of the tent floor, at the edge of the floor space and immediately outside. The bone cluster was positively discriminated by the test; although, the samples ranked moderate (8750 ppm), which is lower than

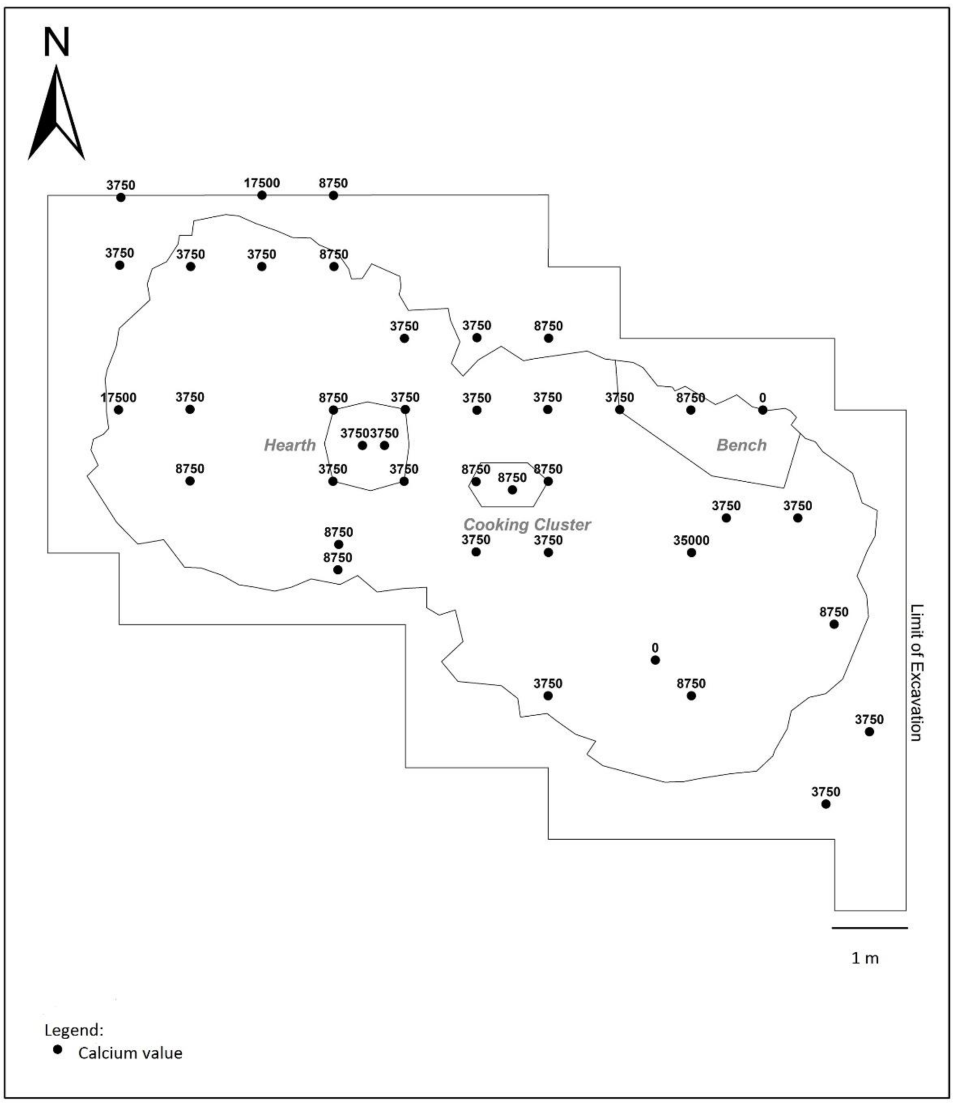

Figure 58. Distribution of calcium values recorded in Tent Ring 1.

expected. Only one sample at the edge of the hearth ranked moderate (8750 ppm). The rest of the hearth ranked low (3750 ppm); although, it was associated with macroscopic bone fragments identified in the field.

On the floor of Tent Ring 1-East, ten samples ranked low (3750 ppm), seven samples ranked moderate (8750 ppm), one ranked high (35000 ppm) and two samples read 0 (Figure 58; Table 13). Sample distribution roughly follows the pattern from Tent Ring 1-West, with samples ranked moderate

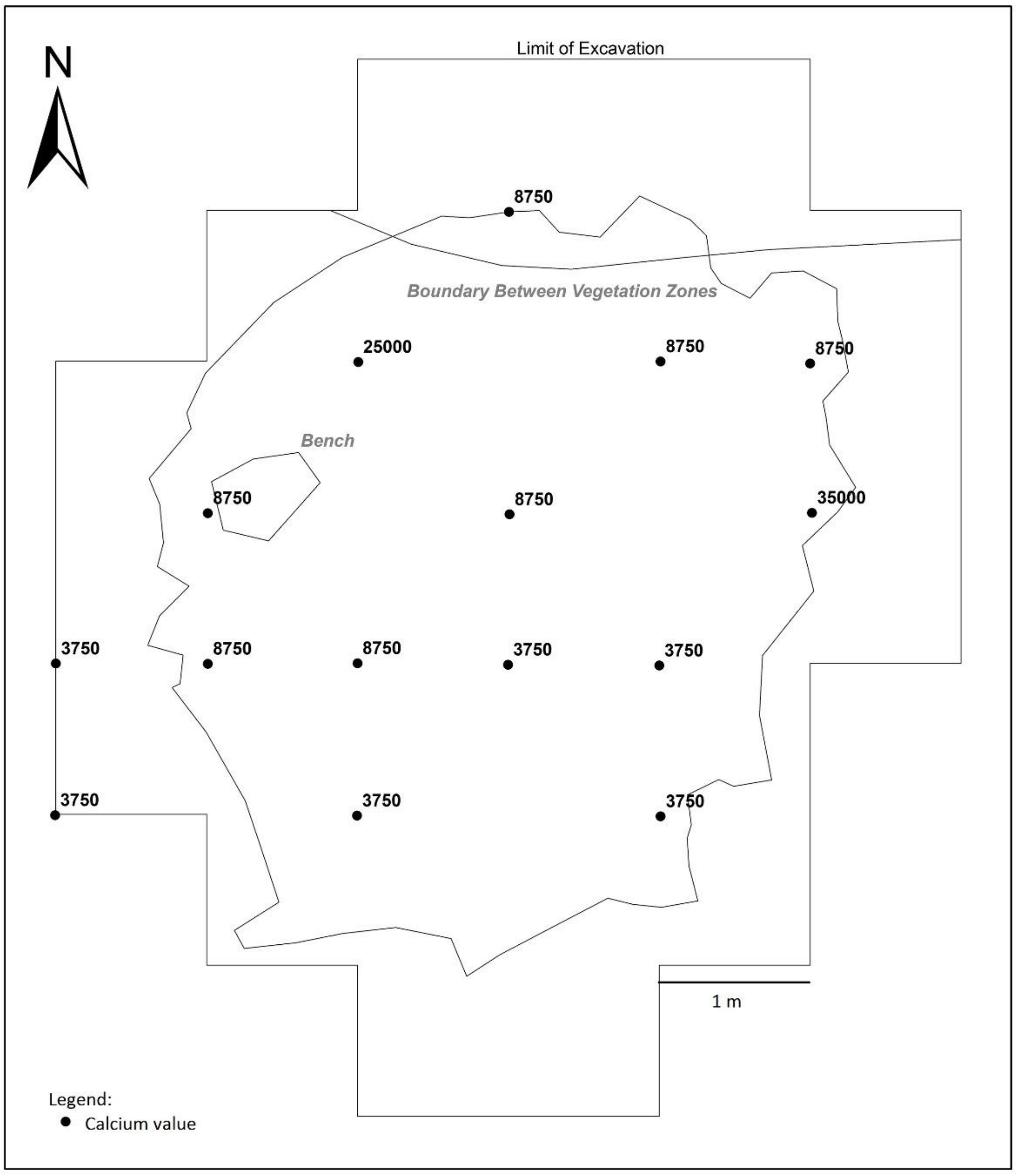

Figure 59. Distribution of calcium values recorded in Tent Ring 4.

(8750 ppm) clustering in the interstitial spaces of the floor in proximity to the hold-down rocks. One sample ranked high (35000 ppm) was located closer to the floor centre. The cooking cluster was positively identified by the test, but all the samples ranked moderate (8750 ppm), which was lower than expected given the visible fragments of bone identified here in the field. The samples immediately adjacent to this feature ranked low (3750 ppm). Lower than expected readings recorded from these tents may suggest that bone was either purposely removed, or cleaned away before the tent was abandoned or that bone discard was minimal at the site, which would be consistent with a short-term occupation.

On the floor of Tent Ring 4, five samples ranked low (3750 ppm), seven samples ranked moderate (8750 ppm) and two samples ranked high (25000 and 35000 ppm) (Figure 59; Table 13). Samples ranked above 3750 ppm cluster in the northern section of the tent and around the bench, roughly opposite the section of tent floor where the highest phosphorus values were clustered. Tent Ring 4 yielded the highest calcium values, which is consistent with the whale bone artifacts recovered from this feature.

7.3.7. Iron

When released in soil water, iron takes two different ionic forms, ferrous iron (Fe^{2+}) and ferric iron (Fe^{3+}). Ferrous iron is mostly dominant in aerobic conditions and ferric iron in anaerobic conditions (Tan 1996: 195). Iron is found to be generally high on human occupations but there is no direct association with any human activities (Butler 2008). Similar to aluminum and calcium, iron binds with phosphorus and is an indirect indicator of human activity (Holliday 2004: 300; Oonk et al. 2009b: 1224).

Iron values range between 62.5 (very low), 187.5 (low), 625 (moderate), 1250 (high), 1562.5 (very high) ppm. The lowest reading obtained is 0 and the highest reading is 1562.5 ppm. The mode is 625 ppm (Figures 60 and 61; Table 14).

Table 14. Distribution of iron values in soil samples from Huntingdon Island 5.

(ppm)	Number of samples/ value range								
	TR1-W	TR1-E	TR4	TERR	SHORE	TRANS	H2	H4	Modern
0		4	2						1
62.5 (very low)	1								
187.5 (low)	2	2							
625 (mod)	11	12	4	4	1				
1250 (high)									
1562.5 (very high)	5	2	9		1	1	3	3	
Total samples	/19	/20	/15	/4	/2	/1	/3	/3	/1

(TR1-W = Tent Ring 1-West; TR1-E = Tent Ring 1-East; TR4 = Tent Ring 4; Shore = rocky shore samples; TERR = terrace samples; Trans. = Transitional Coast Area;)

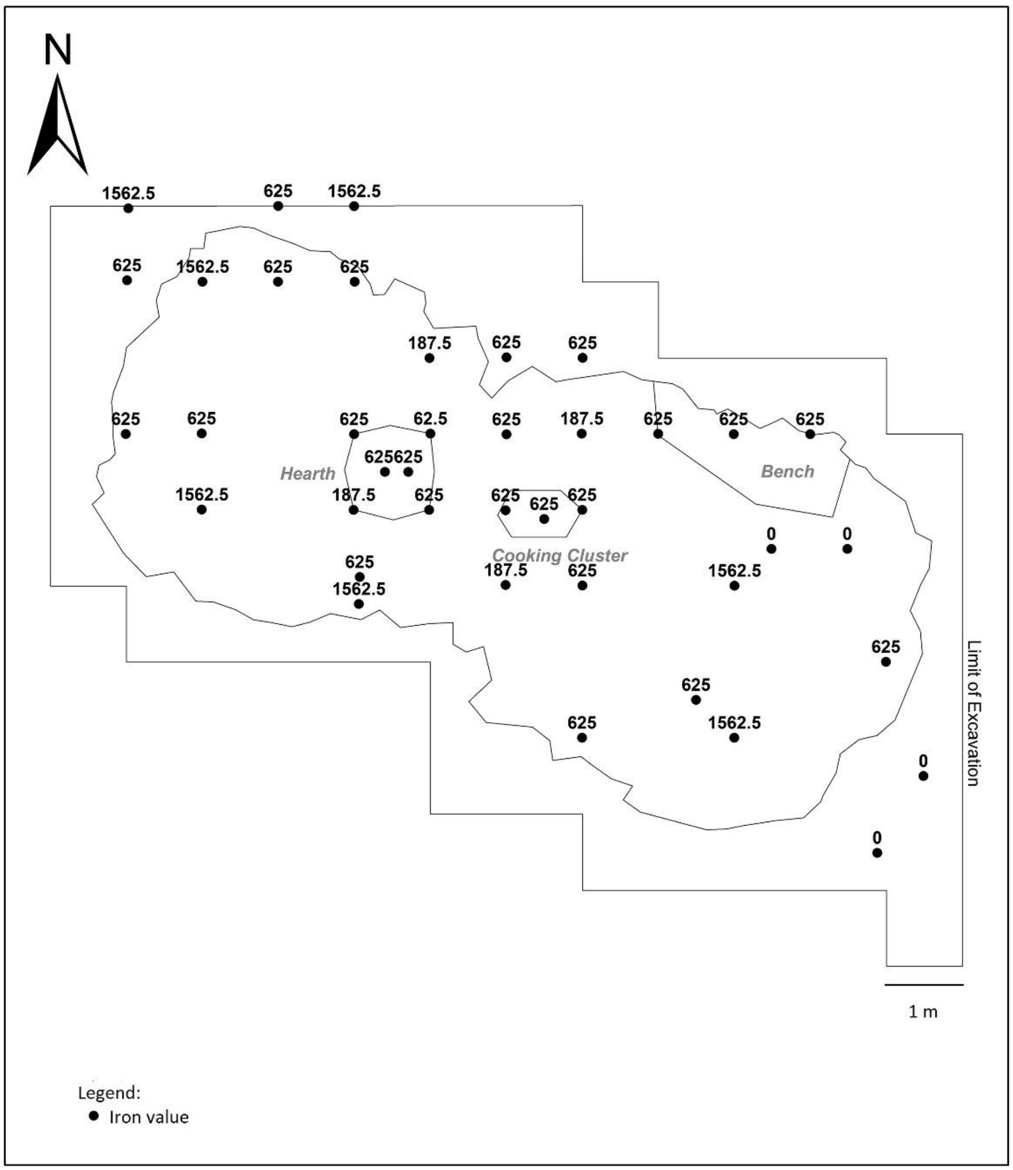

Figure 60. Distribution of iron values recorded in Tent Ring 1.

The distribution of iron in the control samples follows phosphorus distributions, refecting the tendency of iron to bind with phosphorus. Iron values in the samples from the vegetation zones indicate an upwards trend towards the beach. All terrace samples ranked moderate (625 ppm). The rocky shore provided one moderate (625 ppm) and one very high value (1562.5 ppm), and the transitional coast area provided a very high value (1562.5 ppm). All the house samples returned very high values (1562.5 ppm) which are also consistent with the highest phosphorous values recorded in the analysis. The modern kitchen sample provided a 0 reading, although it yielded one of the highest phosphorus

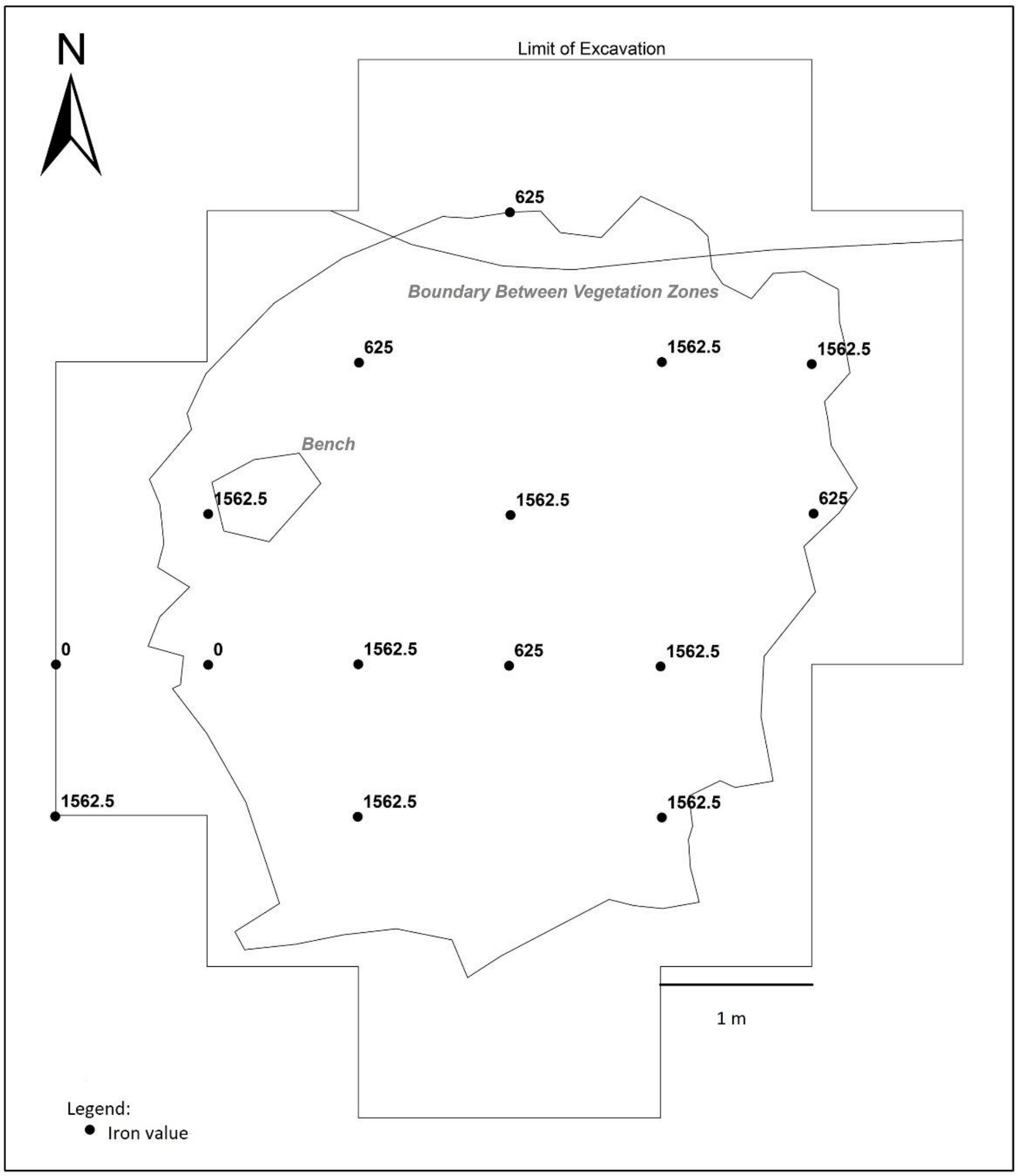

Figure 61. Distribution of iron values recorded in Tent Ring 4.

values. This is probably related the recent age of the chemical input (Table 14).

Tent floor samples generally clustered around the medium value (625 ppm) in Tent Ring 1 and the very high value (1562.5 ppm) in Tent Ring 4; however, the patterning of iron values does not follow the patterning of phosphorus on the tent floors.

On the floor of Tent Ring 1-West, one sample ranked very low (62.5 ppm), two samples ranked low (187.5 ppm), 11 samples ranked moderate (625 ppm) and five ranked very high (1562.5 ppm) (Figure 60; Table 14). The iron test did not positively discriminate any features from unassigned floor space. The highest values seem to cluster in the interstitial spaces of the floor and immediately outside the boundary in the northwest section but do not correspond to the highest distributions of phosphorus.

On the floor of Tent Ring 1-East, four samples returned 0 values, two samples ranked low (187.5 ppm), 12 ranked moderate (625 ppm) and two ranked very high (1562.5 ppm) (Figure 60; Table 14). The iron test did not discriminate against the cooking cluster or the workbench. The highest values come from two floor samples in the centre of the floor, which correspond with areas of increased phosphorus values. The individual samples that yielded high phosphorus values, however, did not rank highly in iron.

On the floor of Tent Ring 4, two samples ranked 0, four samples ranked moderate (625 ppm) and nine samples ranked very high (1562.5 ppm) (Figure 61; Table 14). Samples ranked very high are roughly associated with the southern section of the tent floor but do not correspond with high phosphorus readings. These distributions were likely impacted by occasional water saturation, indicated in the micromorphological analysis by the presence of redox features. Reduction and oxidation also involve some translocation of solubilized iron, which may explain the differential patterning of iron and phosphorus values.

7.3.8. Magnesium

Available magnesium is present in soil in the Mg^{2+} form. Magnesium is very useful in distinguishing areas characterized by wood ash, fish and bird bones (Holliday 2004: 301; Oonk et al. 2009a: 38). Elevations in magnesium values should be a good indicator of human activity at the site, as natural magnesium concentrations are characteristically low in *Empetrum* heath meadows (Knudson et al. 2004: 450). However, there is a significant chance that this signal is obscured by natural processes. Derry et al. (1999) showed that bird activity more significantly impacted magnesium levels in soil than human inputs at the Dorset/Thule site of Arnaqquaksaat, and this is likely a factor that also influenced the magnesium distribution identified by the analysis.

Magnesium values range between 125 (very low), 250 (low), 625 (moderate), 2000 (high) and 3750 (very high) ppm. The lowest value recorded was 125 ppm and the highest 2000 ppm. The vegetation zones displayed very low (125 ppm) and low (250 ppm) values that appear to increase from the terrace to the shoreline, similar to phosphorus values. Some samples yielded notable increases that did not fit the pattern. Some of these locales revealed fragments of feathers when they were screened for paleoethnobotanical analysis, confirming the impact of local bird activity on soil magnesium levels. The highest magnesium value from the terrace samples, 2000 ppm, came from a baulk sample that revealed nine fragments of feathers during the paleoethnobotanical analysis. The sod house samples did not differ significantly from the background samples (Table 15).

Table 15. Distribution of magnesium values in soil samples from Huntingdon Island 5.

(ppm)	Number of samples/ value range								
	TR1-W	TR1-E	TR4	TERR	SHORE	TRANS	H2	H4	Modern
125 (very low)	2	5	1	2				1	1
250 (low)	4	4	4		1	1	2	2	
625 (mod)	9	3	7	1			1		
2000 (high)	4	8	3	1	1				
3750 (very high)									
Total samples	/19	/20	/15	/4	/2	/1	/3	/3	/1

(TR1-W = Tent Ring 1-West; TR1-E = Tent Ring 1-East; TR4 = Tent Ring 4; Shore = rocky shore samples; TERR = terrace samples; Trans. = Transitional Coast Area;)

On the floor of Tent Ring 1-West, two samples ranked very low (125 ppm), four samples ranked low (250 ppm), nine samples ranked moderate (625 ppm) and four samples ranked high (2000 ppm) (Figure 62; Table 15). Samples ranked high (2000 ppm) predominantly came from the interstitial space against the boundary of the floor, from a sample closer to the centre floor rather than the hold-down rocks and the edge of the hearth and from immediately outside the feature in the north section. The contents of the hearth ranked lowest, similar to the bone cluster; although, one edge of the hearth yielded a value of 2000 mg. This may indicate that the negative distribution of magnesium is significant.

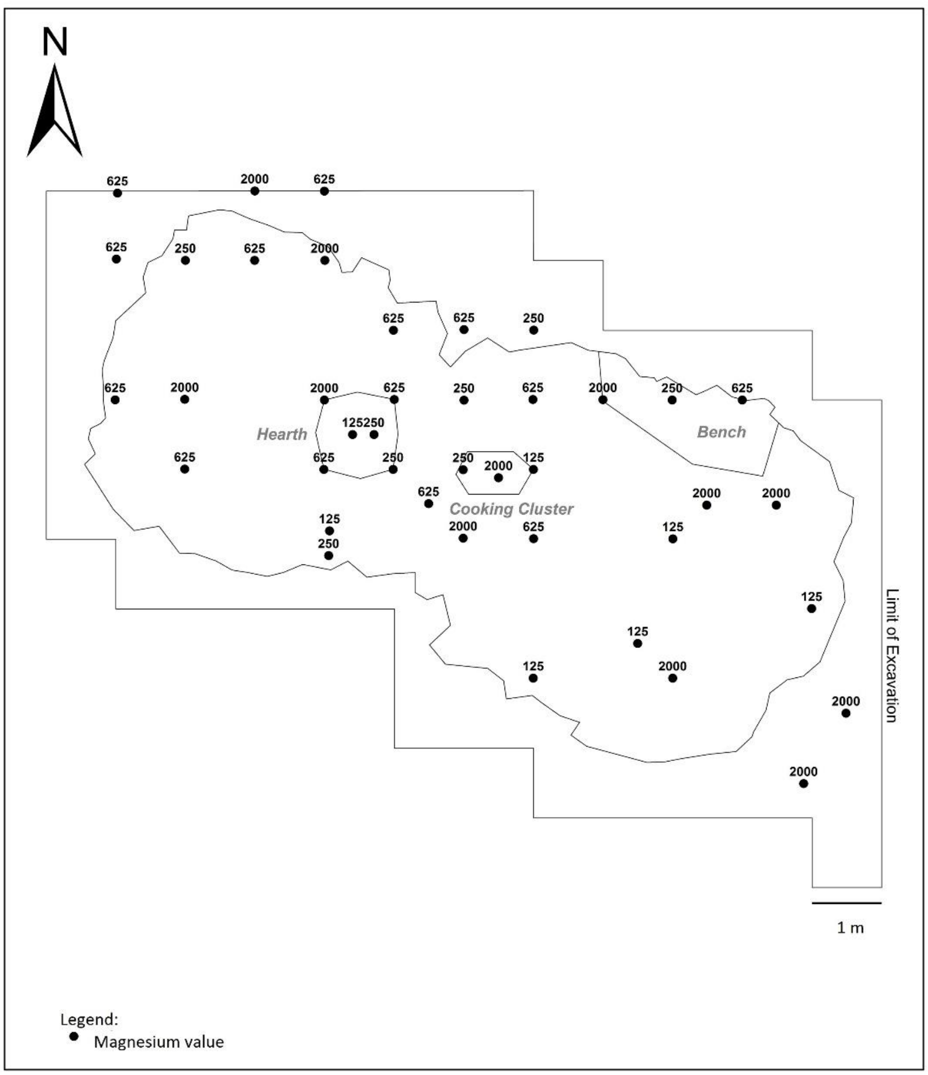

Figure 62. Distribution of magnesium values recorded in Tent Ring 1.

On the floor of Tent Ring 1-East, five samples ranked very low (125 ppm), four ranked low (250 ppm), three ranked moderate (625 ppm), and eight ranked high (2000 ppm) (Figure 34; Table 15). The highest values come from the eastern extremity of the feature, from the floor and immediately outside the hold-down rocks, from the presumed entranceway. The centre of the cooking cluster also yielded a high value, as well as one sample immediately south of it and the edge of the workbench area. The lowest values cluster in the centre of the floor.

On the floor of Tent Ring 4, one sample ranked very low (125 ppm), four samples ranked low (250 ppm), seven samples ranked moderate (625 ppm), and three samples ranked high (2000 ppm) (Figure 63; Table 15). The highest ranked samples come from the corner of the bench, the centre floor

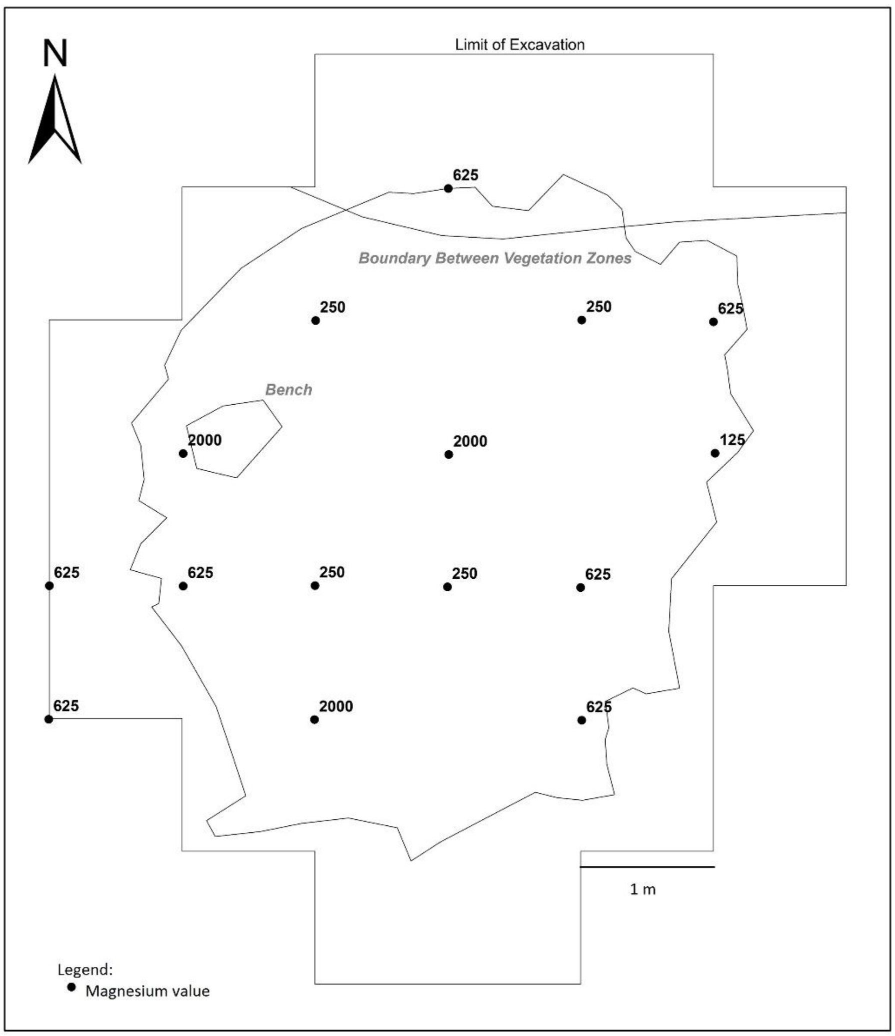

Figure 63. Distribution of magnesium values recorded in Tent Ring 4

and the southwestern extremity. Moderate values seem to cluster around the edges of the feature and immediately outside the hold-down rocks, and most low and very low values come from the centre of the floor, in the southern section of the tent ring. Just like with phosphorus, the distribution of values over a wide range may suggest the presence of several factors impacting magnesium levels in soil. The association of high background values with samples that also yielded feathers suggests that bird activity constitutes at least one additional factor.

7.3.9. Manganese

Available manganese in soils can be present as Mn^{2+}, Mn^{3+}, Mn^{4+}, with the divalent manganese ion (Mn^{2+}) being the most predominant (Tan 1996: 204). Manganese may be an indirect indicator of human inputs, due to its tendency to bind with phosphorus (Holliday 2004: 300; Oonk et al. 2009b: 1224).

Manganese values can range between 125 (low), 300 (moderate), 625 (moderate to high) and 1000 (high) ppm. Manganese is the only chemical element that positively identifies the sod houses relative to all the other samples. The sod houses provided the only samples that yielded values over 0 on the manganese test. In House 2, the outside sample ranked moderate (300 ppm), whereas the rest of the samples yielded 0. In House 4, all samples ranked low (125 ppm).

Manganese was detected in thin section in the form of opaque redox nodules. Owing to its increased solubility relative to iron, manganese is more rapidly impacted by water saturation periods (Lindbo et al. 2010: 129; Stoops et al. 2010: 30). Negative readings, therefore, may reflect the effect of water saturation on soil. Low readings coming from House 4 suggest more substantial inputs for the entire dwelling that were subsequently impacted, whereas the moderate value from outside the entrance in House 2 may indicate a more localized dumping area.

7.4. Conclusions

Chemical readings of soil samples from Tent Ring 1 and Tent Ring 4 provided higher than background values for all chemical elements investigated except manganese, which was only detected in samples coming from the sod houses relative to all other contexts studied. Chemical readings appear patterned on the tent ring floors, suggesting that the tents, as a whole, cannot be differentiated from samples taken outside of living contexts, but produce signatures that are patchy, and generally associated with features and visible partitions identified during the excavation.

On the floor of Tent Ring 1-West, the hearth yielded high values for nitrate nitrogen, phosphorus and aluminum concentrations. The edge of the feature yielded one of the only two positive readings for potassium outside of the sod house contexts. The same sample also yielded a moderate calcium reading, which was the only elevated calcium value associated with the hearth relative to background conditions. Values tend to cluster around the moderate and moderate to high ranges, closely following house samples, which are significantly higher than expected given the leaching effect and the presumed taphonomical differences between these two contexts. This may be a result of the lack of precision of a commercially available kit. High readings of nitrogen, comparative to background values, have been tentatively attributed to the young age of the structure. As the hearth feature is thought to belong to an earlier episode of use, based on the absence of surface markers such as hearth stones, as discussed in Chapter 5, this suggests that the last instance of use for this structure is even more recent. The low values obtained for elements closely associated with cooking and food preparation may suggest a very short-term occupation. Low levels of calcium, in particular, may suggest limited food preparation, and the low levels of potassium may be consistent with low amounts of burning or contained burning inside oil lamps. These results are similar to the findings of the micromorphological analysis, which also suggested a short-term occupation of the structures. The hearth of Tent Ring 1-West was also negatively defined by low levels of magnesium, comparative to unassigned floor samples, similar to levels found inside the sod houses.

On the floor of Tent Ring 1 - East, the cooking cluster consistently revealed moderate levels of phosphorus and calcium and a high reading of magnesium, relative to surrounding values. Similar to the hearth feature, these moderate values seem to suggest a limited impact of leaching and a higher than expected stability of chemical elements in soil. Low levels of nitrate nitrogen, similar to surrounding soil conditions and considerably lower than the values obtained from the hearth feature in Tent Ring 1-West suggest an older age for Tent Ring 1-East, which would be consistent with the artifact distribution. In the easternmost section of Tent Ring 1-East, the negative relationship noted between high aluminum and low phosphorus values, or the old phosphorus effect (Oonk et al. 2009a: 40), also denotes an older age for the Tent Ring 1-East structure. This process is linked to the length of time spent by phosphorus particles in soil, which causes them to enter into less accessible mineralogical phases thereby limiting the effectiveness of fertility packages (Oonk et al. 2009b: 1220). Given the instability of nitrogen relative to phosphorus in soil, this process is considerably slower than the leaching of nitrogen. As the easternmost section is thought to have been used as an entranceway during a second episode of use that was unrelated to the cooking cluster, these findings suggest that both episodes took place before the occupation of Tent Ring 1-West and would confirm that Tent Ring 1-East and Tent Ring 1-West are two independent structures. More investigations are required to confirm this hypothesis. The bench area, located against the north wall of Tent Ring 1-East, was not associated with significant increases in any of the elements. It registered moderate phosphorus values, similar to sections of unassigned floor space, and occasional spikes in elements that are not sufficient to confirm it as an activity area.

The patterning of phosphorus values on both floors demonstrates that increased concentrations tend to be present in interstitial spaces, closer to the hold-down rocks. Should this distribution reflect real conditions, it is consistent with the patterning of phosphorus at outdoor sites (Terry et al. 2000) and it is likely an effect of the tendency of debris to accumulate on the edges as opposed to the centre of open spaces. On the floor of House 3, from the winter component of Huntingdon Island 5, both the artifact and faunal remains distributions favored interstitial spaces, suggesting that these areas were cleaned less frequently (Murphy 2011: 107). This reveals that the impact of modern phosphorus inputs on the floor of Tent Ring 1 was minimal.

On the floor of Tent Ring 1, chemical testing for manganese did not return any readings, similar to the background samples and Tent Ring 4. Most iron values cluster in the moderate range, similar to values present in the terrace samples. There are some variations at either end of the spectrum but no pattern is apparent, which is consistent with the effect of periods of water saturation on manganese and iron in soil.

On the floor of Tent Ring 4, nitrogen and aluminum values did not differ from the baseline values that were established by comparison with the background samples. The tests returned no values for manganese, which is consistent with all the samples taken on the terrace, and may be the result of reduction and oxidation due to water saturation. Iron values alternate between the two values recorded by the samples from the rocky shore, with the higher end of the spectrum being more prevalent. The same value was recorded for the sample from the transitional coast area. No pattern is evident, which is consistent with the effect of periods of water saturation. High phosphorus values seem to cluster on the southern section of the floor, but these values may also reflect modern inputs. Magnesium values cluster in the moderate range with three samples yielding high values. Neither a negative or positive pattern has been observed. The distribution of values in the vegetation zone samples has also revealed a broad range, with some samples yielding high magnesium values which have been associated with bird activity. Therefore, it is likely that magnesium values reflect a variety of inputs, at least some of them coming from birds. The north section, closer to the shore, revealed higher levels of calcium and a single reading of potassium. Calcium seems to produce the only significant distribution, consistent with the presence of whale bone artifacts, which also confirms the bench area as an activity or storage area.

Temporary hunter-gatherer sites have been considered poor prospects for chemical analyses (Holliday 2004: 290). However, chemical testing with a commercially available fertility package has shown some significant variations on the tent floors, consistent with features identified during excavation. These findings replicate the success of Knudson et al.'s (2004) study of ephemeral fishing camps in the Yukon-Kuskokwim Delta with one significant difference being that temporal considerations were more likely to emerge rather than aspects related to the intensity or length of occupation. This is likely due to the poorly developed nature of regosols, where low levels of mineral mixing and chemical weathering of underlying sediments, as well as the slow rate of pedogenesis, contribute to the effectiveness of chemical tests using basic fertility packages. This suggests that subarctic environments are particularly suitable mediums for the application of chemical methods. However, this study has met with the same level of uncertainty as more intensive laboratory methods (Butler 2008: 151), which strengthens the necessity of applying chemical analyses in broad soil science frameworks.

Chapter 8. Paleoethnobotanical Analysis of Soil Samples from Tent Ring 1, Tent Ring 4 and Associated Contexts from Huntingdon Island 5

8.1. Introduction

This section of the analysis provides an ecological perspective that adds depth to the soil chemistry section through a qualitative and quantitative vegetational cover analysis, while simultaneously assessing plant use at Tent Ring 1 and Tent Ring 4. These objectives will be accomplished through the study of four composite categories of plant species, based on ecological parameters obtained through a literature review, data provided by the vegetation survey undertaken on Indian Harbor (Appendix A), and information gathered about Inuit plant use, which was presented in the ethnographic review from Chapter 4.

Paleoethnobotanical analysis has not been traditionally applied to hunter gatherer-contexts. However, a recent series of paleoethnobotanical studies of hunter-gatherer contexts have met with considerable success (Mason and Hather 2002). In northern Labrador, paleoethnobotanical analysis of an Inuit sod house from Uivak has revealed the presence of large amounts of crowberry (*Empetrum nigrum*) and bearberry (*Arctostaphylos uva-ursi),* both on the floor and the midden associated with the dwelling, with some samples revealing as many as 10000 seeds (Zutter 2009). In southern Labrador, the only paleoethnobotanical study of an Inuit structure to date is the analysis of samples from House 2, House 3 and House 4 from Huntingdon Island 5 (Dobrota 2014). The analysis recovered small amounts of *Empetrum nigrum* (crowberry) and *Rubus chamaemorus* (cloudberry), as well as the dessicated fruit of *V. caespitosum,* from samples collected from the floors and outside the entrance tunnels of the houses. These revealed a slight preference for *Rubus* in House 2, which is the oldest structure investigated. The scope of the analysis, however, was limited by the sample size and differential sampling procedures applied during the excavation of each house (Dobrota 2014: 56). A less investigated aspect is the domestic use of plants, described extensively in the early contact ethnographic literature discussed in Chapter 4. This analysis targets the domestic use of plants by focusing on macroremains as well as on seed specimens (Perry 2002: 108).

The Huntingdon Island 5 study has also demonstrated the necessity for the development of methodological and interpretive approaches that overcome specific issues associated with the southern Labrador landscape. The shallowness of the soil layer on tundrascapes has caused the active layer of plant growth to become intermixed with the occupation layer, while the brief periods of occupation characteristic of southern Labrador Inuit dwellings preclude the formation of sealed contexts in middens (Dobrota 2014: 48). These issues are likely to impact tent ring analyses more significantly, due to their even more ephemeral nature.

The analysis attempts to overcome these shortcomings by focusing on environmental aspects. The environmental dimension is brought into focus by the study of post-occupational regrowth on disturbed soils associated with the sod houses and tents. Post-occupational regrowth is known to surveyors of the Labrador coast, and several researchers have previously attempted to study it. Fitzhugh (1972: 123) has previously attempted to use regrowth patterns to determine site chronology at historical Inuit sites, based on the assumption that a more luxuriant vegetation cover suggests a more recent occupation, while Kaplan used differential regrowth to identify sod houses during surveys on the coast of north Labrador (Kaplan 1983: 45). Differential regrowth over Inuit sod house sites has been previously referred to as 'midden grasses' (Kaplan 1983: 564) or 'long grass' (Murphy 2011: 47), but no systematic studies have been attempted. The information collected during the vegetational survey undertaken at Huntingdon Island 5 during the 2013 fieldwork season and an assessment of plant species based on their ecological parameters will be used for this purpose.

8.2. Laboratory Methods

Sample processing was done in the Paleoethnobotany laboratory at Memorial University following Pearsall (2000). The samples were processed using an IDOT screen with a 5 mm mesh opening, mounted on a cylindrical frame. This method allows the user to operate the sieve by hand inside a bucket filled with water. Sample contents are emptied in the sieve, whereby the organic fraction, or flot, floats to the surface and the heavy mineral fraction, or coarse, settles to the bottom. Due to some peat content, the samples were partially dried prior to processing and soil clods were gently broken down. However, completely drying the sample is not recommended because it will allow the clods to become indurated. Drying was done by laying out the sample on a tray over paper sheets.

After processing, the samples now separated into flot and coarse are again laid out to dry and then processed using geological sieves. The geological sieves consist of three mesh sizes with a collection pan at the bottom. Mesh sizes are 1.7 mm, 500 micrometers and 250 micrometers. Three of the samples, HS1 (C_g), HS2 (C_g) and P consisting of sand and visible charred inclusions were dry sieved to minimize specimen damage.

Sample screening was performed with a low magnification stereo binocular microscope. Specimens were manipulated with Victorinox Swiss Army Swiss Card tweezers and small brushes, to avoid damage. The specimens were then packaged in individual gel caps. The analysis focused on seeds, macroremains and microartifacts.

Sample loss during flotation was assessed by adding 100 mustard seeds to several samples and counting the number of seeds recovered. This approach was used to identify potential bias introduced by differential recovery rates between IDOT processed and dry sieved samples. Results are listed in Table 16. Mustard seed recovery rates proved to be variable, with most values lying between 47% and 62% with an outlier at 80%. Therefore a truncated average, excluding the outlier, was computed using the more representative values. A correction value was computed for the dry-sieved samples using the truncated IDOT recovery average. Values obtained from dry sieved samples had 44.3% subtracted from their total to eliminate the bias introduced by the different processing method, and a further 10% to eliminate the bias introduced by discarding the coarse fraction for samples processed by IDOT.

Table 16. Average and truncated IDOT recovery rates, and the correction value obtained from the mustard seeds test.

Sample	Method		Coarse	Flot	Total (out of 100):
S8E26 (TR1-west)	IDOT	Mustard	18	29	47
N29E20 (TR4)	IDOT	Mustard	58	4	62
N29E16 (TR4)	IDOT	Mustard	37	9	46
N35E25(B)	IDOT	Mustard	78	2	80
S1E76(B)	IDOT	Mustard	53	5	58
Average recovery rate (IDOT), mustard counts					58.6%
Truncated average rate (IDOT), mustard counts					53.2%
Recovery rate (dry sieving)					100%
Correction applied to dry sieved samples					-44.3%

The distribution of recovered seeds within the samples brought an additional issue to light. It is a common practice to discard the coarse fraction in order to minimize processing time (Lepofski 2002: 65), and this analysis follows the same approach. However, mustard counts seemed to indicate that seeds would concentrate in the coarse fraction. In order to verify whether this was representative of all the seed remains, those samples that had control seeds added were fully screened, and the distribution of all the seeds in the flot and coarse were compared to the control seeds (Table 17).

Table 17. The average distribution of seeds within the flot and coarse fractions of a samples.

Sample:	Distribution:	Coarse:	Flot:
S8E26 (TR1-west)	Seeds recovered	22%	78%
	Mustard	38%	62%
N29E20 (TR4)	Seeds recovered	4%	98%
	Mustard	94%	6%
N29E16 (TR4)	Seeds recovered	9%	90%
	Mustard	80%	20%
N35E25 (B)	Seeds recovered	5%	95%
	Mustard	98%	2%
S1E76 (B)	Seeds recovered	20%	80%
	Mustard	91%	9%
Average distribution of seeds within a sample		12%	88%

Average distribution of mustard seeds within a sample	80%	20%

Table 17 shows amounts of seeds recovered, expressed in percentages for both the flot and coarse, together with the distribution of mustard seeds. Averages were computed for both mustard seeds and sample seeds, and distributions and ratios were determined. Based on these averages, samples display a ratio of 8:2 mustard seeds between the coarse and flot, compared to a ratio of 1:9 for seed specimens. The difference between these ratios coincides with the difference between fresh and old seeds. Fresh mustard seeds are filled with paste and will tend to sink, whereas old seeds will be hollow and will be more likely to float. A similar finding was reported by McWeeney (1989) for the living and dead sclerotia of mycorrhize. This distribution is significant because the shallowness of the soil layer on the site causes the active layer of plant growth to become intermixed with the archaeological layer. Discriminating between coarse and flot may be a simple means to distinguish between seeds coming from the active layer of plant growth and old, potentially archaeobotanical seeds.

Observer error was minimized by having only one person screen all the samples. One sample was screened twice to assess how much of the sample become lost through observer error and the results were negligible. The analysis also revealed some microartifactual evidence, consisting of small fragments of bone, feathers, and two chert flakes which will be used to interpret the data.

8.3. Results and Discussion

Paleoethnobotanical results are listed as raw counts per sample in Table E.1 (Appendix E), and in Table 18, as seed counts per liter for four composite categories, consisting of adjusted seed counts, regrowth seed counts, charred seed counts and charred macroremain counts. Specimen identification was performed using Memorial University's comparative seed collection (Agriculture Canada 1988a; 1988b) and various online sources including National Park databases and botanical garden reference collections, such as the C.V. Starr virtual herbarium (New York Botanical Garden 2014). Macroremains were identified using the Rooms comparative vascular seed collection. An asterisk denotes a tentative identification. All species recovered have been found growing on Indian Harbor during the vegetation survey except *Abies* (see Appendix A). Results are compared to samples coming from Houses 2 and 4, from the winter component of Huntingdon Island 5 and to background samples from the vegetation zones identified during the vegetation survey of the island. Values for samples from House 2 and House 4 are reproduced in modified form from Dobrota (2014).

8.3.1. Plant Species Identified by the Analysis

Identified species are mostly berry-producing shrubs, sedges, trees consisting only of conifer species and weeds. An unidentified category was added to include those specimens that were either charred or too deteriorated to permit recognition. Where not otherwise specified, the species refers to a seed find. Macroremains have been labeled and include desiccated fruit, leaf, needle or husk. Most specimens were found both in a charred and uncharred state, and charred specimens have been listed separately (Table E.1, Appendix E).

Two berry-producing shrubs were identified, crowberry (*Empetrum nigrum*) and dwarf blueberry (*Vaccinium caespitosum*), which are both *Ericaceous* species. As they come from the same family, *Empetrum* and *Vaccinium* seeds have a very similar texture. Identification was based on overall shape and size, and attachment site. *Vaccinium caespitosum* is also one of the two types of desiccated fruit recovered. Specimens were attributed to *V. caespitosum* based on one specimen that contained a highly weathered seed and a preserved stem; therefore, identification remains tentative. The second type of desiccated fruit remains unidentified, but seems to be a species of *Vaccinium* based on the texture and color of its shell. These fruit appeared to have been treated and may be the result of storage practices, either drying or storage in fat (Zutter 2009). *Calluna* is the only *Ericaceous* shrub identified that does not produce berries. Its identification, however, is tentative.

Empetrum nigrum was the only species seen growing over the entire site. It constitutes the principal species on the terrace and on top of dried sphagnum in the wetland. It grows out into the coastal area up to a point where soil conditions become too unfavorable. *Empetrum* specimens identified are both charred and uncharred seeds, as well as burned leaves. *Empetrum* is not part of the regrowth over the site of the sod houses and therefore its find in the houses was considered significant. This was also due to the discovery of multiple charred specimens both in the houses and tent samples. Crowberries are also a staple berry for Inuit groups (Jones 2010; Zutter 2009).

Cloudberry (*Rubus chamaemorus*) was the only *Rosaceae* in the berries group. *Rubus* was seen growing mainly in the wetland. It is not commonly found on the terrace or the coastal area; therefore, its presence in the samples is more likely to be associated with human activities. Cloudberries have been noted as a source of food by Jones (2010), while other early researchers noted that the Inuit avoided eating them or found them unpleasant (Jenness 1922: 97).

The grasses group is composed of *Carexes* species. The *Carexes* consist of two composite groups. *Carex spp. (1)* is most likely composed of *Carex bigelowii* and *Carex neofilipendula,* which were seen growing over the surface of former sod houses, the backfill of excavations and in the transitional coast area. Precise identification was not possible due to the lack of documentation. *Carex spp. (2)* is composed of *C. curta* and *C. nigra*. *Carex spp. (2)* were only found in samples from Tent Ring 4. Bunchberry (*C. canadensis*) seeds were only recovered from the house samples. It was also identified as one of the most numerous colonizer species and was therefore labeled a regrowth species, always occuring with *Carex* and unrelated to the archaeological layer. Outside of the house sites, *C. canadensis* was found growing on the southern edge of the wetland together with *Heracleum* and was labeled an indicator of human activity. Its status as a low-nitrogen species designates it as a late seral plant (see Appendix A). The grass finds are predominantly seeds, but some burned husks, unidentifiable at the species level, have also been recovered.

Coniferous specimens were mainly represented by needles. Only one bud was identified in the house samples. Both *Abies* and *Picea* were found. A third category remained unidentified and is labeled *Pinaceae sp*. Unidentified conifer needles were only found in Tent Ring 4 and the transitional coast area. All finds coming from the houses and Tent Ring 1 are either *Abies* or *Picea* and have been separated into charred and uncharred. Uncharred *Abies* and *Picea* needles were not considered in the analysis, as they are likely to be recent inclusions.

Salix uva-ursi was also identified in the samples and is represented only by leaf fragments. Most *Salix* finds are charred and come predominantly from Tent Ring 1. Although uncharred fragments have been found in Tent Ring 4 as well, their significance may be different in that context because the floor of Tent Ring 4 is interspersed with areas of *Salix* growth, observed during the vegetation survey. Derry et al. (1999) noted *Salix arctica* growing luxuriantly at the entrances of old Inuit dwellings in the arctic; therefore, *Salix* may be an indicator species for anthropogenically altered contexts.

Weed species identified are cinquefoils, *D. fruticosa* and *P. anserina,* as well as *Apiaceae* spp., *C. maculatum, Heracleum* and an unidentified *Apiaceae* sp. that closely resembles *C. maculatum.* The unidentified group consists of seeds that could not be identified because they were too weathered or charred and unidentified wood charcoal.

Sclerotia of *Cenoccocum graniforme* were identified in some samples. *C. graniforme* is part of the group of mycorrhizae that form symbiotic relationships with the roots of trees and shrubs, commonly *Abies, Picea* and *Juniperus* (Dickson 2000: 150 – 152; McWeeney 1989). They are associated with the roots of creeping shrubs, based on their prevalence in the transitional coast area sample. Several sclerotia found in thin section on the floor of Tent Ring 1, embedded in the C_g layer, were in an inactive state, suggesting that they may be coming from the roots of trees or shrubs harvested elsewhere and stored or used in the tents and houses. Their presence was associated with wooden structural elements and harvested wood.

8.3.2. Classification of Specimens into Composite Categories

Results have been categorized based on their status designated by the vegetation survey, whether they are within or outside their vegetational zone, and ecological parameters collected for each plant species. Ecological parameters have been collected for all species identified during the analysis based on Klinka et al. (1995), Jones (2010) and published ecological analyses of individual plant species (Bell and Tallis 1979; Sheppard 1991; Taylor 1971). Ecological parameters were also collected from the C.V. Starr virtual herbarium (New York Botanical Garden 2014) collection sheets (Table A.1., Appendix A).

Based on these data and the field observations associated with this study, a post-occupation regrowth (Table 18) group has been defined, consisting of *Carexes, C. canadensis,* and weeds, *Heracleum, C. maculatum* and cinquefoils, *P. anserina* and *D. fruticosa*. *Carexes* have been observed colonizing the site of former sod houses and backfill piles during the survey. They occur naturally in the transitional coast area and the creation of these anthropogenic contexts allowed them to migrate inland. Ecological parameters collected from a number of *Carexes* indicate these species thrive on sandy soils in nitrogen-rich areas. They have been grouped together with weed seeds based on their vegetational zone association, in the transitional coast area and due to each weed species' individual ecological parameters. *Heracleum maximum,* for example, also thrives in nitrogen-rich soil and is listed as a characteristic species in early seral communities or in communities of colonizer plants that reoccupy freshly disturbed soils. *Conium maculatum,* or hemlock, grows on road sides and in association with human occupations. *Potentilla anserina,* or silverweed, thrives in sandy soils and is also found adjacent to anthropogenic features, such as road sides. *Dasifora fruticosa,* or shrubby cinquefoil, does not have a weed status but it has been observed growing in strong association with *Carex* (Appendix A). This group allows the analysis to assess the post-occupational impact of the dwellings on the landscape.

Table 18. Seed and macroremain concentrations per liter for total seed counts, adjusted seed count, regrowth seed counts, charred seed counts and charred macroremain counts.

Sample	Description	Total seed count/L	Seed count adj/L	Regrowth seeds/L	Charred seeds/L	Charred macro'/L
S10E27	TR1-west	29	29	0	0.4	8.5
S8E26	TR1-west	23.3	23.3	0	1.1	0
S8E28	TR1-west	6	6	0	1.3	0.6
S8E29	TR1-west	0.8	0.8	0	0.8	1.6
S10E29	TR1-west	10.7	10.7	0	1.4	7.1
H1 (Cg) (Adj*)	TR1-west	3.5	3.5	0	3.5	52.9
H2 (Cg) (Adj*)	TR1-west	7.9	7.9	0	7.9	190.9
S11E30	TR1-west	16.6	16	0.6	1.3	2.6
S7E28	TR1-west	1.8	1.8	0	0	0.9
S11E27	TR1-west	5.8	5.8	0	0.5	9.4
S10E26	TR1-west	26	26	0	2.5	11.5
S9E30	TR1-west	1	1	0	0	0
S8E27	TR1-west	4.1	4.1	0	0.6	0.6
S7E26	TR1-west	9.7	9.7	0	0	0.6
S11E29	TR1-west	26.8	26.8	0	0	0.6
S10E30	TR1-west	0.5	0.5	0	0	0.5
S7E29	TR1-west	43.8	43.8	0	0	1.2
S14E32	TR1-east	0.7	0.7	0	0	0
S14E34	TR1-east	1.4	1.4	0	0	1.4
S13E36	TR1-east	7	7	0	1	0
S12E34	TR1-east	2.8	2.8	0	1.4	0.7
S12E32	TR1-east	83	83	0	0	3.5
S12E31	TR1-east	4	4.7	0	0	0
S11E32	TR1-east	4.1	4.1	0	4.1	1.6
S10E32	TR1-east	9.7	9.7	0	0	0.6
S10E33	TR1-east	8.4	8.4	0	0	1
S10E34	TR1-east	3	3	0	0.6	0
S10E35	TR1-east	9.9	9.9	0	0	0
P1 (Adj*)	TR1-east	0.8	0.8	0	0.8	0
S9E32	TR1-east	3.7	3.7	0	0	0.7
S11E31	TR1-east	15.8	15.8	0	3.5	28.2
S10E31	Border?	3.7	3.7	0	0	0
S9E31	Border	7.3	7.3	0	0	0
CC	TR1-east	7.2	7.2	0	3.6	261.8
N30E18	TR4	162.5	160.8	1.6	0	0
N29E18	TR4	76.6	75	1.6	0	0
N31E17	TR4	1251.1	1249.4	1.7	1.1	0
N29E20	TR4	141.2	139.3	1.8	0	0
N32E21	TR4	41.4	41.4	0	0	0

N31E19	TR4	21.8	21.1	0.7	0.7	0
N30E16	TR4	0	0	0	0	0
N30E20	TR4	359.3	356.8	2.5	0	0
N30E19	TR4	33.5	32.8	0.6	0	0
N30E17	TR4	378.2	378.2	0	0	0
N31E21	TR4	208.1	204.3	3.7	0.6	0
N33E19	TR4	361.1	356	5.0	0.6	0
N29E16	TR4	66.6	66.6	0	1.7	0
N32E20	TR4	60.9	60.9	0	0.7	0
N32E18	TR4	75.8	73.3	2.4	0	0
N15E1H2	Floor	22.5	11.6	10.3	2.08	0.4
N12W3H2	Entrance passage	3.2	1.6	1.6	0.4	0
N9W4H2	Outside entrance	59.4	8.1	51.3	1.8	0
N31W29H4	Sleeping platform	69	68.5	0.5	9.5	1
N34W27H4	Floor	36.3	17	19.2	1.4	0
N37W24H4	Entrance tunnel	35.6	27.2	8.4	1.4	0.4
Terr 1	Terrace	15.2	15.2	0	0	0.7
Terr 2	Terrace	2.1	2.1	0	0	0
Terr 3	Terrace	3.3	3.3	0	0	0
Terr Avg (1 to 3)	Terrace	6.8	6.8	0	0	0.2
Terr 4	Terrace	2.7	2.7	0	0	0.6
Terr 5	Terrace	2.1	2.1	0	0	0.5
Terr 6	Terrace	12.3	12.3	0	0	0
Terr Avg (4 to 6)	Terrace	5.7	5.7	0	0	0.4
Terr Avg	Terrace	6.3	6.3	0	0	0.3
N35E25	Transitional coast area	207.8	207.2	0.6	1.2	3
S0E72	Rocky shore	16	16	0	2.6	0
S1E76	Rocky shore	20.5	20.5	0	0	0
Rocky shore (Avg)	Rocky shore	18.2	18.2	0	1.3	0

Total seed count adjusted (Table 18) is the total seed count not including regrowth seeds, consisting of both charred and uncharred seeds. Total seed count adjusted consists of edible berry species, including *Empetrum, V. caespitosum* and *Rubus. Rubus* has never been seen growing on the surface of the site, its natural context being raised sphagnum layers in the wetland, and therefore each occurrence is significant. Quite opposite, *Empetrum* is the main vegetative cover over the tent sites and is likely to have constituted the vegetation cover prior to the building of the sod houses, however it has been found in a charred state, both in the houses and the tents, and its association with the human occupation is based on this find. Further measures taken to minimize modern seed inclusions during processing make the association more relevant. *V. caespitosum* seeds have never been found in a charred state, but desiccated fruit attributed to *V. caespitosum* are present both within the house and tent samples. No *V. caespitosum* seeds have been found in any samples other than Tent Ring 4 and it is unclear whether they are part of the vegetation cover. Although most of these seeds have a recent appearance, they have not been observed during the vegetation survey; however, they are present in such small amounts that they do not constitute a significant portion relative to *Empetrum* seed counts. Therefore, *V. caespitosum* has been subsumed under adjusted seed counts. As regrowth species are at the boundary of their vegetational zone here, the adjusted seed count and regrowth species reflect the interplay of coastal and *Ericaceous* vegetation at the boundary of two vegetation zones, having been impacted by the activities connected to the archaeological excavations carried-out on the island.

Two additional groups have been categorized in order to further assess plants consumed or used for domestic purposes during the occupation of the tents. These include charred seeds and charred macroremains (Table 18). Uncharred macroremains have been discarded, because they cannot be confidently associated with the occupation due to the shallowness of the soil layer. The distribution of charred seeds will be compared with the distribution of adjusted seed counts to assess the latter category's strength.

Total counts for each of these categories have been used to calculate amounts per liter in order to make the samples comparable. The dry-sieved sample amounts were reduced by 44.3% to eliminate the recovery error, and then further reduced by 10% to eliminate the subsampling error as discussed above. These values appears as Adj* (Table 18). Values will be illustrated and discussed individually for each context.

The background samples assigned to each vegetation zone and context, expressed as density per liter, have been averaged and will be used as threshold values. Samples have been grouped based on their spatial proximity across the terrace. As Terr 1 to 3 and Terr 4 to 6 each come from the same test pits (Appendix B), they represent two spatially related sets and were averaged together. The final value represents the arithmetic average of these two sets, which were used as a threshold for Tent Ring 1 samples since they originate from the same vegetation zone.

None of the terrace samples contained regrowth or charred seeds; therefore, any regrowth values and charred seeds recovered from Tent Ring 1 were considered significant. However, any adjusted total seed counts equal to or lesser than 6.3 seeds/litre and any charred macroremain counts equal to or lesser than 0.3 macroremains/litre were considered background values and will not be reproduced in the illustrations of results. For example, such a small count of burned macroremains per litre may indicate that this area does not experience frequent fires, or that land use practices do not include extensive outdoor fires from which charred remains could be scattered by the wind.

For Tent Ring 4, the upper boundary of widely spaced *Carexes,* representing the inland boundary of the transitional coast area, transects the northern edge of the excavation, placing Tent Ring 4 in two vegetation zones (Figure 14). The rocky shore averages were used as thresholds on the inland section of this boundary, and the transitional coast area averages were used as thresholds on its shoreline extremity. This distinction only applies to one sample, N33E19, which was collected from this context.

The rocky shore samples have not yielded any regrowth seeds or charred macroremains; therefore, any regrowth seeds or charred macroremains identified in the inland section of Tent Ring 4 were considered significant, whereas only adjusted seed counts above 18.2 seeds/litre and charred seed counts above 1.3 seeds/litre were considered significant. For sample N33E19, threshold values were provided by the sample from the transitional coast area, which yielded an adjusted seed count of 207.8

seeds/litre, a regrowth seed count of 0.6 seeds/litre, a charred seed count of 1.2 seeds/litre and a charred macroremains count of 3 macroremains/litre.

8.3.2.1. Adjusted Seed Counts

On the floor of Tent Ring 1, the adjusted seed count category largely consists of *Empetrum* seeds with small amounts of *Rubus* and unidentified species present in some of the samples. Adjusted seed count values ranked higher than the threshold value in 17 out of 34 samples, with nine of the samples located in Tent Ring 1-West , seven of the samples located in Tent Ring 1-East and one located

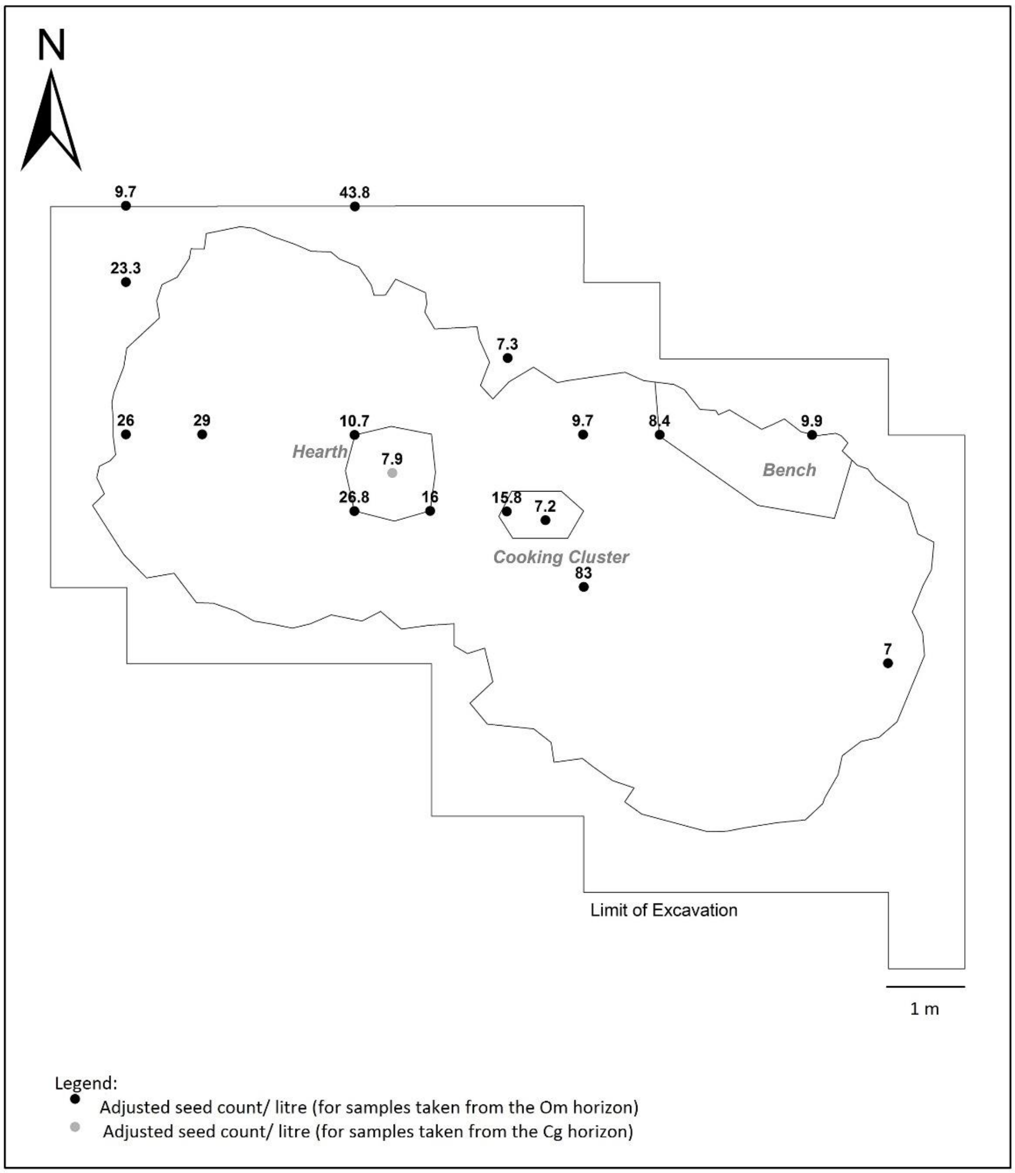

Figure 64. Adjusted seed counts above threshold values recorded in Tent Ring 1.

in the indent section (Figure 64). On the floor of Tent Ring 1-West, three out of four outside wall samples in the northwestern section ranked higher than the threshold value, with an average of 25.6 seeds/ litre and four out of six hearth samples, with an average of 15.3 seeds/litre, with the highest yields located on the edges of the features. Out of seven unassigned floor samples in Tent Ring 1-West, two samples ranked above the threshold value against the western wall with 26 seeds/litre and 29 seeds/litre. The highest value was recorded outside the tent wall in the northwestern section of Tent Ring 1-West with 43.8 seeds/litre (Figure 64; Table 18).

On the floor of Tent Ring 1-East, two out of three bench samples with an average of 9.1 seeds/litre, two out of three cooking cluster samples, with an average of 11.5 seeds/litre, and three out of eight unassigned floor samples ranked higher than the threshold value. Two of the unassigned floor samples yielded 9.7 and 7 seeds/litre. The highest value for Tent Ring 1-East and the entire Tent Ring 1 feature came from an unassigned floor sample located in proximity to the cooking cluster with 83 seeds/litre (Figure 64; Table 18).

In terms of the distribution of plant species, *Empetrum* seeds were present in all samples and constitute the bulk of the adjusted seed values; however, charred *Empetrum* seeds are predominant in Tent Ring 1-West. Only two samples from Tent Ring 1-East yielded charred *Empetrum* seeds. The sample with the highest yield, consisting of five specimens, comes from the western edge of the coking cluster, which is closest to the floor of Tent Ring 1-West. *Rubus* seeds total nine in Tent Ring 1-West. Three were recovered from samples outside the hold down rocks, in the northwestern section of the rock ring, four come from the hearth, one of which was charred, and two come from an unassigned floor sample against the western wall. All *Rubus* seeds recovered from Tent Ring 1-East were collected from the southwestern section of the floor. Two of them came from the cooking cluster, one of which was charred, and three of them come from unassigned floor samples south of the cooking cluster. This brings the total of *Rubus* recovered from Tent Ring 1 to 14 seeds (Table E.1, Appendix E).

Desiccated fruit of *V. caespitosum* were also recovered from Tent Ring 1. They are not included in the adjusted seed count but may represent consumption practices. They total eight in Tent Ring 1-West and 26 in Tent Ring 1-East, and mostly come from unassigned floor samples. The highest amount of *V. caespitosum* was recovered from an unassigned floor sample located in proximity to the cooking cluster, where 12 specimens were found (Table E.1; Appendix E). High amounts of desiccated fruit, exceeding any background samples, were also found in House 2 and House 4, where they were associated with the storage of berries for consumption, either treated with fat or dried (Dobrota 2014: 64). The highest amounts came from the floor of House 2 (267 specimens), the oldest occupation investigated at Huntingdon Island, and are, therefore, thought to indicate a more traditional practice.

On the floor of Tent Ring 4, adjusted seed counts consist of *Empetrum nigrum, V. caespitosum* and small amounts of *R. chamaemorus,* with *Empetrum* being the most prevalent species. As noted above, *Empetrum* and *Rubus* have been included in this group owing to the presence of charred *Empetrum* and *Rubus* seeds in house and tent samples. The presence of *Rubus* is particularly informative, as the floors of the tents are not within the species' vegetation zone. The floor of Tent Ring 4, in particular, has registered calcium values that are considered prohibitive for the growth of *Rubus* (Taylor 1971). Only two samples from the centre of the floor contained *Rubus,* with one sample yielding one specimen and the other 11, none of which were charred. *V. caespitosum* seeds have also been associated with this group, based on the presence of desiccated *V. caespitosum* fruit in both house and tent samples, but they make up a small percentage of the finds (Table E.1, Appendix E).

Out of 15 samples processed, 14 ranked above the threshold values. The lowest count yielded by a sample was 21.1 seeds/litre and the highest 1249.4 seeds/litre. The latter values represents an outlier, as most values clustered between 21.1 and 378.2 seeds/litre (Figure 65; Table 18). The samples from Tent Ring 4 yielded two species of desiccated fruit pods, consisting of *V. caespitosum* and an unidentified species. These amounts are comparable to those found in Tent Ring 1 (27 *V. caespitosum* and 31 unidentified respectively); however, their status is undetermined due to the unclear status of *V. caespitosum* and the presence of residual desiccated fruit pods in the transitional coast sample, immediately adjacent to the feature (Table E.1, Appendix E).

In traditional paleoethnobotanical analyses, total seed counts are reported as the qualitative and quantitative expression of plant species used or consumed at a site, based on the sealed context of the samples. Processing measures described in the methodology section, the use of a regrowth category and the threshold approach have been developed to address interpretation issues caused by the shallowness

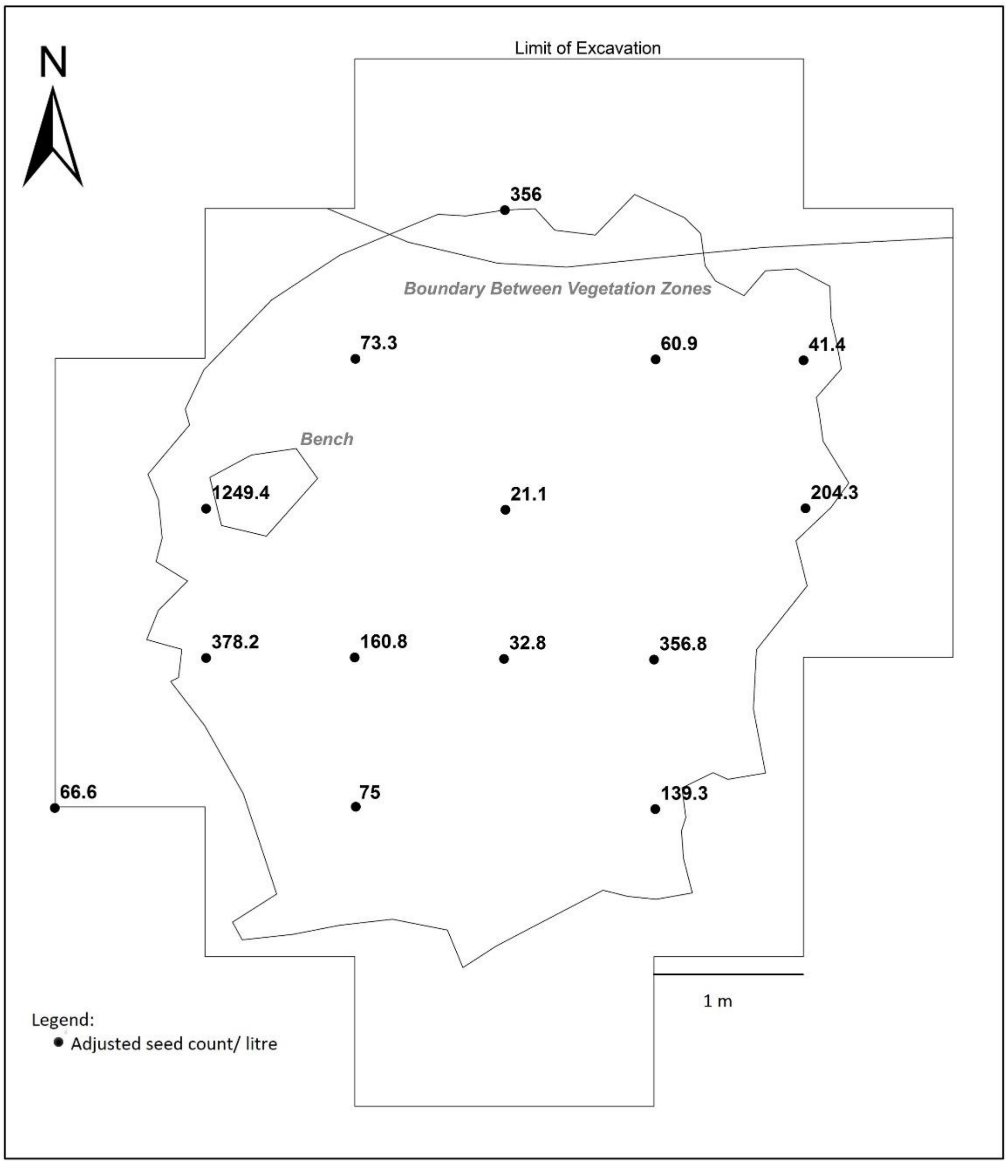

Figure 65. Adjusted seed counts above threshold values recorded in Tent Ring 4.

of the soil layer on the site, which precludes the formation of sealed contexts. However, owing to the fact that the bulk of each seed count consists of *Empetrum,* which is the predominant species growing over the site, it is possible that this category simply reflects characteristics of the vegetation cover. This possibility is greater in Tent Ring 4, based on the micromorphological analysis of the soil horizon, which indicated that it is mostly composed of recent organic inclusions with intact cellular structures. On the floor of Tent Ring 1, high seed counts positively discriminate the hearth and cooking cluster and the areas immediately adjacent to them, as well as the area outside the hold-down rocks in Tent Ring 1-West, which may reflect the dispersal of microscopic debris after the dismantling of the tent. In both contexts, the highest adjusted seed counts registered also contain the smallest charred seed counts. In Tent Ring 1, the sample that yielded the highest adjusted seed count, 83 seeds/litre, yielded a charred seed count of 3.5 seeds/litre. In Tent Ring 4, the discrepancy was even higher with the sample that registered the highest adjusted seed count, 1249.4 seeds/litre, yielding only 1.7 charred seeds/litre. Inferences about plant use coming from these samples should be considered unreliable compared to samples such as HS2 (C_g) from the hearth of Tent Ring 1-West, which yielded an adjusted seed count of 7.9 seeds/litre, all of which were charred (Table 18).

The possibility that adjusted seed counts simply reflect differences in vegetational cover yields, caused by differential chemical patterning in soil was assessed based on ecological parameters. *Empetrum nigrum,* the main constituent species of this category, prefers typical tundra soils low in phosphorus (Bell and Tallis 1979: 289). Laboratory tests have shown that the species responds positively to slight increases in calcium; although, it is defined as a calcifuge plant and is very sensitive to increased levels of aluminum and iron, which produce toxic conditions for such plants (Bell and Tallis 1979: 300). Therefore, the distribution of adjusted seed counts was compared to the distributions of iron, aluminum, phosphorus and calcium across the tent floors.

On the floor of Tent Ring 1, samples that ranked moderate (937.5 ppm), moderate to high (1250 ppm) and high (1875 ppm) on the phosphorus test exhibited a variety of values for adjusted seed counts; therefore, no relationship between adjusted seed counts and phosphorus values can be demonstrated. However, values above the threshold were predominantly associated with samples that ranked moderate (625 ppm) on the iron test and very low (125 ppm) on the aluminum test, which does suggest a relationship and is consistent with laboratory findings (Bell and Tallis 1979: 300). No relationship between calcium values and adjusted seed counts could be investigated in Tent Ring 1, as the number of samples that ranked above the background values (3750 ppm or low) on this test was too small (Figures 55, 57, 58 and 60).

On the floor of Tent Ring 4, samples that ranked moderate (8750 ppm) on the calcium test provided three of the highest adjusted seed counts, consistent with reported laboratory tests (Bell and Tallis 1979: 300). However, these samples also displayed the greatest variability in yields, while samples that ranked low (3750 ppm) and high (25000 and 35000 ppm) consistently displayed lower yields. Higher yields were also recorded for samples that ranked low (125 ppm) on the phosphorus test, which is consistent with Bell and Tallis (1979)'s findings. Samples ranked moderate (937.5 ppm) displayed the greatest variability, and samples ranked moderate to high (1250 ppm) and very high (1875 ppm) provided consistently low yields. The iron test provided only two values (625 ppm or moderate and 1562.5 ppm or very high) for all the samples tested from Tent Ring 4, and both displayed a wide range of variability that does not indicate any relationship. The aluminum test provided the same value (125 ppm or very low) for all samples tested in Tent Ring 4, therefore, no relationship can be demonstrated (Figures 56, 59 and 60).

Overall higher yield counts from samples from the floor of Tent Ring 4, as opposed to samples from Tent Ring 1, may also be connected to the better aeration of the soil layer, as *Empetrum* does not respond well to water saturation (Bell and Tallis 1979: 300). It should also be noted that associations between plant growth and soil conditions at the level of an individual plant are determined in the area of root growth, which can be more extensive than the above surface plant organism, and does not have a one-to-one correspondence with the area where the plant may naturally shed seeds (Gobat et al. 2004: 235). Therefore, associations between chemical levels and plant growth cannot reach a high level of precision.

8.3.2.2. Regrowth Seed Counts

The regrowth category was developed based on samples from the sod houses (Dobrota 2014) and represents the most visible difference, from a vegetational perspective, between the environmental context of the tent rings and sod houses at Huntingdon Island 5. At the time of the excavation, the surface of Tent Ring 1 was mainly covered by *Empetrum,* and no differential plant growth was recorded. The analysis revealed a single *Carex* seed coming from a sample located at the edge of the hearth feature in Tent Ring 1-West. Undoubtedly the excavation of the hearth into the C_g horizon during the occupation disturbed the soil layer and perhaps some sections of the floor were covered with colonizer species, but the disturbance was not substantial and the vegetation cover eventually reverted to its pre-occupation state. It is likely that the high nitrate nitrogen readings recorded by the chemical analysis in the hearth were partially maintained by a temporary differential vegetation cover.

On the floor of Tent Ring 4, the patterning of regrowth seed counts per liter reflects existing vegetation conditions, with shoreline species migrating inland following the disturbance of the soil layer associated with the excavations. Regrowth seed counts per liter increase towards the shoreward section, where they cluster between 2.4 and 5 seeds/litre, while the inland section of the floor yielded counts between 0.6 and 1.7 seeds/liter, consistent with visual assessments during the vegetation survey (Appendix A).

8.3.2.3. Charred Seed Counts

The charred seeds category may represent a more reliable expression of plant use on the tent floors. It consists mostly of *Empetrum* seeds with only two charred *Rubus* seeds and some unidentified specimens (Table E.1, Appendix E). The two charred *Rubus* seeds come from the hearth feature from Tent Ring 1-West and the cooking cluster from Tent Ring 1-East. For the charred seed category, 18 samples out of 34 yielded significant values, with 11 samples coming from Tent Ring 1-West and 7 samples coming from Tent Ring 1-East (Figure 66; Table 18). On the floor of Tent Ring 1-West, one out of four samples located outside the northern wall yielded charred seeds with a value of 1.1 seeds/litre. Four out of six hearth samples yielded charred seeds with two samples from the edges of the hearth yielding 1.4 and 1.3 seeds/litre and the two samples from within the hearth yielding 7.9 and 3.5 seeds/ litre. Six out of seven unassigned floor samples yielded charred seeds with values between 0.4 and 2.5 seeds/ litre (Figure 66; Table 18). Tent Ring 1-West yielded both the highest number of samples containing charred seed remains and the highest count of charred seeds, which were collected from within the hearth sample (7.9 seeds/ litre). Charred seed counts coming from the hearth samples also provide a pattern, with the edges of the feature yielding smaller counts than the interior. However, total values are quite small. The floor samples yielded, what appear to be, residual values.

Within Tent Ring 1-East, one out of three bench samples contained charred seeds, with a value of 0.6 seeds/ litre. All three cooking cluster samples yielded charred seeds with values between 3.5 and 4.1 seeds/ litre and two out of eight unassigned floor samples yielded 1.4 and 1 seed/litre. The P1 sample yielded 0.9 charred seeds/litre. As the threshold value is 0, all yields are significant. Values recovered positively discriminate the cooking cluster from the rest of the floor, but there is no pattern of distribution, with the edges ranking similar to the contents of the cluster. Charred seed counts, on the other hand, have not positively discriminated the bench area (Figure 66; Table 18). Similar to Tent Ring 1-West, the values collected from the floor samples appear to be residual.

As discussed above, charred *Empetrum* seeds were mostly recovered from Tent Ring 1-West, with nine recovered from the hearth, six from unassigned floor samples and two from a sample outside the hold down rocks. Although six charred *Empetrum* seeds were recovered from Tent Ring 1-East, the bulk of them were collected from the western edge of the cooking cluster, closest to the floor of Tent Ring 1-West. Charred seeds from Tent Ring 1-East predominantly come from an unidentified category, which totals seven specimens. A single charred *Rubus* specimen was obtained from the cooking cluster

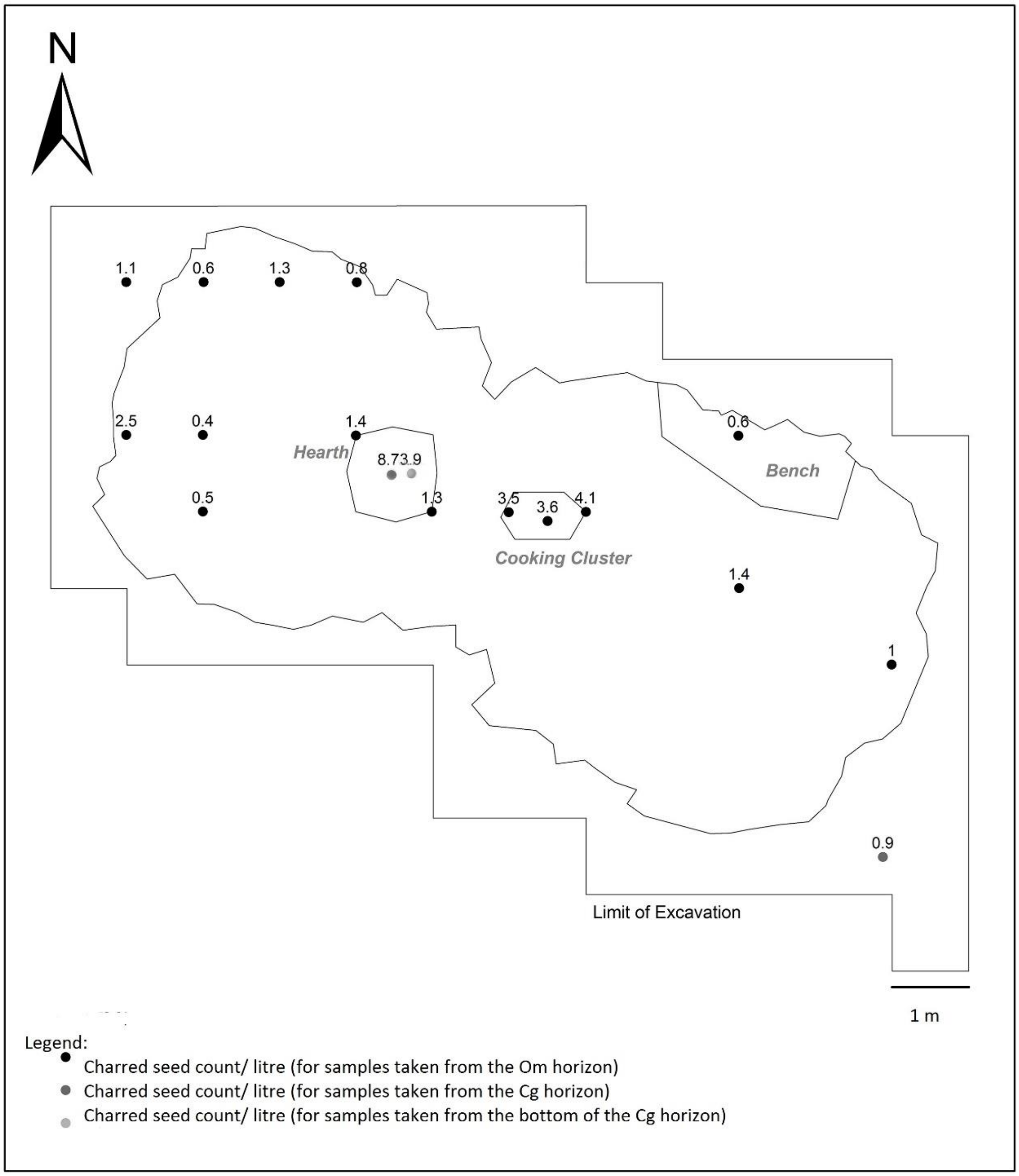

Figure 66. Charred seed counts recorded in Tent Ring 1.

(Table E.1, Appendix E). Although these quantities are very small, they seem to suggest a positive association of *Empetrum* with Tent Ring 1-West. However, charring does not presume consumption, as most berries are traditionally consumed uncooked (Jones 2010; Zutter 2009).

On the floor of Tent Ring 4, charred seeds have been recovered from six samples. One of the samples was located outside the hold-down rocks in the eastern extremity of the tent, one was associated with the edge of the bench and the rest come from the northern section of the tent floor.

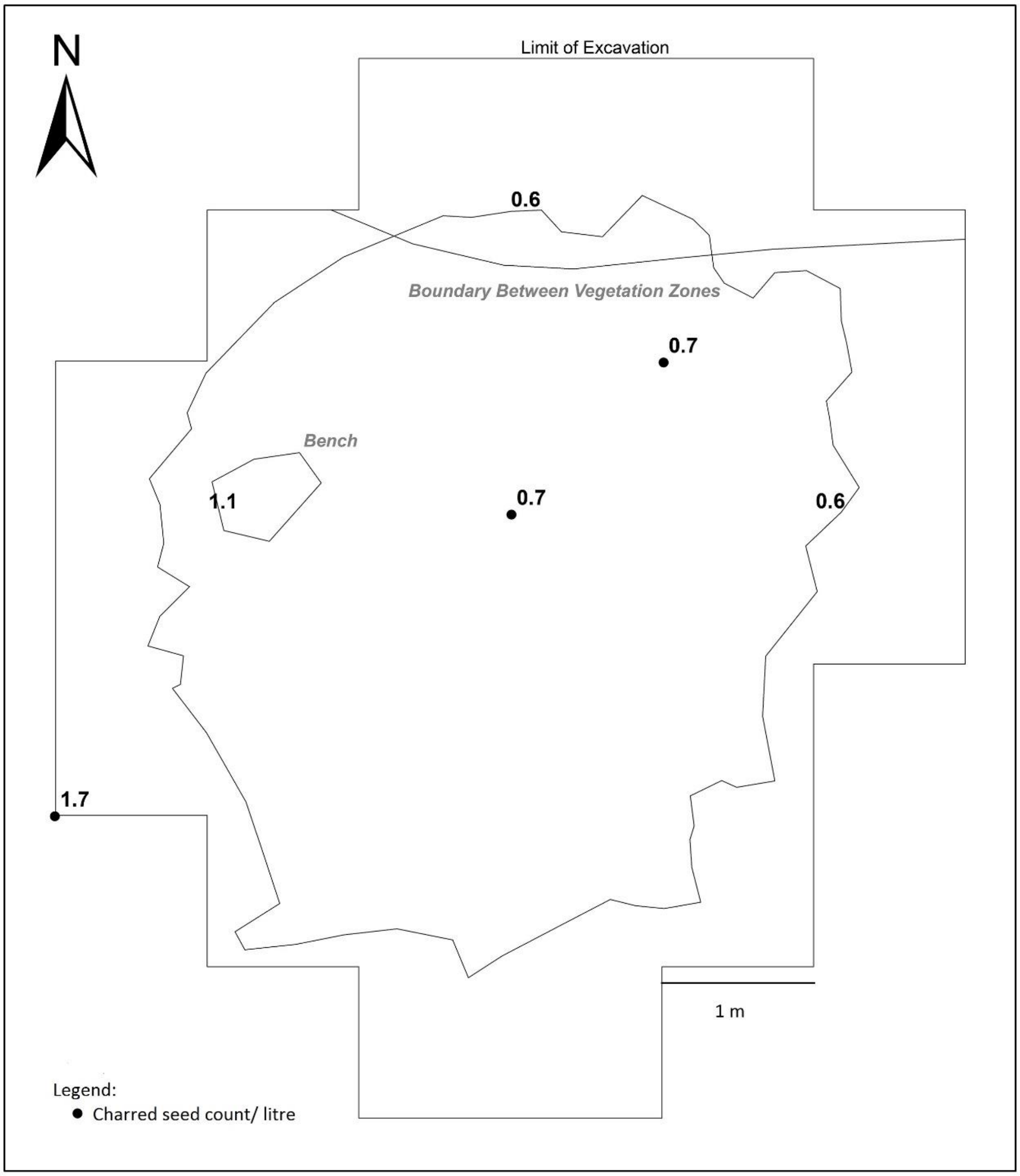

Figure 67. Charred seed counts recorded in Tent Ring 4.

Empetrum was the only charred seed recovered from Tent Ring 4. Counts ranged between 0.6 and 1.7 seeds/litre, which are all beneath the threshold established for this feature (Figure 67; Table 18). However, the distribution of charred seeds is roughly consistent with the highest calcium values recovered from Tent Ring 4, as well as the only potassium reading provided by any of the samples (Figure 59). Together, these disparate data may indicate that the north section of Tent Ring 4 was a food preparation area. This is consistent with the presence of a disturbed row of hold-down rocks that separates the northern and southern extremities of the tent, and which may indicate a sleeping platform partition in the southern section of the floor, similar to those identified by Kaplan on tent ring sites from north Labrador (1983).

8.3.2.4. Charred Macroremain Counts

For the Tent Ring 1 feature, a total of 21 samples out of 34 yielded charred macroremains above the threshold value, with 15 samples located in Tent Ring 1-West and nine samples located in Tent Ring 1-East (Figure 68; Table 18). In Tent Ring 1-West, three out of four samples located outside the tent wall in the northwestern section yielded charred macroremains above the threshold value, with values between 0.6 and 1.2 macroremains/litre, while all hearth samples produced significant amounts of charred macroremains. Samples coming from the edges of the hearth yielded values between 0.6 and 2.6 charred macroremains/litre with one outlier totaling 7.1 charred macroremains/litre. The two samples collected from inside the hearth yielded the highest values, at 190.9 and 52.9 charred macroremains/ litre. Out of the unassigned floor samples, six out of seven samples yielded charred macroremains above the threshold value. Samples coming from the north section of the floor of Tent Ring 1-West provided values between 0.6 and 1.6 macroremains/litre and the group of samples in the western section of Tent Ring 1-West provided values between 8.5 and 11.5 charred macroremains/litre (Figure 68).

In Tent Ring 1-East, one out of three bench samples yielded 1 macroremain/litre. All cooking cluster samples produced macroremain counts above the threshold, with the samples coming from the edges of the feature providing 28.2 and 1.6 macroremains/litre respectively and the sample taken from within the cluster providing 261.8 macroremains/litre. The latter represents the highest yield count of charred macroremains coming from the entire Tent Ring 1 feature. A sample outside the hold down rocks from the northern section of Tent Ring 1-East, in the indented section of the wall, yielded 0.7 macroremains/litre. Out of eight unassigned floor samples, four yielded charred macroremains above the threshold with values ranging between 0.6 and 1.4 charred macroremains/litre (Figure 68).

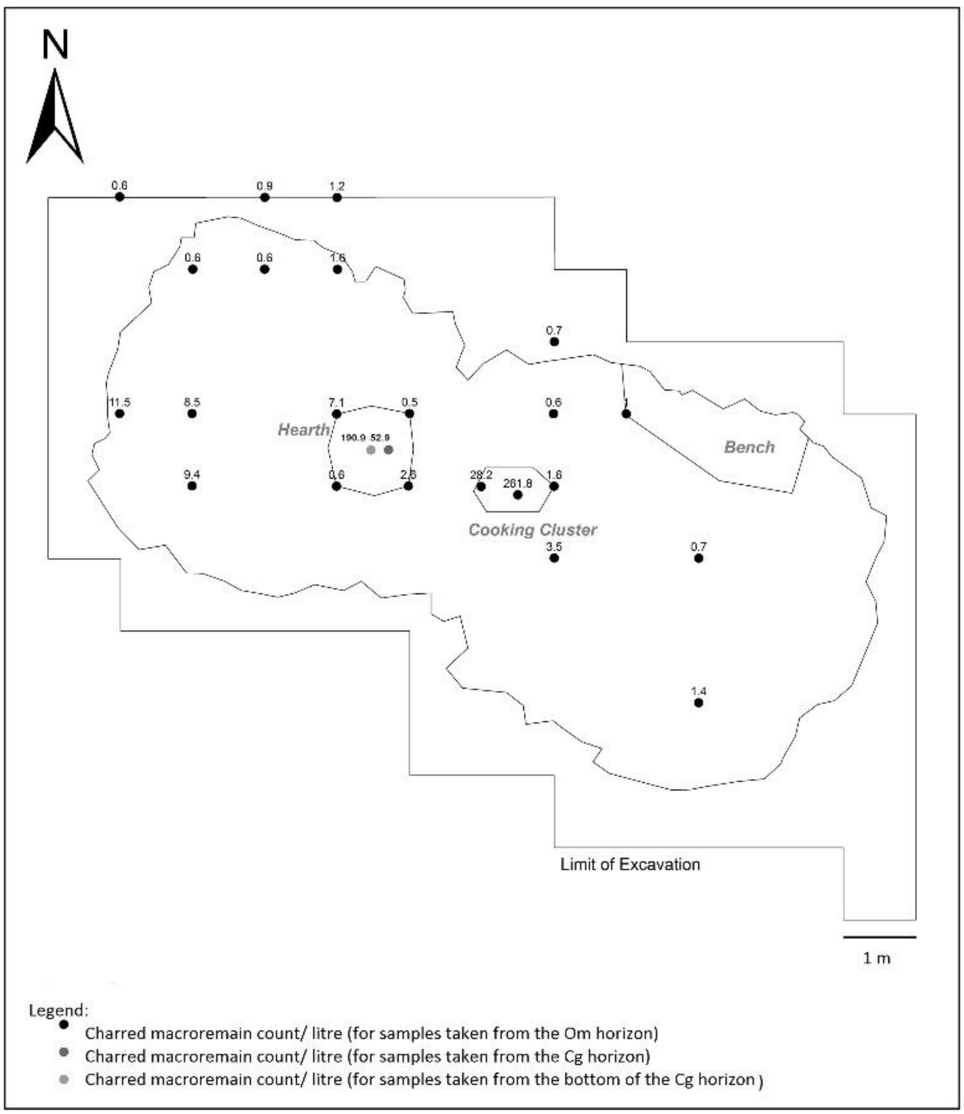

Figure 68. Charred Macroremain counts above threshold values recorded in Tent Ring 1.

The charred macroremains group largely consist of *Abies* and *Picea* needles and charred *Empetrum* leaves. Charred *Empetrum* leaves are the most significant component in both Tent Ring 1-West and Tent Ring 1-East. A total of 359 burned *Empetrum* leaves have been identified in Tent Ring 1, 161 in Tent Ring 1-West and 198 in Tent Ring 1-East. The majority of burned conifer needles are *Abies,* which total 138. Most charred *Abies* come from Tent Ring 1-West. Only one *Abies* needle was recovered from the floor of Tent Ring 1-East. A total of 35 *Picea* needles were recovered, 30 of which came from Tent Ring 1-West and five of which come from Tent Ring 1-East (Table E.1, Appendix E).

The charred macroremains group also includes some residual species. A total of nine charred *Salix* leaves were recovered, seven from the floor of Tent Ring 1-West and two from the floor of Tent Ring 1-East. On the floor of Tent Ring 1-West, charred *Salix* leaves were collected from two samples located at the western extremity of the feature, one unassigned floor sample in the northwest extremity of the feature, and the two hearth samples, HS1 and HS2. The two charred *Salix* leaves from Tent Ring 1-East came from the northern extremity of the feature, immediately outside the hold-down rocks, and from the edge of the cooking cluster. Only two fragments of charred grass husks were recovered, one from the western extremity of Tent Ring 1-West, from the same sample that yielded charred *Salix* leaves and one from the edge of the bench, in Tent Ring 1-East. Residual wood charcoal has also been recovered. All fragments are only a few millimetres long, and the greatest quantity recovered from one sample totals 6 g. Most samples provided between 0.5 and 2.2 g of wood charcoal and originated primarily from Tent Ring 1-West (Table E.1, Appendix E).

The hearth in Tent Ring 1-West and the cooking cluster in Tent Ring 1-East contain the highest concentrations of burned macroremains, which were thought to represent the remains of cooking fires. Content analysis has revealed significant similarities and differences between the two features. Both features contain burned leaves, needles and residual charcoal as opposed to large amounts of significant vegetal fuel and more closely resemble descriptions of small twigs and pieces of wood that were used as tinder and to tend to oil lamps rather than to keep a fire burning (Jenness 1922: 108 – 109), suggesting that traditional oil lamps were in use at the site. This is consistent with the low potassium readings obtained by chemical analysis that suggest the presence of small amounts of vegetal ash.

The charred macroremain composition in the hearth samples of Tent Ring 1-West is dominated by charred *E. nigrum* leaves (125 specimens) and *Abies* needles (118 specimens), followed by charred *Picea* needles (26 specimens) and two *Salix* leaf specimens. In the cooking cluster sample from Tent Ring 1-East, on the other hand, the charred macroremain composition is dominated by *Empetrum* leaves (191 specimens) followed by two *Picea* needles and one *Salix* specimen, which reflect a very limited variety (Table E.1, Appendix E). *Abies* is the only species that is not currently growing on the island and its presence in Tent Ring 1-West alone may suggest a different episode of use, consistent with the findings of the chemical analysis. The large amount of burned *Empetrum* leaves suggests that *Empetrum* seeds may have become burned on small twigs that were used to tend to fires, which precludes consumption.

No charred macroremains were recovered from the floor of Tent Ring 4. However, the sample from the transitional coast area yielded 3 charred macroremains/ liter, consisting of charred *Abies* and *Picea* needles (Table E.1, Appendix E).

8.4. Conclusions

This section concludes the first application of paleoethnobotany on samples from an Inuit tent camp. The analysis was conducted following protocols established by a previous study on samples from nearby sod houses, which demonstrated the necessity of devising means to overcome issues associated with the shallowness of the soil layer and the brief duration of occupations (Dobrota 2014). These issues were approached by conducting a vegetation survey, defining seral communities and developing a regrowth species category. The study of tent rings required a further refining of this approach, owing to the absence of seral plants in the overlying vegetation cover. The differential patterning of recent and old seeds in the flot and coarse fractions of a sample, caused by the tendency of fresh seeds to sink into the coarse fraction and of old seeds to float, motivated the discard of the coarse fraction following flotation. An additional measure used to eliminate bias was established by applying a threshold approach, based on average seed concentrations in background samples. A comparison of the distribution of adjusted seed count values relative to the patterning of phosphorus, calcium, iron and aluminum on the tent floors has shown, however, that adjusted seed counts are more likely to reflect existing vegetation cover characteristics, rather than aspects of plant use and consumption connected to the occupation of the floors. On the floor of Tent Ring 1, adjusted seed counts above the threshold value are associated with moderate (625 ppm) iron values and very low (125 ppm) aluminum values, whereas on the floor of Tent Ring 4, high adjusted seed counts are associated with low (125 ppm) phosphorus values and moderate (8750 ppm) calcium values. These findings are consistent with the ecological requirements of *Empetrum nigrum,* the main constituent species of this category. On the other hand, charred seed counts and charred macroremains have been successfully used to discriminate samples from the hearth and cooking cluster, as opposed to unassigned floor samples in both Tent Ring 1 and Tent Ring 4.

On the floor of Tent Ring 1-West, the hearth sample was positively discriminated relative to unassigned floor samples in four out of six samples using adjusted seed counts, in one out of six samples using regrowth seed counts, in four out of six samples using charred seed counts and in six out of six samples using charred macroremains. Both the charred seeds and macroremains distributions revealed a pattern, with the edges of the hearth yielding residual values and the interior yielding more substantial results. The different composition of the hearth from Tent Ring 1-West relative to the cooking cluster in Tent Ring 1-East, and particularly the presence of *Abies* needles, which are absent from Tent Ring 1-East, further confirm the findings of the chemical analysis, which indicated that at least one episode of occupation in Tent Ring 1-West was not concomitant with the occupation of Tent

Ring 1-East. The distribution of charred seeds in the two features also suggests some differences, with *Empetrum* seeds being predominant in Tent Ring 1-West. This was, however, attributed to the use of *Empetrum* twigs to tend fires. The western and northern sections of the floor of Tent Ring 1-West have also consistently ranked above threshold values, with the western section consistently ranking higher than the north section of the floor. Judging by the position of the hearth at the entrance of Inuit tents, these finds may indicate the presence of a sleeping area.

On the floor of Tent Ring 1-East, the cooking cluster was positively discriminated relative to unassigned floor samples in two out of three samples, using adjusted seed counts, in three out of three samples, using charred seed counts, and in three out of three samples using charred macroremains. The predominance of charred needles, leaves and residual charcoal amounts as opposed to more substantial amounts of vegetal fuels in both the cooking cluster and the hearth feature from Tent Ring 1-West, suggests that oil lamps were in use in both tents, and that small fragments of plants were used as tinder and to tend to the fire rather than as fuel. This is consistent with low readings of potassium obtained by the chemical analysis. The presumed bench area, on the other hand, was not positively discriminated relative to unassigned floor samples. These findings, along with the results of the chemical analysis suggest that this was not a significant refuse-generating activity area. Some of the unassigned floor samples have also yielded counts above the threshold values for many of the categories investigated, but yields were consistently lower than those from Tent Ring 1-West. These quantitative differences may reflect the different ages of these two structures indicated by the chemical analysis.

In terms of achieving a positive identification of floor space relative to outside contexts, the analysis has been less successful. Large sections of the floor have not ranked above threshold values, but this is likely connected to the patterning of activities on the tent floor. It must also be considered that summer settlements are likely associated with a more diffuse *taskscape*, with lots of activities taking place outside. Another issue is the impact of the dismantling of the camp on the tent floor at the end of the occupation period. In Tent Ring 1-West, the section sampled outside the hold-down rocks on the northwestern boundary yielded higher amounts of charred macroremains, which can be attributed to the displacement of microscopic floor contents by wind following the dismantling of the camp. On the other hand, charred seed yields are largely confined to the perimeter of the floor.

On the floor of Tent Ring 4, paleoethnobotanical investigations have been less successful in determining domestic practices than the chemical analysis. This was also suggested by the micromorphological assessment, which indicated the predominance of recent holo-organic inclusions in the soil horizon. The analysis revealed very high adjusted seed counts, relative to the thresholds established for this feature, but they contained very few charred seeds, whereas macroremains were entirely absent. Although they were beneath the threshold value, residual amounts of charred seeds present on the tent floor are spatially associated with high yields of calcium and a reading of potassium, which may indicate a general cooking and food preparation area near the bench in the north section of the floor. This inference is also supported by the presence of a structural element, a disturbed row of hold-down rocks, which suggests that the south section of the floor may have functioned as a sleeping area.

Chapter 9. A Perspective on Tent Rings from Huntingdon Islands 5 Arising from the Integrated Application of Thin Section Micromorphology, Soil Chemistry and Paleoethnobotany

9.1. Introduction

This chapter presents an integrated perspective on Tent Ring 1 and Tent Ring 4 based on the three lines of research presented in Chapter 6, 7 and 8, as they pertain to the goals of the study. These goals are determining the *taskscape* of the occupations, and defining their environmental and taphonomic context on the landscape of southern Labrador. Section 9.2. presents aspects related to the *taskscape* of Tent Ring 1 and Tent Ring 4 in relation to findings from House 2 and 4 from the winter component of Huntingdon Island 5, while Section 9.3. presents aspects related to the environmental and taphonomic context of the occupations.

9.2. The *Taskscape* of Tent Ring 1 and Tent Ring 4

This section discusses aspects of the micromorphological, chemical and paleoethnobotanical analysis that can be directly linked to the *taskscape* of Tent Ring 1 and Tent Ring 4, defined as the structure of internal space and the patterning of domestic practices on the tent floors. These aspects were determined through observations of the patterning of chemical values and the distribution of charred seeds and macroremains in samples from the tent floors, which will be discussed according to potential features identified during the sampling process. Data coming from the sod houses will be used for comparison.

An initial hypothesis that Tent Ring 1 consists of two separate structures was suggested by a structural analysis of the feature and the patterning of artifacts on the tent floor. Most artifacts come from the western ring, labeled Tent Ring 1-West, which was occupied at least on two separate occasions. The earliest instance of use is associated with the hearth feature identified in the entranceway, which faces east. A second episode of use is presumed due to the absence of surface markers for the hearth feature, which suggests that it was obliterated during a subsequent occupation.

In the eastern ring, labeled Tent Ring 1-East, one episode of use is associated with a western-facing entranceway containing a cooking cluster and a second episode with an eastern-facing entranceway where a post hole was present.

This hypothesis is confirmed by the presence of two samples that ranked moderate to high and high on the nitrate nitrogen test in the perimeter of the hearth in Tent Ring 1-West, as well as the distribution of phosphorus inside Tent Ring 1. Due to the rapid removal of nitrogen from acidic tundra soils, high nitrate nitrogen values suggest a recent age for the hearth feature, which is associated with the earliest episode of occupation in Tent Ring 1-West. Additionally, Tent Ring 1-West contained the most samples that ranked high in phosphorus as well as the highest values, with eight samples ranked high and eight samples ranked moderate to high. Upon further investigation, the lower values obtained from Tent Ring 1-East were found to be associated with high aluminum, magnesium and iron values, which suggested an old phosphorus effect, caused by the gradual immobilization of phosphorus inside mineral lattices. Whereas phosphorus values from Tent Ring 1-West are not in themselves indicative of a more recent episode of use, the identification of an old phosphorus effect in the eastern entranceway of Tent Ring 1-East and the absence of nitrate nitrogen from the cooking cluster points to the latter being an older structure, with both instances of use occurring before the oldest occupation of Tent Ring 1-West. This finding is somewhat supported by the patterning of macroremains on the tent floors with *Abies* needles being present only in samples coming from Tent Ring 1-West, which may also suggest a different episode of use. Cumulatively, these finds confirm that Tent Ring 1-West and Tent Ring 1-East are two separate structures and also indicate that Tent Ring 1-West was the last structure in use.

On the floor of Tent Ring 1-West, sampling targeted the northern and western sections of the floor which may have served as a sleeping area, an area immediately outside the hold-down rocks in the northwest section and the hearth identified in the entranceway. The north section of the floor provided three samples from the interstitial space that would have been created by the tent wall. This area is compared to a section immediately outside the hold-down rocks, which provided four samples.

The north section of the floor is defined by one high and two moderate to high values of phosphorus, one moderate value of calcium, one high and one moderate value of magnesium, one high iron value, undifferentiated values of aluminum and nitrate nitrogen relative to the baselines established by the background samples, and 0 readings for potassium and manganese. The paleoethnobotanical analysis did not provide adjusted seed counts above the threshold. The samples contained three charred *Empetrum* leaves, one charred *Empetrum* seed, one charred *Picea* needle, one desiccated *V. caespitosum* and 2.2 g of charcoal. All macroremain count values were less than 1 macroremain/litre. The highest charred seed count was 1.3 seeds/litre.

The area immediately outside the hold-down rocks in the northwest section is defined by two high, one moderate to high and one moderate value of phosphorus, one high (17500 ppm) and one moderate calcium value, one high magnesium value and two high iron values. The samples yielded undifferentiated values relative to the baselines established by the background samples for nitrate nitrogen, potassium and aluminum and a 0 reading for manganese. The paleoethnobotanical analysis revealed higher than threshold values on adjusted seed counts for three of the samples, which yielded 9.7, 23.3 and 43.8 seeds/litre; however, these values are chiefly composed of uncharred *Empetrum* seeds. The samples also contained three charred *Empetrum* leaves and one charred *Empetrum* seed, as well as one desiccated *V. caespitosum* fruit. Three of the samples ranked above the threshold for charred macroremains with values between 0.6 and 1.2 seeds/litre.

The two areas sampled revealed a similar botanical composition as well as similar phosphorus levels but the outside section was characterized by higher levels of calcium and lower levels of magnesium, relative to the inside, which had higher levels of magnesium and lower levels of calcium. Low levels of magnesium were found to be characteristic of the hearth, the bone cluster and the inside of the houses and could potentially signal an activity or storage area immediately outside the tent. As the paleoethnobotanical composition of these samples is similar to that of samples from inside the tent, it suggests that plant remains may have been displaced during the dismantling of the camp.

The western section of the floor is defined by one high, one moderate to high and one moderate value of phosphorus, one high (17500 ppm) and one moderate value of calcium, one high and two moderate values of magnesium, and one high value of iron. The samples yielded undifferentiated values relative to the baselines established by the background samples for nitrate nitrogen, potassium and aluminum and a 0 reading for manganese. The paleoethnobotanical analysis revealed higher than threshold values for two samples, which yielded 26 and 29 seeds/litre. The samples contained charred remains consisting of four *Empetrum* seeds, 30 *Empetrum* leaves, 18 *Abies* needles, three *Picea* needles, three *Salix* leaves, one charred grass husk, as well as four desiccated *V. caespitosum* and 6 g of charcoal. The highest count of charred seeds is 2.5 seeds/litre and the highest count of macroremains is 11.5 macroremains/litre. Albeit limited, these values distinguish this area, relative to the north section of the floor. The presence of *Abies* needles, in particular, might indicate where a sleeping platform covered in branches was located, while high levels of calcium are consistent with the storage and consumption of food on the sleeping platform.

The hearth feature was discriminated by the highest number of chemical variables and yielded the most botanical remains. It is characterized by a chemical pattern consisting of high nitrate nitrogen, phosphorus and aluminum values, and single moderate values of calcium and potassium, on the edges of the feature. On the nitrate nitrogen test, the edges of the hearth were undifferentiated relative to the baselines established by the background samples, whereas the inside of the feature yielded a high and a moderate to high value. For phosphorus, the entire feature yielded high and moderate to high values, and a single moderate value from the edge of the feature. A high aluminum value was retrieved from inside the feature, whereas the edges yielded values undifferentiated to the baselines established by the background samples. Magnesium levels revealed a negative pattern, with moderate and high values, higher than most of the background values, found on the edges and low and very low values found inside the feature. The paleoethnobotanical analysis revealed adjusted seed count values higher than the threshold for three of the samples on the edges of the features and one sample inside the feature, with values between 10.7 and 26.8 seeds/ litre. Charred seed count values are higher than the threshold for two samples from the edges of the feature, and both samples from inside the feature, one of which also yielded the highest count of charred seeds for Tent Ring 1, which was 7.9 seeds/litre. All the samples associated with this feature yielded above threshold values for charred macroremains, with samples from the edges yielding values between 0.5 and 7.1 seeds/litre and the samples from inside the feature yielding 52.9 and 190.9 seeds/litre. The samples were composed of charred specimens consisting of 125 *Empetrum* leaves and 10 seeds, one *Rubus* seed, 118 *Abies* needles, 26 *Picea* needles, two *Salix* specimens and 7 g of charcoal.

The predominance of charred leaves over more substantial vegetal fuels are more consistent with the use of kindling for oil lamps than the burning of substantial vegetal fires. Limited or contained burning is also consistent with low potassium values obtained from the features. The presence of charred *Empetrum* seeds with charred leaves in all the samples indicates that they likely became charred through the use of twigs as kindling. Only the presence of *V. caespitosum* desiccated fruit may be indicative of berry consumption and would be consistent with finds coming from the sod houses, but they are only present in trace amounts. The presence of *Rubus* is considered very significant, even though only one specimen was charred, as the species is found outside its vegetation zone. Relatively low values for calcium have been associated with the presence of small amounts of bone, which suggest a limited occupation period. A limited occupation period was also suggested by the micromorphological analysis, which identified only two probable anthropogenic structures in thin section. These consisted of compacted mineral layers in the O_m horizon, both found in the vicinity of the hearth, which are commonly associated with living floors.

On the floor of Tent Ring 1-East, sampling targeted a feature identified as a cooking cluster and a potential bench area. Sections of unassigned floor space in the southern and eastern extremities of the floor, as well as outside of the hold-down rocks, at the northern and eastern boundaries of the structure, were also targeted. At the eastern boundary, a rock cluster was marked as a potential post hole and gaps in the row of hold-down rocks suggested a probable entryway.

The cooking cluster feature is defined by uniform, moderate phosphorus levels, uniform moderate calcium levels, and one high magnesium value, from the middle of the feature. The samples were undifferentiated relative to the baselines established by the background samples for nitrate nitrogen, aluminum, iron, potassium and provided 0 readings for manganese. Adjusted seed count values ranked above the threshold in one sample on the edge of the feature, which yielded 15.8 seeds/litre and the sample from the middle of the feature, which produced 7.2 seeds/litre. All feature samples yielded charred seed and macroremain counts above threshold values. The charred seed counts revealed similar values from the edges and the middle of the feature, which ranged between 3.5 and 3.6 seeds/litre. Charred macroremain counts provided a pattern, with the edges revealing lower values, between 1.6 and 28.2 macroremains/litre, while the sample from the middle of the feature revealed 261.8 macroremains/litre, which is the highest amount of macroremains obtained from all the samples from Tent Ring 1. Charred remains consisted of 191 *Empetrum* leaves and five seeds, one *Rubus,* seven unidentified seeds, two *Picea* needles, one *Salix* leaf, and 2.6 g of charcoal.

Similar to the hearth feature, the predominance of charred leaves over more substantial vegetal fuels suggests that small twigs were being used to kindle and tend to oil lamps, which is consistent with the 0 reading obtained on the potassium test. The presence of charred *Empetrum* seeds in only one sample, from the western edge of the feature, may indicate they are associated with activities in Tent

Ring 1-West and calls into question the consumption of these berries in Tent Ring 1-East. Similar to Tent Ring 1-West, the presence of *V. caespitosum* desiccated fruit and *Rubus* seeds, albeit only one specimen was charred, may be linked to consumption practices. The presence of higher amounts of *V. caespitosum* desiccated fruit in Tent Ring 1-East is similar to findings from Houses 2 and 4 and seem to represent a more traditional practice. The cooking cluster ranked above the hearth on the calcium test; however, the values obtained are relatively small, suggesting a limited use of Tent Ring 1-East as well. The feature ranked below the hearth on the phosphorus test and revealed an inverse pattern on the magnesium test, with the interior of the feature yielding higher values than the edges, compared with the hearth.

Sections of unassigned floor space in the immediate vicinity of the cooking cluster, consisting of four samples immediately south and north of the feature, are defined by moderate phosphorus levels, two iron samples that ranked lower than the baseline established by the background samples, and one moderate and one high magnesium value. Values provided by the samples do not differ from the baselines established by the background samples for nitrate nitrogen, calcium, aluminum and potassium, and provided 0 readings for manganese. Adjusted seed counts above the threshold value were obtained for two samples which yielded 9.7 seeds/litre and 83 seeds/litre. The same samples also yielded the only macroremain counts above the threshold value. Contents were similar to the cooking cluster, suggesting they have been scattered from the feature, but values are very low and most chemical measurements did not differ from the baselines established by the background samples. One of these samples also yielded 12 *V. caespitosum* dessicated fruit, similar to the floor sample analyzed from House 2.

The bench feature is defined by two moderate to high and one moderate phosphorus value, one moderate calcium value, and one high magnesium value. The samples did not differ from the baselines established by background samples for nitrate nitrogen, aluminum, iron, potassium and provided 0 readings for manganese. Adjusted seed count values above the thresholds came from two samples, which yielded 8.4 and 9.9 seeds/litre. Only one sample provided charred seed counts above the threshold, with 0.6 charred seeds/litre. The sample also provided charred macroremains, with 1 macroremain/litre. Comparative to the south section of the tent ring, defined as an unassigned floor area, this feature ranked lower on the phosphorus and calcium test and similarly on the magnesium test. Botanical remains ranked slightly above the southern section and one of the samples also provided four desiccated *V. caespitosum.* These findings are not sufficient to confirm that this was a significant activity area.

Samples from the eastern extremity of the floor and the area immediately outside the hold-down rocks are from a presumed entranceway. Samples here are defined by very low to moderate values of phosphorus, with the moderate values located closer to the hold-down rocks, one high aluminum value, one moderate calcium value, and two high magnesium values. The samples were undifferentiated relative to the baseline values established by the background samples for nitrate nitrogen, potassium, and all the samples ranked 0 on the manganese test. One sample also yielded 0 on the iron test. The high aluminum value is associated with a very low phosphorus value, a 0 reading for iron and a high magnesium value. This is similar to both samples located outside the feature, which ranked very low on the phosphorus test but generated high aluminum and magnesium values, and 0 readings for iron. This pattern was associated with the tendency of phosphorus to bind with aluminum, magnesium and iron, which eventually form occluded compounds.

The area outside the hold-down rocks has yielded negligible values, for all the paleoethnobotanical categories, which is inconsistent with the tendency of botanical remains to cluster at the entrance of dwellings, such as was noted in House 2, nor with the presumed concentration of activities at the entrance of tents. The rock cluster presumed to be a post hole has, however, provided 15 sclerotia from level of the C_g horizon. Based on the results of the micromorphological analysis and the vegetational cover at the site, these sclerotia are considered additions to the soil associated with the storage or use of wood transported by humans. This is consistent with the feature's designation as a post hole. The sample from the eastern extremity of the floor also yielded negligible values for all the paleoethnobotanical categories investigated, as well as 13 desiccated *V. caespitosum.* Phosphorus values in this section followed the same pattern as in Tent Ring 1-West, with the higher values concentrating in interstitial spaces closer to the hold-down rocks. Overall, these findings may suggest the overlap of multiple patterns, which is consistent with the presumed reuse of the feature and the possible obliteration of some evidence due to the older age of the occupations.

The micromorphological analysis detected minimal evidence that points to the occupation of Tent Ring 1-East. Two horizontal layers of wood tissue from the proximity of the cooking cluster were identified as part of the wooden elements of the frame on which the tent covers were hung. Similar to Tent Ring 1-West, the absence of compaction features suggests that the tent was occupied for brief amounts of time only. The influence of root activity on soil microstructure, however, cannot be discounted in both cases.

Tent ring 4 presented a more difficult context for interpretation. All the methods applied have pointed to several factors that have impacted this feature. The patterning of vegetation over the surface indicates recent disturbances associated with archaeological excavations carried out at the site. The productivity of this location is also far greater than the context of Tent Ring 1, which has been linked to soil characteristics as well as to the positive effect elicited by slightly higher levels of calcium coming from the whale bone artifacts recovered here. This makes it more difficult to identify archaeological patterns here. Micromorphological investigations indicated that the soil layer was composed of very recent organic inclusions, based on the intactness of cellular tissues observed and the poor development of soil organic matter. Increased fungal activity was shown to have a significant impact on organic inclusions.

On the floor of Tent Ring 4, the presence of a large rock slab against the western wall of the feature was associated with a potential bench area, and the sparser concentration of hold-down rocks in the eastern extremity was associated with a potential entryway. A disturbed row of hold-down rocks in the southern extremity of the feature was interpreted as a partition, which is generally associated with the presence of sleeping platforms.

The floor of Tent Ring 4 is characterized by moderate to high and high phosphorus values in the south section, with one outlier in the southwest corner that generated a moderate value, and low to moderate and moderate values in the north section, with one outlier in the northwest corner that generated a high value. Moderate to high (25000 and 35000 ppm) calcium values have been registered in an area roughly consistent with the bench feature and the north section of the floor in association with the distribution of low phosphorus levels. This area also yielded a single potassium reading, which ranks at the lower range of the scale. Magnesium values are enriched in the bench area and the southwest corner. The rest of the feature generated values between low and moderate, which are undifferentiated from background samples in this section of the terrace. Most iron values cluster between the two values found in the background samples, with two of the samples raking 0 on the iron test. The samples were undifferentiated relative to baselines established by the background values for nitrate nitrogen and aluminum and provided 0 readings for manganese. The samples did not yield any charred macroremains and charred seed counts were beneath the threshold with values between 0.6 and 1.1 seeds/litre. Adjusted seed counts for this feature were shown to be consistent with low phosphorus values and moderate calcium values, which is consistent with the ecological parameters of *Empetrum nigrum,* the main constituent species of this category and the main component of the current vegetational cover. This suggested that adjusted seed counts obtained by the analysis reflect the composition of the vegetation cover rather than aspects of plant use. On the other hand, charred seed remains, albeit beneath the threshold value, came from the northern section that also provided higher calcium values and a single potassium value. High calcium values have been associated with the presence of whale bone artifacts; however, the presence of overlapping high values of calcium, residual charred seeds and a single potassium value may also indicate a general food preparation area in the north section of the feature. It is likely that the south section was used as a sleeping area, as it also appears delimited by an internal row of hold-down rocks; however, the results are not conclusive in this respect.

9.3. The Environmental and Taphonomic Context of Tent Ring 1 and Tent Ring 4

This section describes the tent sites as distinct environmental and taphonomic contexts on the *soilscapes* of Indian Harbour. Chemical readings of nitrogen and aluminum are chiefly considered to have an environmental significance in relation to regrowth and adjusted seed counts provided by the paleoethnobotanical analysis. These data pertain to the composite effect of initial anthropogenic chemical inputs, physical soil modifications and subsequent revegetation patterns related to the occupation of Tent Ring 1 and Tent Ring 4. Taphonomical aspects are discussed with regards to the findings of the micromorphological analysis.

The terrace where Huntingdon Island 5 is located is a young substrate consisting of unweathered glacial sediments, covered by a shallow and poorly humified organic soil horizon, consisting of a coarse, boreal mor humus. Constraining climatic factors maintain a tundra vegetation, characterized by *Ericaceous* species, rich in tannic acids that limit organic decomposition and halt pedogenesis. The same horizons, an O_f horizon consisting of poorly decomposed holo-organic inclusions and a C_g horizon consisting of mono- and polymineralic medium to coarse sand-sized grains, have been traced through test pits from the edge of the wetland to the bottom of the terrace, on the north shore, with minimal differences in depth and physical characteristics. The lowermost strata of the organic horizon on the top of the terrace and in sheltered sections of the shore did, however, reveal a more advanced degree of humification, defined by more thoroughly decomposed organic inclusions, characteristic of an O_m horizon designation.

Field investigations revealed a vegetation cover with a low diversity of plant species. Zonation occurs in a gradient from the acidic wetland that constitutes the central area of the island to the shoreline. In the wetland, warping green and red sphagnum carpets overgrown with *Rubus chamaeomorus* and *Empetrum nigrum* form occasional pools of water that host semi-terrestrial communities of *Eriophorum angustifolium* (cotton-grass). The wetland gives way to stands of *Rhododendron groenlandicum* (Labrador tea) and then to the low, prostrate *Empetrum nigrum* that forms a uniform cover across the entire unit. Desiccated organic substrates are covered by *Cladonia rangiferina.* At the edges of the terrace, the surface gently slopes to the shore and, where not constrained by large boulders, forms a transitional coastal area consisting of *Apiaceae, Onagraceae* and *Cyperaceae* species. Soil investigations have confirmed that these vegetation communities reflect the succession from a stable to an unstable substrate, disturbed by frequent additions of driftwood and sediment from wave action, consistent with their ecological parameters. Indian Harbour is almost devoid of trees. Small groups of *Picea glauca krummotlz* grow in sheltered spaces on the western hill, where they obtain protection from the wind.

Paleoethnobotanical investigations have offered a quantitative expression of the productivity of each vegetational zone. At an average depth of 10 cm, the terrace unit yielded the lowest productivity, at 6.3 seeds/liter of soil. The edge of the terrace at the section of the shore constrained by boulders yielded 18.2 seeds/liter and the transitional coast area yielded 207.8 seeds/ liter. On the terrace, sample composition is dominated by *Empetrum nigrum,* with single specimens of *Rubus* present in only two samples, in accordance with visual assessments performed during the vegetation survey. Two samples yielded single specimens of desiccated *V. caespitosum* fruit which are thought to have an anthropogenic source. The density of charred macroremains is 0.3 specimens/liter, consisting of two charred

Empetrum leaves and a charred *Picea* needle. Sample screening also recovered bird feathers, with the highest amount of feathers recovered from a sample coming up to nine specimens. Sample composition on the rocky shore is similar to the composition of the terrace samples. The transitional coast area sample revealed a distinct composition and included the highest species diversity. The sample is dominated by *V. caespitosum* seeds, followed by *Empetrum nigrum.* A single *Rubus* seed was recovered from this sample as well. The only coastal species present in the sample was *P. anserina,* which is an effect of sampling on the upper edge of this vegetation zone. The sample also revealed a variety of charred and uncharred macroremains, including needles of *Abies, Picea,* an unidentified conifer and *Salix* leaves.

Chemical analysis has confirmed the acidifying effect of *Ericaceous* litter and has revealed that pH varies both horizontally and vertically with the vegetation layer. In a gradient from the centre of the terrace to the shoreline, pH increases from a moderately acidic to a slightly alkaline value. Vertically, sample pH can vary by as much as two points between the O_m and C_g horizon, with most C_g samples ranking above the O_m horizon in the upwards section of the slightly acidic range. Phosphorus values also revealed an upwards trend from the top of the terrace to the shoreline, with values ranging from low and very low, to high. This trend is disrupted by spikes in phosphorus associated with recent activities connected with the archaeological excavations conducted at Indian Harbour. The distribution of iron also seems to follow this trend, but the coarseness of the colorimetric scale for this test makes it more difficult to ascertain patterns. All units ranked low on the nitrate nitrogen test and no differences were determined between units, consistent with the evidence of leaching provided by the micro-morphological analysis. Magnesium distributions revealed a slight tendency to increase from the top of the terrace to the shore, with terrace samples yielding very low values and the shoreline ranking low. Spikes in values associated with the presence of feathers, however, disrupt this trend. Potassium, aluminum, calcium and manganese readings were uniform across vegetation zones. The potassium and manganese tests both generated 0 readings and the aluminum and calcium tests generated very low and low readings.

Micromorphological analysis has indicated a host of soil processes that differentially impact soil elements. Reduction and oxidation under saturated conditions, translocation of fine organic mass and poor humification are the most significant soil processes affecting levels of chemical elements in soil. Reduction and oxidation chiefly impact nitrate nitrogen, manganese and iron, while the translocation of fine organic mass has been linked to the down-profile leaching of aluminum. On the other hand, the presence of an unweathered mineral substrate significantly limits the bias created by chemical inputs coming from geogenic sources, and low amounts of mineral and organic mixing limit the chemical complexity of the humic layer, increasing the effectiveness of a basic fertility package. Background investigations have also revealed two sources of disturbance that differentially impact phosphorus and magnesium, consisting of modern activities connected to the recent fieldwork seasons that took place on Indian Harbour and the activity of local bird life respectively.

Micromorphological investigations confirmed the presence of a young soil, but also identified factors that halt pedogenesis, chiefly related to climate and vegetation. The predominance of tannic residues in the fine organic fraction and occasional water saturation halt soil fauna and bacterial activity, which slows down litter decomposition and prevents the mixing of the organic and mineralic substrates. The effects of water saturation are more evident on the terrace, due to the presence of higher amounts of fine organic mass and wood layers with a higher moisture retaining capacity. The main decomposing agents in soil are saprophytic fungi. Fungal activity is more substantial on the shoreline as it increases with soil porosity and the density of cellulose-based organic inclusions. The context of the findings is minimally impacted, as cryoturbation, the only soil process likely to have a substantial mechanical impact on sediments on this flat surface, is limited.

When observing the landscape, sod house sites are the only visually distinctive contexts, due to their differential vegetation cover attributed to post-occupational regrowth. House sites support the growth of full sized *Picea glauca* along their walls, where additions of soil produced a thicker soil layer, and are colonized by coastal species, like *Carex spp., Heracleum* and *C. canadensis. C. canadensis* has only been identified on the island in another anthropogenic context, associated with modern cabins on the south shore (Appendix A). Most of the species attributed to post-occupational regrowth, based on their ecological parameters and presence within or outside their vegetation zone, were identified in surface photographs taken prior to the excavation of the houses (Appendix A). These species form seral communities of plants with heterogeneous ecological parameters, which reflect the mosaic effect of localized chemical inputs that are consistent with domestic activities. In the paleoethnobotanical section of the analysis, seral plants are subsumed under the regrowth category. The floor of House 2 provided 10.3 regrowth seeds/litre, the entrance tunnel provided 1.6 seeds/litre and the outside entrance area provided 51.3 seeds/litre. In House 4, the sleeping platform provided 0.5 regrowth seeds/litre, the floor provided 19.2 seeds/litre and the entrance tunnel provided 8.4 seeds/litre. *Carex* is predominant in the regrowth species category for each sample. *Heracleum* and *Maculatum* favored the entrance tunnel of House 4, whereas *D.fruticosa, P. anserina* and *C. canadensis* favored the floors and the areas outside the entrance tunnel at both houses. These distributions indicate that the floors and the area outside of the entrance tunnel experience higher levels of regrowth, but these findings are limited by the small number of samples.

Similarly, the small number of samples available from these houses can only provide a comparative standard for the chemical analysis. The number of samples is insufficient to provide a complete picture of chemical patterning on sod house floors or to support the establishment of links between plant species density and distribution and the patterning of chemical inputs. The sod house contexts generated the highest values for nitrate nitrogen, phosphorus and iron, as well as spikes in aluminum values. Several samples yielded readings for potassium, as opposed to only one sample from each tent ring and one of these samples ranked above any other context studied. Four out of the six samples yielded readings for manganese, which is unique to this sample set. The house dataset is also defined by low magnesium values, consistent with the lowest values recorded from the background samples and considerably lower than expected calcium values, with only two samples ranking slightly above the baseline established by the terrace samples. It is likely that the high values obtained for nitrate nitrogen were the resulted of initial anthropogenic chemical inputs but were maintained and/or amplified by the differential vegetation cover. Herbaceous species are also a major contributor of nitrogen to soil. Therefore, they represent the environmental response elicited by human action with an indirect link to the *taskscape* associated with the occupations (Appendix D).

The tent rings are not visually distinctive when the landscape is observed, but the analysis has identified elements that are clearly distinctive to surrounding soil conditions. The more extensive sampling strategies applied in these contexts permit some associations between plant species distribution and density and chemical values. However, associations between plant growth and soil conditions at the level of a plant individual remain imprecise because these associations are determined at the level of contact between soil and the plant's root system, which is more extensive than the above surface plant organism.

Although these contexts maintain an undifferentiated vegetation cover, paleoethnobotanical analysis has revealed higher yields of adjusted seed counts per liter, compared to background values which can not be securely linked to the *taskscape* of the settlement. On the floor of Tent Ring 1, a limited number of samples, relative to the size of the feature, provided values above the thresholds. The highest adjusted seed count obtained from Tent Ring 1 is 83 seeds/litre, followed by a range of values between 7 and 43.8 seeds/litre. Seed yields in Tent Ring 1 seem to be indirectly proportional with aluminum and iron levels. Low yields of seeds per liter have been associated with increased aluminum and iron concentrations, which are thought to be consistent with initial high inputs of phosphorus that have become occluded in mineral lattices with time and are therefore unavailable to the extraction method. Therefore, low seed yield counts may be the delayed product of initial high phosphorus inputs associated with the occupation of the eastern section of the dwelling.

On the floor of Tent Ring 4, 14 out of 15 samples provided seed counts that are considerably higher than the threshold values. The highest seed count obtained from Tent Ring 4 is 1249.4 seeds/litre, followed by a range of values between 73.3 and 356 seeds/litre. On the floor of Tent Ring 4, the highest yield counts of adjusted seed counts per litre have been associated with moderate values of calcium, associated with the presence of whale bone artifacts, as well as with improved soil aeration in this section of the terrace. This is thought to be an environmental effect of the occupation, indirectly linked to the *taskscape* of the settlement, based on laboratory studies that demonstrated the positive effect of moderate calcium enrichment on the fertility of *Empetrum* plants. Areas with the lowest phosphorus values have also been positively associated with high adjusted seed counts; although, the same pattern could not be identified on the floor of Tent Ring 1. On the floor of Tent Ring 4, the regrowth seeds category is thought to reflect the patterning of *Ericaceous* vegetation and migrating coastal species, chiefly *Carex spp., D. fruticosa, P. anserina, Heracleum, C. maculatum* and some unidentified *Apiaceae.* This patterning is the result of disturbances associated with the excavations carried out at sod houses in the proximity of the tent floor.

The tent contexts uniformly ranked low on nitrogen readings, which has been attributed to intensive leaching under an *Ericaceous* vegetation cover. Only two samples, from the hearth feature in Tent Ring 1, have yielded a moderate and a moderate to high value for nitrogen consistent with a single regrowth species seed, revealed by the paleoethnobotanical analysis. This finding suggests that at least portions of the hearth, which was excavated to the C_g horiozon, could have been initially colonized by *Carexes* only to revert to the initial vegetation cover with time.

The analysis has been less successful in delimiting a host of modifications consistent with the boundaries of the floor surface. Samples taken outside the floor space, in both Tent Ring 1 and Tent Ring 4, have occasionally ranked similar to floor samples for both chemical and paleoethnobotanical variables and patterning on the floor of Tent Ring 1 can be described as patchy. This is likely caused by the patterning of activities inside and outside the dwelling. Another issue is the impact of the dismantling of the tent.

Additions of wood layers detected in thin section appear to have an ameliorating effect on the soil, boosting faunal and fungal activity and the development of soil organic matter. However, these layers are not exclusively associated with the occupation of the tents, as wood tissue has been found in various degrees of decomposition suggesting a wide range of ages.

9.4. Summary and Conclusions

This chapter has provided an integrated perspective, based on the analysis and interpretation of findings provided by individual lines of research. Integration has offered information on the internal organization of the tents and potential activity areas, especially in relation to food preparation, storage, cooking and the location of sleeping platforms, entryways and wooden structural elements. Furthermore, the analysis has also offered information on multiple episodes of use and a relative sequence of occupation, as well as the season of use and length of occupation for the tents. From an environmental perspective, the analysis has been successful in identifying the effect of the occupations on local vegetation and soil conditions, as well as a host of taphonomic processes subsumed under the concept of *environmental context*. These aspects, however, could not have been investigated without a thorough understanding of soil conditions at the site.

Based on the findings, Tent Ring 1 represents two conjoined structures, likely conical skin tents with hearths located in the entryway, that were both reoccupied at least once. Tent Ring 1-East is the oldest structure and experienced a minimum of two episodes of occupation. During its earliest occupation, it had an eastern-oriented entryway where initial high inputs of phosphorus bonded with aluminum, magnesium and iron in soil. This had a negative effect on the vegetation cover, leading to current low seed yields in this section of the feature. During a later occupation, the feature had a western-facing entryway. A cooking feature was located inside the entryway, suggesting that vents were not present in the tent frame, which is characteristic of conical tents. This cooking feature consisted of boulders that most likely acted as oil lamp supports. The inhabitants used crowberry twigs, immediately available on the ground, and locally available *Salix* and *Picea* to kindle the fire and make the tent floor more comfortable and had preserved bilberries with their meals. Residual amounts recovered by the paleoethnobotanical analysis, low chemical readings for calcium and the absence of substantial micromorphological structures associated with living floors suggest that the occupation was very brief.

Tent ring 1-West also exhibited evidence for at least two episodes of occupation. The entryway faced east during both of these occupations. During an early episode of use, the entryway contained a cooking feature, which suggests the use of a conical skin tent. This cooking feature was most likely used with an oil lamp, based on the nature of the charred residues recovered. The high nitrate nitrogen values provided by samples associated with it testify to the more recent age of Tent Ring 1-West. During a subsequent episode of use, the cooking feature was obliterated. It is also highly likely that the artifactual assemblage recovered from the structure is linked to this last instance of use, as the literature review has suggested.

The inhabitants of the tent used crowberry twigs and fir branches to kindle the fire. Fir branches were also used to cover the sleeping platform, located in the western extremity of the structure. Similar to Tent Ring 1-East, inhabitants consumed preserved bilberries with their meals. Small amounts of charred remains recovered by the paleoethnobotanical analysis, low chemical readings for calcium and the absence of substantial micromorphological structures associated with living floors suggest that the occupations were brief.

The similar paleoethnobotanical composition of samples coming from the tents and the sod houses, as well as the likely use of oil lamps, suggest that tent occupations took place either in the autumn or spring and that the tent camp is not a summer camp. It is most likely that these tents represent brief spring or autumn occupations, prior to or following the occupation of winter sod houses.

The range of plants recovered from Tent Ring 1 have been predominantly associated with domestic uses, such as kindling material for fires and vegetal platform covers. Only a small number of finds have been linked to consumption practices. The predominance of charred crowberry leaves in all samples collected, as well as the presence of locally available shrubby willow and spruce, signal a nonselective use of locally available plant resources. The only non-locally available plant resources identified were fir needles, which were linked to the use of fir branches as platform covers and as kindling material.

Most species identified are similar to those available to the Inuit in the high arctic and consist predominantly of low-lying prostrate shrubs, which are also characteristic of the coastal tundra landscape in southern Labrador. This may signal a more conservative use of the local landscape, but may also be a result of the limited occupation period attributed to the dwellings and the season of occupation. The use of fir branches as platform covers, despite the limited occupation period and its limited local availability, however, denotes that fir was a strongly preferred resource.

Overall, the presence of relatively high amounts of conifer needles, both fir and spruce, and wooden structural elements, signal the importance of trees as resources for the creation of suitable living spaces in the warmer seasons. This is continuous with practices observed in the arctic, where the use of wood is only limited by its restricted availability.

Tent Ring 4 provided the least amount of evidence regarding plant use. The spatial association of charred remains, present in very small amounts, with high readings of calcium and a reading of potassium in the north section of the feature adjacent to a bench, suggest a general food preparation and activity area. A potential sleeping platform was located in the south section of the feature, behind an internal partition that consisted of a displaced row of hold-down rocks. The entryway likely faced east. Considerably higher calcium levels, relative to Tent Ring 1, have been attributed to the presence of whale bone artifacts, which are linked to older Inuit occupations. Their burial has elicited a positive influence on the productivity of the vegetation cover, leading to the highest yields recovered from all the terrace samples. This find also highlight a potential geochemical aspect pertaining to Inuit culture change. Established cultural periods in the history of Labrador Inuit, defined by material assemblages consisting of different types and combinations of raw resources, may encompass their own geochemical regime that produces a distinct environmental signature.

The context of Tent Ring 4 also provided evidence of the effect of later archaeological activities. As it represented a link between a boat landing, the sod house excavations and the camps, it experienced repeated disturbance that led to the migration of many coastal plant species inland. The interplay of coastal vegetation and terrace species was evident in the distribution of adjusted seed counts and regrowth species revealed by the paleoethnobotanical analysis. These findings are consistent with visual assessments of the area conducted during the 2013 field season.

Chapter 10. Methodological Considerations and Future Research Directions

10.1. Introduction

This chapter presents a brief discussion of the strengths and shortcomings of integrated soil analysis and outlines methodological strategies that will improve its future application. Chief issues include limiting uncertainty about results, increasing the resolution of finds, addressing time constraints and the need to develop better means of integration.

This final chapter also highlights promising new research directions offered by integrated soil analysis, that foster a closer link between archaeology and soil science, based on an understanding of human culture as a factor of soil formation (Amundson and Jenny 1991; Certini and Scalenghe 2011; Jenny 1941). This approach emphasizes the ecological underpinnings of cultural behaviors, and their impact on the environment and redefine archaeology as an important player in climate change science (Hudson et al. 2013; van de Noor 2011: 1043; Ruddiman 2007; 2013).

10.2. Methodological considerations

This section briefly outlines difficulties encountered during research and prospective methodological directions that will improve the application of integrated soil analysis. Discussion will focus on each individual segment of the analysis and conclude with a brief statement on integration procedures.

The micromorphological analysis segment was fairly successful, in that results come with a limited amount of uncertainty; however, regosols and other predominantly organic soils are under-researched comparative to other soil types (Agriculture Canada 1977; 1998) which results in the limited availability of guidelines for description. This shortcoming was overcome by consulting the literature available on plant anatomy, as well as silviculture publications that tend to focus more closely on humus types. The absence of similar studies also limits the researcher's ability to generalize on the results. This is significant because regosols likely represent the main soil type present at Inuit sites in

Labrador, regardless of the season of occupation. Future studies should include samples from multiple locations with regosolic soils in order to address this issue. This can only be achieved by making undisturbed core collection a basic part of excavation at Labrador Inuit sites.

The soil chemistry segment of the analysis was more tentative. This was offset by the sizable literature available, which could be used to cross-check results. Even though the analysis used a commercially available fertility kit which provided lower-resolution data, the patterns observed were similar to those obtained by several other studies discussed in Chapter 7, which increased confidence in the results reported. One significant shortcoming is the limited ability of geochemical studies to throw light on past activities. While they represent a fast and relatively inexpensive method to study environmental aspects, especially in conjunction with plant studies, chemical analyses offer a very broad perspective on past activities and equifinality is always an issue. An integrated perspective that includes organic chemistry may be more suited to provide a higher resolution image of past activities at a site, while simultaneously focusing on environmental aspects (Charrie-Duhaut et al. 2009; Heron et al. 2010; Isaksson et al. 2010).

The paleoethnobotanical analysis was the most successful aspect of the study. Composite plant categories were successfully used to make inferences about Inuit plant use, to cross-check the results of the chemical analysis and to assess the *environmental context* of the dwellings. This was achieved by introducing perspectives coming from the science of edaphology into the analysis. One issue that affects all plant studies based on flotation and manual specimen recovery is the potential loss of data due to the differential impact on the integrity of seeds and macroremains of the flotation device, which is determined by morphological variations across plant species. This analysis has indicated that thin sections can be successfully used to study a wider range of plant inclusions and to make more detailed observations about them. Thin section paleoethnobotany would likely overcome many of the shortcomings of traditional flotation-based studies and improve our understanding of prehistoric plant use (Goldberg et al. 1994; Mason and Hather 2002).

The foremost difficulty encountered in this study was the extremely time consuming nature of most segments of the analysis. Better means of integrating various aspects of soil analysis will undoubtedly reduce the time investment required for performing integrated soil analyses. This preliminary study suggests that the most effective means to achieve integration and gain detail and resolution is through the use of thin sections (see also Blum 2008: 1 – 4). Throughout the course of the analysis, micromorphology has provided data about every single segment of the analysis and has proven more effective to address macroremain types such as wood layers than well-established traditional methods like water flotation. The availability of a wide range of optical techniques for micro-chemistry in thin section promises similar advantages for a potential thin section soil chemistry (Stoops 2003: 20 – 32).

10.3. Future Research Directions

Integrated soil analysis provides a strong platform for the study of interrelated aspects of soil that are directly and indirectly impacted by human activities, thus providing a broader picture of human cultural behaviors as active forces in soil systems colonized by humans. The main environmental aspects revealed by this research are the positive effect of anthropogenic wood additions on soil fauna and fungal activity, the positive link between human physical and chemical alterations of soil and vegetation change and plant productivity where no change in vegetation cover was registered. The recovery of high nitrogen values from samples overlain by herbaceous seral communities, from sod houses, as well as from the context of the hearth feature in Tent Ring 1-West, the only context that suggests temporary replacement of vegetation cover, positively link increases in nitrogen values to vegetation changes caused by human activity. Inputs of calcium from deposited whale bone artifacts have been found to stimulate the productivity of the vegetation cover without eliciting species replacement. High aluminum and iron levels, likely a consequence of initial high anthropogenic inputs of phosphorus, have been linked to the reduced productivity of the vegetation cover. The same set of methods that have provided these data were also successful in identifying aspects of the *taskscape* connected to the dwellings under investigation, as well as some aspects of seasonality, a relative sequence of occupation and data on the length of occupation.

The immediate benefit of integrated soil analysis approaches for archaeology, then, is the fact that they allow the researcher to look at aspects of past land use while simultaneously observing current conditions. This incorporates an environmental risk assessment in the process of archaeological research, which is invaluable to current studies, especially in arctic regions where archaeological sites are under significant threat due to increases in global temperatures (Elberling et al. 2011).

Heritage conservation is becoming an issue of main focus in archaeology, as multiple regions of the globe become threatened by the effects of climate change (Chapman 2002; Fitzpatrick 2012; Howard et al. 2008). These effects are disproportionately affecting arctic and subarctic regions of the globe, due to the susceptibility of cryosoils to temperature increases (Burn and Smith 1993; Burn and Kokelj 2009; Miller et al. 2010; Polyak et al. 2010; Yang et al. 2010).

This preliminary study has demonstrated that integrated soil analysis has the potential to engage with these issues directly. The findings related above under the *environmental context* of the occupations also determine the environmental vulnerability of the site. Vegetational change and increased concentrations of soil fauna have an immediate significance for the preservation of archaeological sites in the near future, under conditions of increasing global temperatures. Experimental studies have shown that herbaceous plants, the main species type detected at Inuit sod house sites, are the most responsive species to slight increases in temperature in arctic and subarctic studies (Arft et al. 1999; Doormann and Woodin 2002; Gajewski 2012; Walker et al. 2006). This has a bearing on many soil factors that ensure the current preservation potential of arctic and subarctic soils through increased root activity, and larger additions of ameliorating litter, which will increase soil fauna activity and lead to changes in both the physical structure and the chemistry of soil.

A broader perspective offered by integrated soil analysis approaches relates to its potential to redefine culture as a soil forming process. Previous studies of the effects of humans on the development of new soil types discussed in Chapter 4 have used a threshold approach, whereby only well developed anthropogenic soils are recognized. Currently, the European World Reference Base for Soils also recognizes Technosols, which are soils defined by 20% artifacts in the upper 1 m of the profile or an artificial, impermeable layer covering at least 95% of the horizontal extent of the soil area (IUSS Working Group WRB 2006). The relatively high artifactual threshold is a means to sustain a nature-culture divide whereby, only some cultural behaviors are understood as ecologically significant. The requirement that soils be sealed by surface construction limits focus on those soil systems that have been rendered inactive by human activity. The concept of *environmental context* is a more inclusive means to study anthropogenic soil modifications in a range of cultural contexts. This perspective would highlight the ecological reality of all human occupations and redefine human groups as factors of soil formation regardless of their so-called social complexity (Jenny 1941; Amundson and Jenny 1991; Certini and Scalenghe 2011).

This fosters a closer link between archaeology and soil science, in which prehistoric lifeways can be studied using their environmental signatures as proxies. This eliminates some of the material bias that archaeology has operated with until now and offers a means to study those forms of human expression which have traditionally remained unavailable to researchers.

Additionally, the study of culture as an environmental process may ultimately provide the only perspective in which the impact of anthropogenic factors on climate change can be fully understood. Through the study of environmentally dynamic aspects of archaeological sites, archaeology can shed light on the environmental significance of the entire human experience up to the present. Only through an investigation of human – environmental relations as a historical process can we come to understand the complex influence that humans have exercised over the environment since the beginning of our species (Hudson et al. 2013; Van de Noor 2011: 1043; Ruddiman 2007; 2013).

10.4. Summary and Conclusions

This final chapter has discussed the strengths and shortcomings of integrated soil analysis as a method for the study of human occupations and has briefly outlined future research directions. Future applications of integrated soil analyses will benefit from the integrative potential of soil thin sections, which have proven extremely versatile throughout the analysis. This will reduce time expenditures and costs and make integrated soil analysis a more effective method to obtain high-resolution data about interrelated aspects of soil.

By studying current environmental soil conditions at archaeological sites and redefining these contexts as environmentally dynamic, this method provides data on the vulnerability of archaeological sites in arctic and subarctic regions, which are disproportionately affected by rising temperatures caused by climate change. This can also foster a closer link between archaeology and soil science and offer a more inclusive basis to study human cultures through environmental proxies, regardless of the extent of their material expression.

Ultimately, a redefinition of human groups as factors of soil formation goes towards the creation of a framework in which the environmental significance of the entire human experience up to the present can be fully understood. This makes archaeology a key player in the science of climate change.

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Appendix A. Summary of the Vegetation Survey Carried out on Indian Harbor

Table A.1. summarizes plant species identified on Indian Harbor. Each species is listed by scientific and common name. Ecological parameters were compiled for each species from Klinka et al. (1995), Jones (2010), Boland (2012) and the C.V. Star virtual herbarium (New York Botanical Garden 2014). In order to maintain accuracy, only collection sites from similar latitudes in Labrador were considered.

Table A.1. Scientific and common names of plant species identified on Indian Harbor and their ecological parameters.

Family	Genus and species	Common name	Habitat
Ericaceae	*Empetrum nigrum*	Black crowberry (E)	On sites low on nitrate, calcium and phosphates, with wide range of moisture conditions; shade-intolerant; Moorlands, heaths, bogs, in cool-temperate oceanic climates, with high rainfall and dense cloud cover year-round (Bell and Tallis 1979)
	Vaccinium caespitosum	Dwarf bilberry (blueberry) (E)	dry to moist, nitrogen-poor soils; in coniferous forests and in arctic-alpine heaths;
	Calluna	Heather	Acidic barrens; shade-intolerant
	Rhododendron groenlandicum	Labrador tea	Wet to very wet, nitrogen-poor mor humus forms; Common in semi-terrestrial Sphagnum dominated communities, on water collecting sites and peat accumulations; characteristic of nutrient-poor wetlands;
	Kalmia procumbens	Alpine azalea	Very moist to wet, nitrogen-poor mor humus forms; frequent in heath communities on coastal headlands
Rosaceae	*Rubus chamaemorus*	Cloudberry (E)	Sites low in Ca (between 30 and 300 mg/ 100g) and with a low pH (never above 7); on better drained raised aspects of acidic blanket bogs (Taylor 1971)
	Potentilla anserine	Silverweed	Roadsides and human occupations, sandy soil, riparian communities
	Dasiphora fruticosa	Shrubby cinquefoil	moist habitats, wetlands, streams, pond margins, forest edges and limestone barrens
Onagraceae	*Chamerion angustifolium*	Fireweed (E)	Disturbed sites, recently cut over or burned sites; in nitrogen rich soils; within

			herbaceous communities, it indicates increased decomposition of the remaining forest floor materials;
Cornaceae	*Cornus Canadensis*	Bunchberry	Forests, barrens, wetlands; on nitrogen-poor mor humus, often inhabit decaying wood and elevated ground in nutrient poor wetlands
Cyperaceae	*Carex spp.*		Peaty barrens, moss tundra, sandy boulder beaches, colonizer species on disturbed sites; most Carex thrive on moist, nitrogen-rich soils;
	Eriophorum angustifolium	Cotton-grass (D)	Wet to very wet, nitrogen-poor mor humus; common in semi-terrestrial communities on water-collecting sites (peat bogs); characteristic of nutrient poor wetlands;
Apiaceae	*Conium maculatum*	Hemlock	Roadsides, human occupations
	Heracleum Maximum	Cow parsnip	In fluctuating moisture conditions on water receiving sites; nitrogen-rich soils, mostly moder and mull; characteristic of early seral communities (Sheppard 1991)
	Angelica lucida	Wild celery (E)	Along coasts, both in moist soils and dry beaches
	Ligusticum Scoticum	Sea Lovage, "Alexander" (E)	Gravelly soils along coasts, or along the edges of salt water lagoons.
Cupressaceae	*Juniperus horizontalis*	Creeping juniper	Exposed headlands; very dry to moderately dry, nitrogen-medium soils; sporadic in early-seral communities; Characteristic of disturbed sites
Salicaceae	*Salix uva-ursi*	Bearberry willow	Cool-temperate to arctic climates; harsh environments;
Pinaceae	*Abies balsamea*	Balsam fir	N/A
	Picea glauca, krummoltz	White spruce	Edges of bogs and ponds; variety of well drained sites, mostly in coastal regions; stunted in harsh environments;
Cladoniaceae	*Cladonia rangiferina*	Reindeer (caribou) lichen	Dry to very dry, moisture deficient sites, nitrogen-poor soils; on strongly drained, water shedding sites with shallow soils, very thin acid organic, mostly mor, substrates, or on decaying plant material; soils subject to desiccation
Carophyllaceae	*Honckenya peploides*	"Beach greens" (E)	Above the high tide line along the coast, on beach sand/gravel (Jones 2010)
	Cenoccocum graniforme	N/A	Commonly associated with Abies, Picea, Juniperus and other shrubs, forms a symbiotic relationship with their roots,

			boosting nutrient intake (McWeeney 1989)

(E denotes an edible plant; D denotes a plant used for domestic purposes)

Vegetation Patterning on the Terrace Unit:

Vegetation zones are determined based on the presence of plant communities, consisting of species that always occur together (Figure A.1. and A.2.).

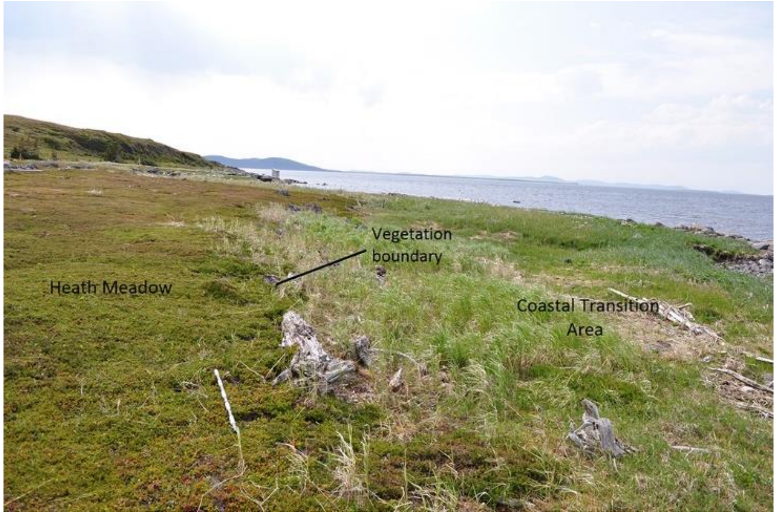

Figure A.1. West view of the northern shore of Indian Harbor indicating the sharp transition between two vegetation zones, the *Empetrum heath* and the *coastal transition area*.

Figure A.2. North view of the terrace unit indicating the sharp transition between the southern extremity of the *Empetrum heath* and the *Sphagnum wetland.*

The following vegetation zones have been identified during the vegetation survey:

1. The Sphagnum wetland

The vegetation cover is predominantly green sphagnum. Elevated sphagnum substrates are overgrown with *Empetrum nigrum*, *Rubus chamaemorus* and *Cladonia rangiferina.* The feature is lined by stands of *Rhododendron groenlandicum* on the north edge and *Heracleum* and *Cornus canadensis* on the south and west edge, against the foot of the hills. Pooling water hosts communities of *Eriophorum angustifolium.* The edge of the sphagnum cover is the limit of *Rubus chamaemorus* (Figures A.3., A.4.).

Figure A.3. Close-up of red *Sphagnum* carpet overgrown with *Empetrum nigrum, Rubus chamaemorus* and *Rhododendron groenlandicum.*

Figure A.4. Community of *Eriophorum angustifolium* growing in an area of pooling water, in the wetland.

2. Empetrum heath

The boundaries of the heath are consistent with the terrace feature. Species diversity is very limited. *Empetrum nigrum* is predominant. *Cladonia rangiferina* grows over areas of dry litter, which produce raised, desiccated substrates (Figure A.5.).

Figure A.5. Close-up of *Empetrum nigrum* with fruit.

3. Coastal transition area

The coastal transition area consists of vegetation occurring in a gradient pattern along the narrow slope that descends towards the beach, on the northwest shore. This vegetation is absent from the northeast section, where the shore is constrained by boulders. Plant species present are *Kalmia procumbens, Salix uva-ursi,* several species of sedges and grasses from the genus *Carex* and *Apiaceae*, including *Heracleum* and *Chamerion angustifolium, Angelica lucida* and *Ligusticum scoticum. Honckenya peploides* grows in isolated patches on the sandy beach (Figure A.6.).

Figure A.6. East view of the coastal transition area taken towards the end of the growing season, depicting the diversity of plant life characteristic of this vegetation zone.

4. Modified contexts:

Modified contexts consist of micro-communities developed over the surface of old sod houses and the backfill of archaeological excavations. Based on the age of the soil disturbance, micro-communities can represent early or late seral communities. An example of a late seral community, gleaned from pictures taken in the field prior to excavation, is the vegetation cover characteristic of a sod house context consisting of *Carexes*, *Cornus canadensis* and *Heracleum* (Figure A.7.). This seral community was recorded approximately 200 years after the abandonment of the structure. Full sized *Picea glauca* are exclussively associated with these contexts (Figure A.8.). Examples of early seral communities, not older than 3 years, were recorded in the field on top of the backfill of past years' archaeological excavations (Figure A.9.). These early communities consist of *Carexes* and *Heracleum*, with *C. canadensis* being absent.

Figure A.7. South view of the surface of House 4, prior to excavation, depicting a late seral community (reproduced with the permission of L. Rankin)

Figure A.8. East view of full sized *Picea glauca* growing from the back wall of a sod house on Indian Harbor.

Figure A.9. West view of House 3, three years following excavation and backfill, depicting an early seral community.

Appendix B. Summary of the Soil and Sediment Survey Carried Out on Indian Harbor

Investigations were carried out against exposed soil profiles, according to the guidelines for geomorphological survey outlined by Goldberg and Macphail (2006). A small number of continuous test pits was considered less destructive but similar in scope to trenching. Soil and sediment layers were recorded against profiles exposed in the excavations of Tent Ring 1 and Tent Ring 4, as well as along soil profiles exposed in three transects that intersect the boundaries of vegetation zones (Figure 11). Transect locations were determined based on variations in site topography and vegetation zones (Smith and Atkinson 1975: 22; Klinka et al. 1995; Goldberg and Macphail 2006: 333), and were used to collect background samples for the chemical and paleoethnobotanical analyses.

Soil horizons were distinguished based on structure, texture, quantity and quality of inclusions, moisture, and color, recorded using a Munsell color chart (Smith and Atkinson 1975). Sediment layers were recorded according to size, degree of sorting of inclusions and color. The size of inclusions was determined against the Ingram-Wentworth scale (Rapp and Hill 2006: 29).

Organic horizons were classified based on their degree of humification (Agriculture Canada 1977; 1998; Green et al.1993). The extent of humification was determined based on the amount of coarse organic inclusions present. All organic horizons identified were classified as non-peaty organic O horizons, either O_f, O_m or O_h (Gobat et al. 2004: 179). O_f and O_m horizons are differentiated based on percentage amount of holo-organic inclusions and extent of decomposition, with O_f horizons characterised by 40% or more poorly decomposed organic inclusions, and O_m horizons characterized by 10% to 40% intermediately decomposed organic inclusions. O_h horizons are characterized by well humified organic materials (Agriculture Canada: 18; Green et al. 1993: 8). Soil type identification was performed according to the Canadian System of Soil Classification (Agriculture Canada 1977; 1998).

Transects carry tent ring numbers, as grid lines were extended from excavation grids. Transect 1 consists of 4 test pits excavated from the boundary between the heath meadow and the sphagnum wetland onto the terrace, south of Tent Ring 1. Soil and sediment layers were followed through these test pits and into Tent Ring 1. Transect 4 consists of three test pits that follow soil variations from the edge of the soil cover, at the bottom of the coastal transition area, and into Tent Ring 4. Transect 2 consists of 3 test pits that investigate soil variations on the section of shore constrained by boulders. Both transects 1 and 4 are oriented north to south, transect 2 is oriented east to west. The following section provides detailed descriptions of soil profiles and horizons recorded. Conclusions will be outlined in the last section.

Profile descriptions:

Transect 1:

Test pit 1 was excavated into the wetland (Figure B.1.). The vegetation cover consists of green sphagnum. Elevated sections of sphagnum provide a substrate for *Empetrum, Rubus* and *Cladonia rangiferina.* The soil profile revealed an O_f horizon with a coarse lenticular platy structure, consisting of poorly decomposed sphagnum. The O_f horizon is underlain by a C horizon, consisting of dull yellowish brown coarse sand (10 YR 5/4). The water table was reached within approximately 30 cm of the surface.

Figure B.1. Soil profile in test pit 1.

The surface of test pit 2 (Figure B.2.) consists of dry sphagnum overlain by *Empetrum, Cladonia rangiferina* and *Rubus*. Excavation revealed a more substantial profile, consisting of a thin O_f horizon, followed by a well humified brownish black (5 YR 2/1) O_h horizon, 10 cm thick. It was followed by a discontinuous C_g horizon, consisting of slightly gleyed dark grey (10 YR 4/1) sand and unsorted pebble and cobble inclusions, approximately 2 cm thick. The C_g horizon was followed by the C horizon, consisting of dull yellowish brown coarse sand (10 YR 5/4). Within the C horizon, the dark brown (5 YR 2/1) O_{hb} is a thin buried soil that probably developed for a short while on the surface and was then reburied by aquatic sediment.

Figure B.2. Soil profile in test pit 2.

Both test pits 3 and 4 were characterized by a patchy cover of *Empetrum* and very sparse *Cladonia rangiferina. Rubus* is restricted to the sphagnic substrates and does not grow further onto the terrace. The excavation revealed a very shallow profile, variable in thickness, not deeper than 6 to 8 cm, consisting of a thin O_f horizon followed by a dark reddish brown (5 YR 2/2) O_m horizon. It was followed by the C_g horizon, consisting of dark gray (10 YR 4/1) sand with pebble and cobble inclusions. Test pit 3 provided samples TERR 4 to 6, whereas test pit 4 provided samples TERR 1 to 3, representative of the *Empetrum* heath.

Figure B.3. Soil Profile in test pit 4 (field label S30E32), also characteristic of test pit 3.

The O_f – O_m – C_g – C sequence continues into the Tent Ring 1 feature with slight variations in the depth of the profile. In the eastern extremity of Tent Ring 1, the O_m and C_g horizons have a discontinuous aspect and variable thickness (Figure B.4.). Figure B.4. depicts soil conditions in the eastern extremity of the excavation of Tent Ring 1, which was the area with the thinnest soil cover. Poor soil development and the coarseness of inclusions in the C_g layer in this section did not permit collection of cores. The soil profile displayed in Figure B.5. is more representative of the extent of soil formation characteristic for the entire feature, with an O_f horizon with a thickness between 3 and 5 cm, consisting of poorly decomposed organic inclusions and a lenticular platy structure, followed by the dark reddish brown (5 YR 2/2) O_m horizon with a thickness of approximately 8 to 10 cm, overlying the C_g and C layers. The vegetation cover consists of *Empetrum. C. rangiferina* developes on elevated substrates, consisting of dessicated plant remains.

Figure B.4. Soil profile in the eastern extremity of Tent Ring 1.

Figure B.5. Soil profile characteristic of the western section of Tent Ring 1, with core embedded in profile.

Transect 2:

Transect 2 was excavated in order to investigate soil conditions adjacent to the boulder beach. The boulders do not permit the formation of a transitional vegetation zone and preclude the influence of waves and contributions of driftwood. Soil profiles confirmed that the soil is similar to the terrace, but substantial anthropogenic wood additions were identified. Three test pits were excavated, S0E72, S1E72 and S1E76.

S1E72 revealed a modern iron blade and the edge of a cut plank (Figure B.6.). Older wood layers in a more advanced state of decomposition show that there were multiple episodes of wood deposition. The presence of soil underneath the recent plank confirms there was soil development taking place in between these episodes (Figure B.6.). The excavation revealed a shallow soil profile with an $O_f – O_m – C_g$ sequence overlying boulders (Figure B.7.. Of note is the more intensive evidence of human activity. Background samples were collected from test pits S0E72 and S1E76, listed as the rocky shore samples.

Figure B.6. Test pit S1E72, the edge of the modern cut plank is visible in the bottom right corner.

Figure B.7. Soil profile in S1E72 with cut plank emerging from the profile in the right corner and older decayed wood layers on the bottom of the test pit.

Transect 4:

Transect 4 consists of three test pits, N34E30, N35E25 and N35E23. This area is characterized by a shallow soil profile, consisting of an O_f – C_g – C sequence on a gentle slope, approximately 3%, that descends to the shore. An O_m designation could not be assigned due the amount and coarseness of holo-organic inclusions. In this section, the C_g layer receives additions of well sorted marine sediments, connected to episodes of high waves. Waves also contribute substantial amounts of driftwood to the soil in this area and prospecting led to the identification of buried soil horizons and intrusive layers associated with wave activity.

Test pit N34E30, closest to the beach, had a cover of *Empetrum, Salix* and closely spaced *Carex.* The excavation revealed a shallow soil profile, characterized by an O_f – C_g sequence (Figure B.8.). An intrusive sand layer was located on the northern edge of the profile, which largely defines the boundary of the soil layer on Indian Harbor. The slope here continues onto the sandy beach defined by a patchy cover of *Carex densa* and *Honckenya peploides.*

Figure B.8. Soil profile in test pit N34E30, revealing intrusive sand layer caused by high waves.

Test pit N35E25 further up slope had a vegetation cover consisting of *Empetrum, Salix* and widely spaced *Carex.* Excavation revealed a shallow soil profile consisting of an $O_f - C_g - C$ sequence. Reddish brown lenses, consisting of decayed wood fibre were identified in the O_f horizon and decaying wood was embedded in the soil layer on the edges of the test pit. This test pit provided a background sample for the transitional coast area (sample N35E25).

Test pit N35E23, at the top of the slope had a cover of *Empetrum, Salix* and widely spaced *Carex.* Excavation revealed a relatively shallow profile, displaying an $O_f - C$ sequence (Figure B.9). The O_f horizon here achieves it greatest depth, nearing 20 cm. An intrusive pebble layer, consisting of well sorted pebbles was identified against the south profile of this pit. Similarities in structure and texture between sections overlying and underlying the pebble layer suggested that this event was relatively recent. The pebble layer was followed into the excavation of Tent Ring 4, where it gradually tapers out, revealing the C layer. In order to test the presence of a potentially young buried soil horizon on the floor of Tent Ring 4, two test pits excavated further into the centre of the pebble layer. This confirmed that the buried soil horizon did not continue further onto the terrace.

Figure B.9. Soil profile in test pit N35E23, revealing intrusive pebble layer.

Figure B.10. Tent Ring 4, showing where test pits were continued into the pebble layer.

Figure B.11. displays a typical soil profile for Tent Ring 4, consisting of an O_f – C sequence. Soil profiles in Tent Ring 4 could not be given the designation O_m, due to the amount and coarseness of soil inclusions. Vegetation cover here consists of *Empetrum* and *Salix* and widely spaced *Carex.*

Figure B.11. Soil profile revealing a typical sequence in Tent Ring 4. The O_f horizon is underlain by the intrusive pebble layer.

Conclusions:

In the wetland, investigations revealed a well developed histic horizon, with a characteristic coarse platy structure, consisting of poorly decomposed Sphagnum. As drainage conditions improve northward, the histic horizon develops into a better humified O_h horizon that gradually tapers away. The terrace is defined by a shallow organic regosol, with a maximum thickness between 10 and 15 cm, with an O_f (O_m) – C_g – C sequence (Agriculture Canada 1977; 1998).

This sequence was recorded on the terrace and in the northeast section of the shore, along the boulder beach. Conditions on the northwest section of the shore appear to be more unstable, with recent episodes of high waves depositing well sorted sediment onto the shore and creating buried layers. Soil profiles here are characterized by an O_f – C_g – C sequence. Based on percentage amount of organic inclusions and decomposition level, an O_m designation could not be assigned.

The C_g and C layers have mainly been distinguished based on size of inclusions, degree of sorting, thickness and vertical variation, but they are also easily distinguishable by color. The C_g layer consists of poorly sorted sediments, with a grey, gleyed appearance. It has an irregular, wavy appearance against the profile wall, and never exceeds a few centimetres in thickness. The C layer consists of well sorted coarse sand and its thickness exceeds the depth of the test pits.

Based on these criteria, the sediment layers are consistent with two types of sediment identified by Smith et al. (2003) on Porcupine Strand, immediately north of Sandwich Bay. The C_g layer consists of glaciofluvial sediments drained by glacier melt water into Sandwich Bay. These sediments were either deposited directly by melt waters, melting ice, or were swept by marine water. The C layer likely has a glaciomarine source, consisting of sediments from the ocean floor that became dry land as the coast gradually rebounded after deglaciation.

Histosols are well developed soils that require a longer time to form than regosols, suggesting that the sequence of emergence began with the southern and central sections. The northern section, consisting of the terrace feature emerged last and is characterized by the youngest soils.

Collection of background samples for the analysis was also undertaken. Soil samples have been collected from three contexts, the terrace, the rocky shore and the coastal transition area and are linked to variations in topography, soil conditions and vegetation outside former living floors.

Appendix C. Micromorphological Thin Section Descriptions and Illustrations

Labeling conventions: horizons and layers are labeled with upper case letters, features and inclusions are labeled with lower case letters.

MM1, FkBg-3 (field label: S12E75SQ1A)

Provenience: Tent Ring 2, path

Horizons present: O_m and C_g

C_g horizon:

Coarse mineral fraction (>63 μm): medium to very coarse sand-sized (>500 μm, 500 – 250 μm) with single pebble-sized inclusion, monomineralic and polymineralic grains, unoriented, moderately sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated

$C/F_{63\ \mu m}$: fine close enaulic

Organic components: fresh roots, dark reddish brown polymorphic organic fine mass;

Fungal material: none observed

Charcoal: none observed

Pedofeatures: organic hypocoatings on mineralic grains, impregnative redox features (subrounded to subangular Fe/Mn nodules)

Voids: simple packing voids

O_m Horizon:

Coarse mineral fraction (>63 μm): monomineralic grains, unoriented, moderately sorted, subagular to subrounded, medium to fine sand-sized (500 – 250 μm, >125 μm)

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated

$C/F_{63\ \mu m}$: open enaulic

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposed root features (r); organ and tissue fragments (single fragment of *Picea*, phlobaphene-containing tissue); Fine (<10 interconnected cells): strips of phlobaphene-containing cells, punctuation, organic pigment, dark reddish brown polymorphic organic fine mass.

Decomposition features: spheroidal microstructures (os, 'onion skin'), blackening, dissolution and associated porosity, shrinkage, colonization by fungal hyphae and tissue replacement by plectenchyma.

Fungal material: fungal hyphae (in SOM, few to moderate), plectenchyma (single standing coalescences or associated with organic tissue and decomposing root cavities)

Charcoal: none observed

Pedofeatures: organic hypocoatings, impregnative redox features (subrounded to subangular Fe/Mn nodules)

Voids: complex packing voids, planar, channel, chamber, vugh, potential artificial voids (v)

Microstructure: Spongy, vughy, angular blocky, channel

Comments: moderately dense compaction noted; resin debris and manufacturing voids present;

Figure C.1. Thin section MM1 displaying C_g and Om horizons, v (void), os (spheroidal microstructure) and r (decomposed root feature).

MM2, FkBg-3 (field label: S16E72EA)

Provenience: Tent Ring 2, backfill

Horizons present: O_{fa} consisting of partially accommodated aggregates with varying fabrics, the result of mechanical disturbance.

O_{fa} horizon:

Coarse mineral fraction (>63 µm): medium to very coarse sand-sized (>500 µm, 500 – 250 µm) monomineralic and polymineralic grains, unoriented, moderately sorted, subangular to subrounded. Mainly as groundmass of a single aggregate and as interaggregate inclusions

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated

$C/F_{63\ \mu m}$: enaulic

Organic components: Coarse (> 10 interconnected cells): fresh roots, organ and tissue fragments that include coalescences of lichen fragments consisting of algal and chondroid tissue of *C. rangiferina*, fragments of an unidentified Bryophyte, strips of phlobaphene-containing cells, and amorphous woody tissue (exhibiting planar voids (d), likely frost cracks); Fine (<10 interconnected cells): strips of phlobaphene-containing cells, punctuation, dark reddish brown polymorphic organic fine mass, occasionally impregnated by a limpid-yellow fine-speckled organic fine mass;

Decomposition features: solubilization of organic tissue, blackening, comminution by soil fauna, shrinkage, colonization by fungi and replacement of tissue by plectenchyma.

Fungal material: plectenchyma, fungal hyphae (few hyphae associated with SOM; predominantly organic tissue and fecal pellets)

Charcoal: single fragment, 1.35 mm in diameter.

Pedofeatures: fecal pellets and coalescences of fecal matter of *Oribatida* in primary context, at 3 locales within cavities in decomposing organic tissue; impregnative redox features (subangular and subrounded Fe/Mn nodules, mainly concentrated on woody tissue), organic hypocoatings on mineralic grains.

Voids: moderately to unaccommodating planar voids, intraaggregate packing voids

Microstructure: coarse angular and subangular blocky with lenticular platy overprint

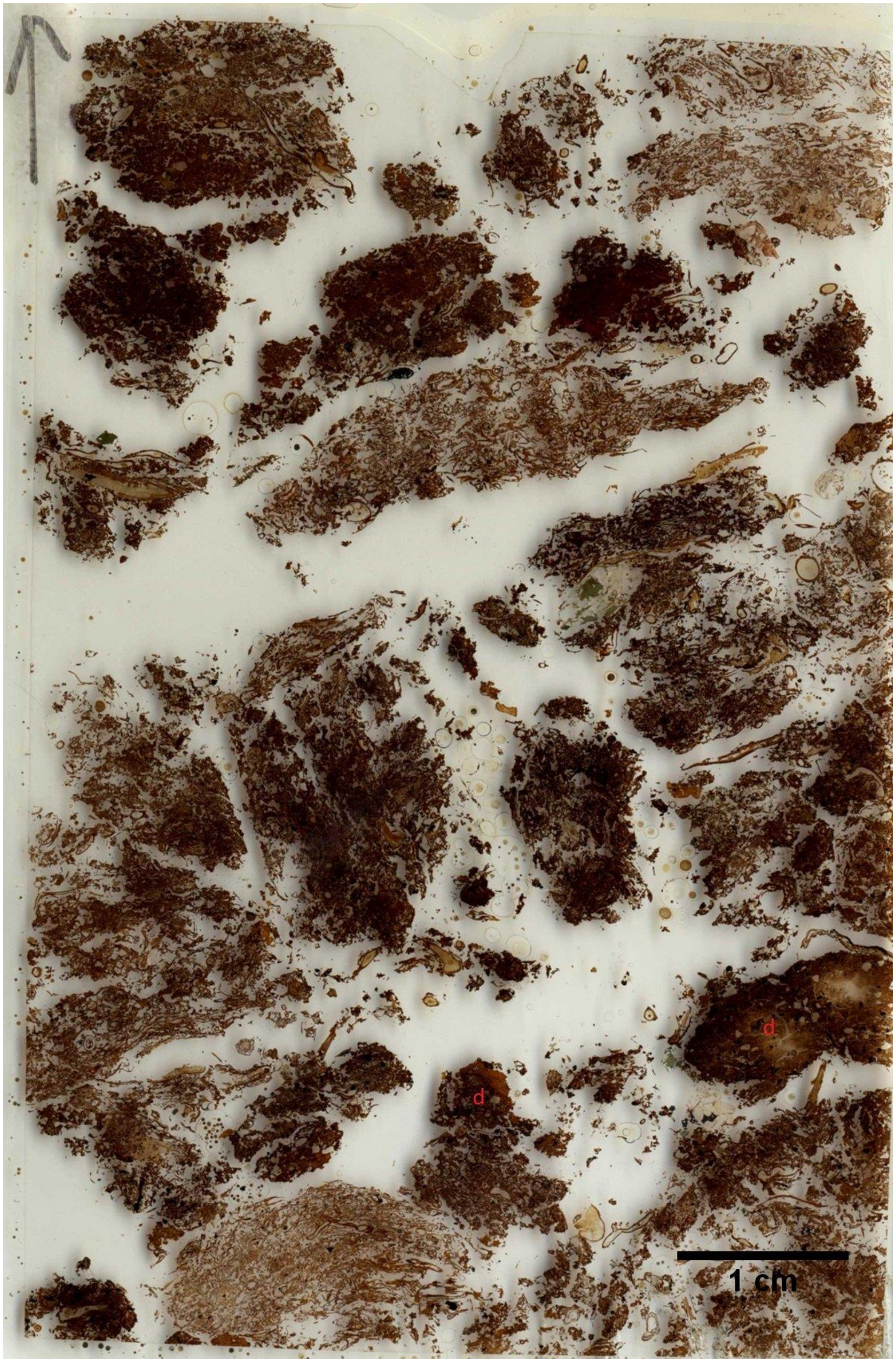

Figure C.2. Thin section MM2 displaying anthropogenically altered O_{fa} horizon, and d, decomposed wood fragments, potentially coming from buried wood layers on the floor of Tent Ring 2.

MM3, FkBg-3 (field label S9E27WB)

Provenience: Tent Ring 1-West (western wall)

Horizons present: C_g, O_m, O_f

C_g horizon:

Coarse mineral fraction (>63 μm): medium to very coarse sand and pebble-sized (>500 μm, 500 – 250 μm) monomineralic and polymineralic grains, unoriented, poorly to moderately sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated

$C/F_{63\ \mu m}$: single to double spaced equal to coarse enaulic

Organic components: polymorphic organic fine mass

Decomposition features: N/A

Fungal material: sclerotia (s)

Charcoal: none observed

Pedofeatures: organic hypocoatings, cappings and link cappings consisting of polymorphic fine organic mass, impregnative redox features (subangular and subrounded Fe/Mn nodules and hypocoatings)

Voids: simple and complex packing voids, potential artificial voids

O_m-O_f horizon:

Coarse mineral fraction (>63 μm): medium to coarse sand-sized (500 – 250 μm) mono- and polymineralic grains, unoriented, moderately sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated

$C/F_{63\ \mu m}$: N/A

Organic components: Coarse (>10 interconnected cells): fresh roots; organic layer W1 (described separately); Fine (<10 interconnected cells): strips of phlobaphene-containing cells, punctuation, organic pigment; dark reddish brown polymorphic organic fine mass;

Decomposition features: solubilization of organic matter; shrinkage;

Fungal material: fungal hyphae (associated with decomposing organic tissue, predominantly in Of horizon), few associated with SOM in O_m horizon

Charcoal: none observed

Pedofeatures: organic hypocoatings on mineralic grains, micropan (m), underlying W1, caused by the deposition of solubilized organic matter and coalesced fecal matter of *Oribatida*

Voids: complex packing voids, planar, chamber.

Microstructure: lenticular platy, develops into spongy at the top of the section above W1

organic layer W1: subhorizontally positioned organic layer, consisting of fragments of *Picea* stemwood, cellulose tissue and coalesced fecal matter of Oribatida.

Decomposition features: shrinkage and cell wall deformation, blackening, comminution by soil fauna, high chromas in XPL and birefringence. Some fragments present are partially burned.

Pedofeatures: fecal pellets, and coalesced fecal matter of Oribatida mixed into the fine mass, infillings with fecal matter of organic tissue.

Figure C.3. Thin section MM3 displaying C_g, O_m and O_f horizons, with organic layer W1 and micropan (m).

MM4, FkBg-3 (field label S9E29EB)

Provenience: Tent Ring 1-West, north of hearth feature

Horizons present: O_m-O_f

O_m-O_f horizon:

Coarse mineral fraction (>63 µm): medium to very coarse sand sized (>500 µm, 500 – 250 µm) monomineralic and polymineralic grains, unoriented, moderately to well sorted, subangular to subrounded. Mostly arranged in a horizontal band at the bottom of the section, with an enaulic-porphyric distribution.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: enaulic-porphyric (mineral grain are largely limited to band feature)

Organic components: Coarse (>10 interconnected cells): fresh and decomposed root cavities; Softwood fragments, spatially associated with charcoal, *Abies* with a diameter of 1.4 mm and *Picea,* 0.7 mm in diameter, strips of phlobaphene-containing cells; Fine (<10 interconnected cells): strips of phlobaphene-containing cells, punctuation, dark reddish brown to dark brown polymorphic fine organic mass.

Decomposition features: some comminution of organic tissue by soil fauna, shrinkage, dislocation of cells and cell walls.

Fungal material: fungal hyphae, plectenchyma (concentrated in textural pedofeature)

Charcoal: a total of 5 fragments with diameters of 0.9 mm, 1 mm, 2.35 mm, 1.1 mm, 1.5 mm, spatially clustered in the bottom of the section, underlying the textural pedofeature (S1).

Pedofeatures: textural pedofeature (s1) (described separately), channels associated with soil fauna activity, channel infillings consisting of fecal pellets (ex) and coalesced fecal matter of Enchytraeidae as well as some coalescences in secondary context (embedded in soil matrix).

Voids: complex packing voids, vughs and channel

Microstructure: vughy, spongy and channel

textural pedofeature s1: characterized by a differential fabric, limpid-yellow, highly organic, consisting of poorly decomposed organics, phlobaphene-containing strips of cells, amorphous organic material and single cells, and fungal hyphae

Decomposition features: spheroidal and radial microstructures (r), colonization by fungal hyphae, replacement of organic tissue by plectenchyma, high chromas and birefringence in XPL, comminution by multiple species of soil microorganisms.

Pedofeatures:clusters of fecal pellets of *Oribatida* and unidentified soil organisms in primary and secondary contexts. These consist of conoidal, spheroidal and single tailed pellets, some of which have developed internal hypocoatings and are fissured along planar voids, developing an angular blocky structure (wetting and drying or frost and thaw features).

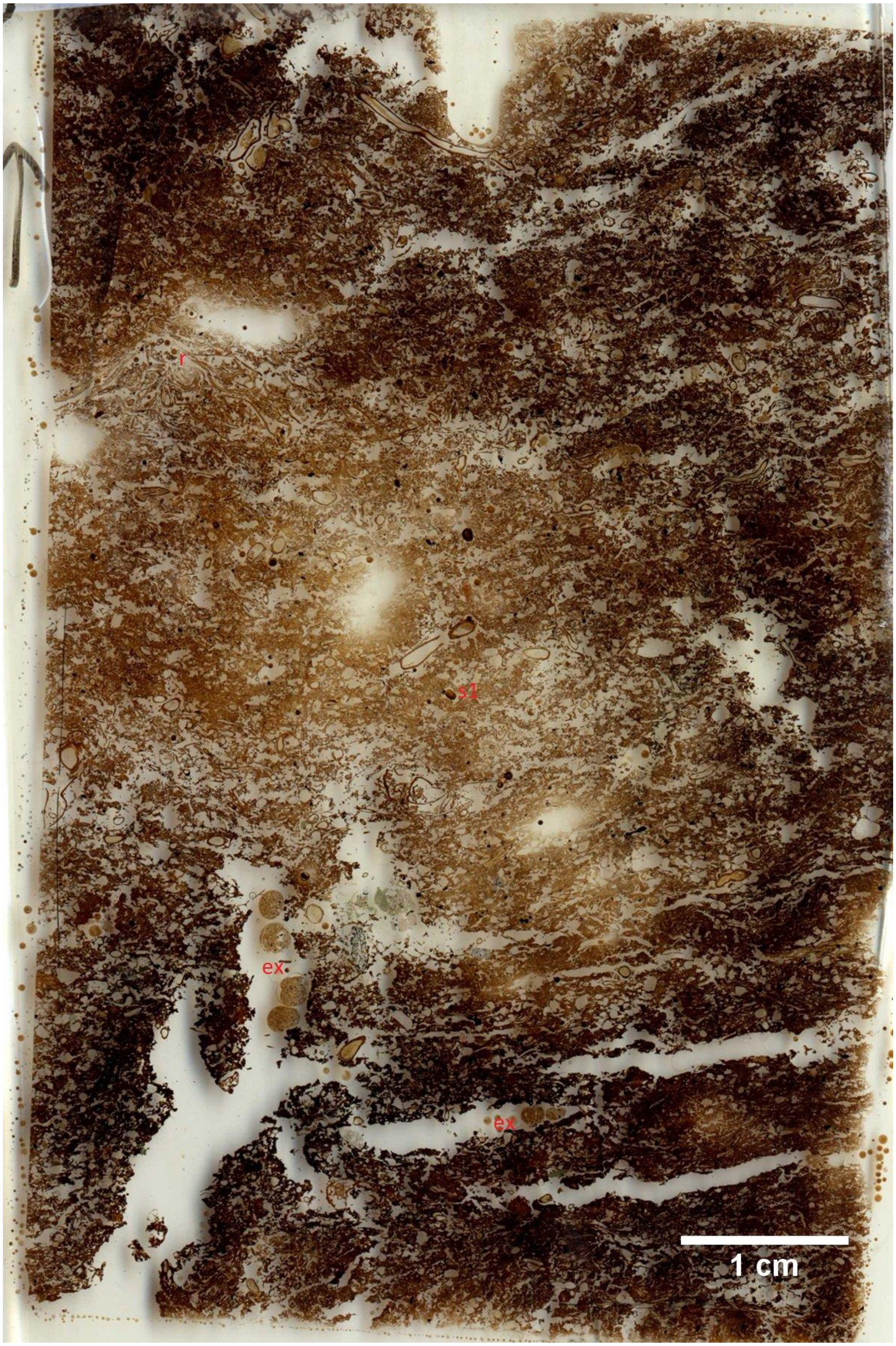

Figure C.4. Thin section MM4 displaying O_m, O_f horizons with textural pedofeatures s1 and *Enchytraeid* worm droppings (ex).

MM5, FkBg-3 (field label S9E33SA)

Provenience: Tent Ring 1-East, bench area

Horizons present: O_m-O_f

O_m-O_f horizon:

Coarse mineral fraction (>63 µm): medium to very coarse sand-sized (>500 µm, 500 – 250 µm) monomineralic and polymineralic grains, unoriented, moderately sorted, subangular to subrounded. Banding noted at the bottom of the section, and mineral grains largely restricted to bands.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: enaulic-porphyric (with a banded basic distribution pattern)

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposed root cavities predominate in the top of the section; tissue fragments (coalescence of unidentified Bryophyte tissue infilled with SOM and stained with pigment, bottom of section, strips of phlobaphene-containing cells); Fine (<10 interconnected cells): strips of phlobaphene-containing cells, punctuation, dark reddish brown to dark brown polymorphic fine organic mass.

Decomposition features: blackening, dissolution and associated porosity, infilling with soil organic matter, shrinkage

Fungal material: fungal hyphae

Charcoal: none observed

Pedofeatures: organic hypo-coatings on mineral grains, impregnative redox features (rounded and subrounded Fe/Mn nodules).

Voids: complex packing voids, vughs chamber and channel

Microstructure: vughy and spongy

Figure C.5. Thin section MM5 displaying a uniform vughy and spongy microstructure, with banding of mineral fraction visible in the bottom left area of the thin section.

MM6, FkBg-3 (field label S10E28SA)

Provenience: Tent Ring 1-West, adjacent to hearth (southwest of hearth feature)

Horizons present: C_g and O_f

C_g horizon:

Coarse mineral fraction (>63 µm): medium to very coarse sand-sized (>500 µm, 500 – 250 µm) monomineralic and polymineralic grains, unoriented, moderately to well sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: single to double spaced fine to coarse enaulic

Organic components: brown polymorphic organic fine mass.

Decomposition features: N/A

Fungal material: none observed

Charcoal: none observed

Pedofeatures: impregnative redox features (subrounded to rounded Fe/Mn nodules)

Voids: simple and complex packing voids

O_f horizon:

Coarse mineral fraction (>63 µm): mostly located at the bottom of the section. Same as C_g

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: N/A

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposed root cavities, organic layer W2 (described separately), strips of phlobaphene-containing cells; Fine (<10 interconnected cells): strips of phlobaphene-containing cells, punctuation, dark reddish brown to dark brown polymorphic fine organic mass;

Decomposition features: spheroidal microstructures, shrinkage of organic tissue, dissolution and associated porosity, high chromas and birefringence in XPL, blackening, dislocation of cells and cell walls.

Fungal material: fungal hyphae, abundant coalescences of plectenchyma (p), mostly at the top of the section, W2 fabric is dominated by fungal hyphae

Charcoal: 1 fragment, 0.65 mm diameter, inclusion of W2.

Pedofeatures: organic hypocoatings on mineral grains, consisting of polymorphic organic fine mass; impregnative redox features (subrounded and rounded Fe/Mn nodules)

Voids: interconnected vughs, complex packing voids, planar.

Microstructure: vughy, spongy

organic layer W2: An amorphous wood layer, completely reworked by fungal activity, no recognizable tissue structures remain present. Characterized by a spongy microstructure with a subsection consisting of subangular blocky aggregates defined by partially accommodating planar voids.

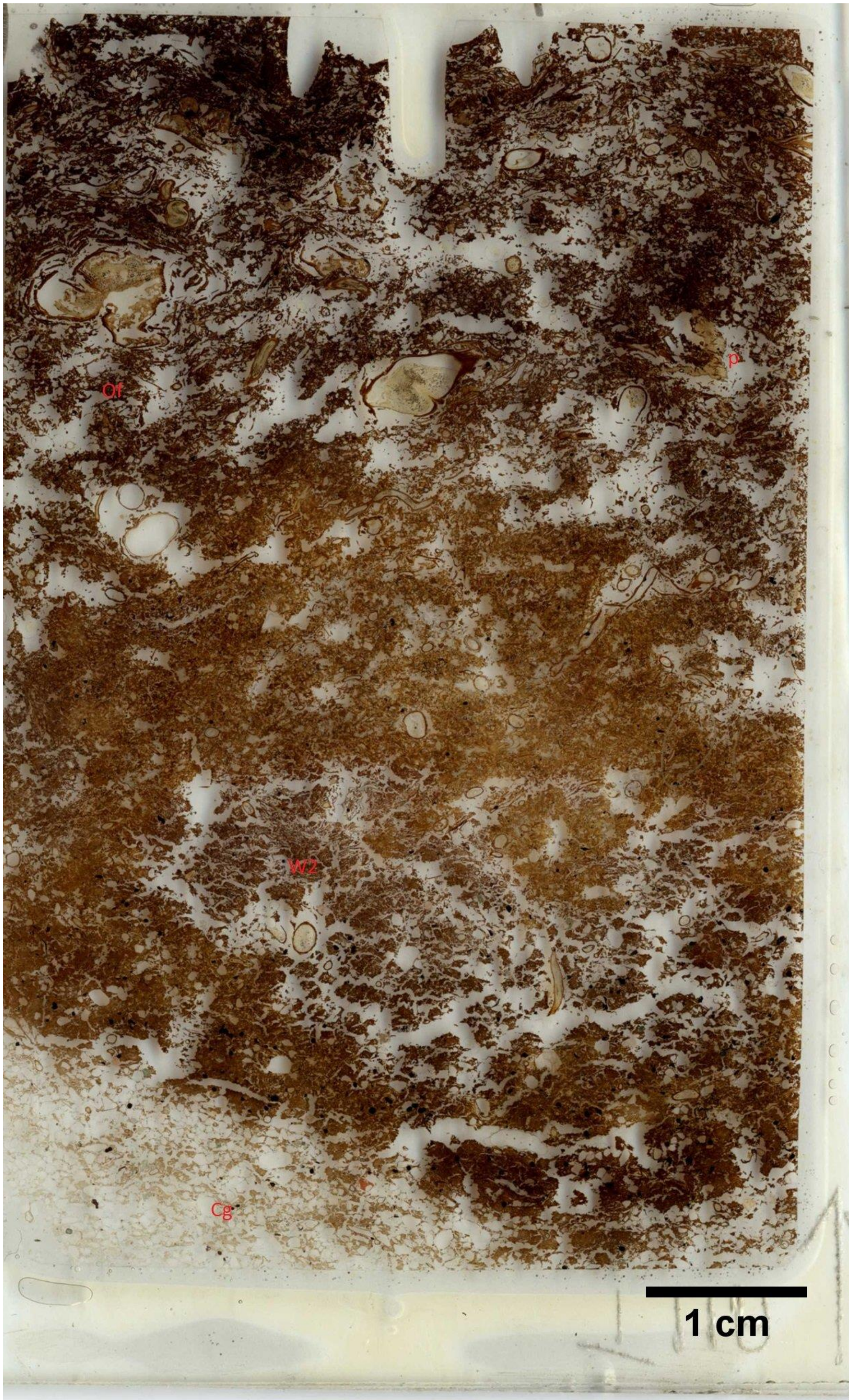

Figure C.6. Thin section MM6 displaying C_g and O_f horizons, with organic layer W2.

MM7, FkBg-3 (field label S12E28NA)

Provenience: Tent Ring 1-West, southeast wall, close to indent

Horizons present: O_m-O_f

O_m-O_f horizon:

Coarse mineral fraction (>63 µm): medium sand-sized (500 – 250 µm) monomineralic grains, unoriented, moderately sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: N/A

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposed root cavities, decomposed organ and tissue fragments of vascular plants, strips of phlobaphene-containing cells; Fine (<10 interconnected cells): strips of phlobaphene-containing cells, punctuation, organic pigment, dark brown polymorphic organic fine mass;

Decomposition features: spheroidal microstructures, porosity, shrinkage, dissolution, colonization of organic tissue by fungi, blackening, infilling with soil organic matter;

Fungal material: fungal hyphae, coalescences of plectenchyma

Charcoal: none observed

Pedofeatures: organic hypocoatings on mineral grains, impregnative redox features (subangular to subrounded Fe/Mn nodules)

Voids: complex packing voids, vughs, channel

Microstructure: vughy and spongy

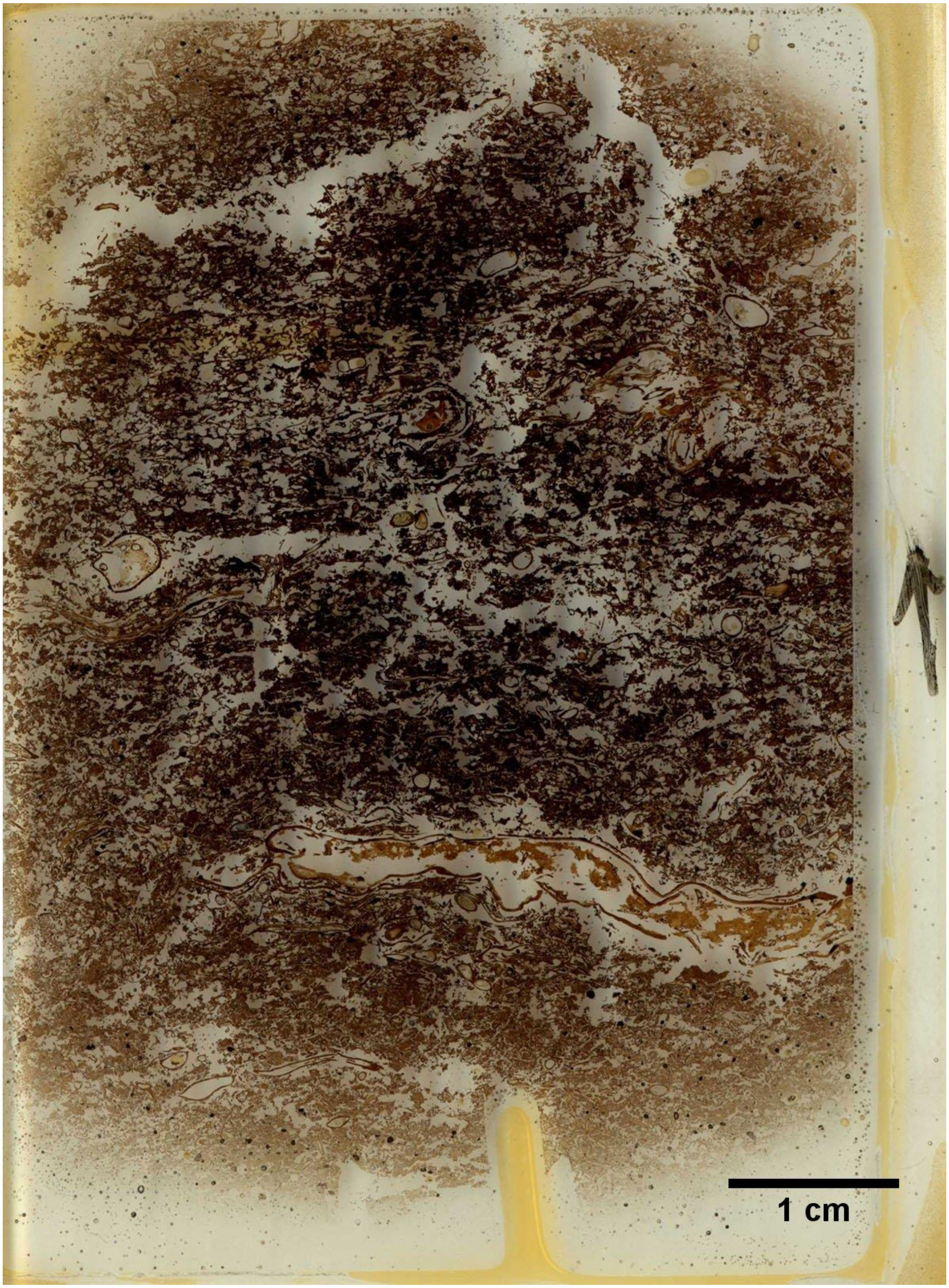

Figure C.7. Thin section MM7 displaying a uniform vughy and spongy microstructure with decomposing holo-organic inclusions.

MM8, FkBg-3 (field label S11E31WA)

Provenience: Tent Ring 1-East, immediately south of cooking cluster

Horizons present: O_m-O_f

O_m-O_f horizon:

Coarse mineral fraction (>63 µm): coarse sand-sized (>500 µm) monomineralic grains, unoriented, moderately to well sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: N/A

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposed root cavities, decomposing organ fragments, strips of phlobaphene-containing tissue (30%); Fine (<10 interconnected cells): strips of phlobaphene-containing tissue, punctuation, organic pigment, brown to dark brown polymorphic fine organic mass, occasionally impregnated by a limpid-yellow fine-speckled organic fine mass.

Decomposition features: spheroidal and radial microstructures, porosity, solubilization of organic matter, cell tissue deformation, shrinkage, dissolution, colonization by fungi.

Fungal material: fungal hyphae (embedding SOM but predominantly colonizing organic tissue)

Charcoal: none observed

Pedofeatures: organic hypocoatings on mineralic grains, impregnative redox features (Fe/Mn nodules)

Voids: complex packing voids, vughs, planar

Microstructure: vughy, spongy, with areas of angular blocky

Figure C.8. Thin section MM8 displaying a vughy, spongy and occasionally angular blocky microstructure with decomposing holo-organic inclusions.

MM9, FkBg-3 (field label S11E31E)

Provenience: Tent Ring 1-East, associated with cooking cluster

Horizons present: C_g, O_m

C_g horizon:

Coarse mineral fraction (>63 µm): medium to coarse sand-sized (>500 µm, 500 – 250 µm) monomineralic and polymineralic grains, unoriented, moderately to well sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated, lamellar

$C/F_{63\ \mu m}$: close fine enaulic

Organic components: Coarse (>10 interconnected cells): fresh roots; organic layer W3 (described separately); brown polymorphic organic fine mass;

Decomposition features: shrinkage

Fungal material: none

Charcoal: Fragments associated with W3, measuring 3 mm, 1.15 mm, 0.55 mm and 0.25 mm in diameter.

Pedofeatures: organic hypocoatings, cappings and link cappings on mineralic grains consisting of polymorphic fine organic mass, impregnative redox features (rounded and subrounded Fe/Mn nodules)

Voids: simple and complex packing voids, planar

organic layer W3: consisting of fragments of amorphous wood tissue, charcoal and soil organic matter in a bow-shaped arrangement. There is no remaining recognizable cell structure, a single fragment developed a lamellar b-fabric with weak birefringence in XPL (l), potentially undergoing mineralization.

Microstructure: subangular blocky, lenticular platy

O_m horizon:

Mineral grains: medium to coarse sand-sized (>500 μm, 500 – 250 μm) monomineralic and polymineralic grains, unoriented, moderately to well sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: N/A

Organic components: Coarse (>10 interconnected cells): Fresh roots and decomposed root cavities; 1 fragment of *Abies* stemwood, 3.4 mm in diameter (a), strips of phlobaphene-containing tissue; Fine (<10 interconnected cells): strips of phlobaphene-containing tissue, punctuation, organic pigment, reddish brown to dark brown polymorphic fine organic mass, heavily impregnated by a limpid-yellow fine-speckled organic fine mass;

Decomposition features: solubilization of decomposing organic tissue, colonization by fungi, replacement of tissue by plectenchyma

Fungal material: fungal hyphae, plectenchyma

Charcoal: none observed.

Pedofeatures: organic hypocoatings on mineral grains, impregnative redox features (subrounded Fe/Mn nodules)

Voids: planar, vughs

Microstructure: lenticular platy, subangular and angular blocky, vughy

Figure C.9. Thin section MM9 displaying C_g horizon with organic layer W3 consisting of decomposed wood tissue, one of which displays a lamelar b-fabric in XPL (l), and charcoal fragments, and the O_m layer with a visible *Abies* fragment inclusion (a).

MM10, FkBg-3 (field label S11E33EB)

Provenience: Tent Ring 1-East, in proximity to the centre of Tent Ring 1-East, adjacent to cooking cluster and workbench

Horizons present: C_g and O_m

C_g horizon:

Coarse mineral fraction (>63 µm): medium to very coarse sand, gravel and pebble-sized (>500 µm, 500 – 250 µm) monomineralic and polymineralic grains, unoriented, poorly sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: close to single spaced enaulic

Organic components: Coarse (>10 interconnected cells): fresh roots, organic layer W4, partially embedded within the C_g layer (described separately); dark brown to black monomorphic fine organic matter;

Decomposition features: N/A

Fungal material: fungal hyphae, sclerotia

Charcoal: single fragment, 2.75 mm in diameter (c).

Pedofeatures: organic hypocoatings, cappings, link capping and micropan, mostly translocated organic matter from organic layer W4, impregnative redox features (rounded and subrounded Fe/Mn nodules) mostly associated with organic layer W4.

Voids: simple and complex packing voids, planar

Organic layer W4: bow-shaped, consisting of fragments of amorphous wood tissue, with an irregular lenticular platy microstructure. The layer exhibits multiple impregnative redox features, including rounded and subrounded Fe/Mn nodules and hypo-coatings on void surfaces, some of which exhibit star-shaped crack patterns.

O_m horizon:

Coarse mineral fraction (>63 µm): considerably sparser, coarse sand-sized monomineralic grains, moderately to well sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: Enaulic

Organic components: Coarse (>10 interconnected cells): fresh roots, tissue fragments (*Picea* stemwood, 4 mm (p) and 1.25 mm in diameter), strips of phlobaphene-containing cells; Fine (<10 interconnected cells): strips of phlobaphene-containing tissue, punctuation, organic pigment, reddish brown to dark brown polymorphic fine organic mass, occasionally impregnated by a limpid-yellow fine-speckled organic fine mass

Decomposition features: high chromas in XPL, blackening, solubilization of decomposing organic tissue

Fungal material: fungal hyphae

Charcoal: none observed

Pedofeatures: coalescences of fecal matter of *Enchytraeidae,* in secondary context, embedded in soil organic matter (ex).

Voids: complex packing voids, vughs, planar.

Microstructure: lenticular platy, vughy and spongy.

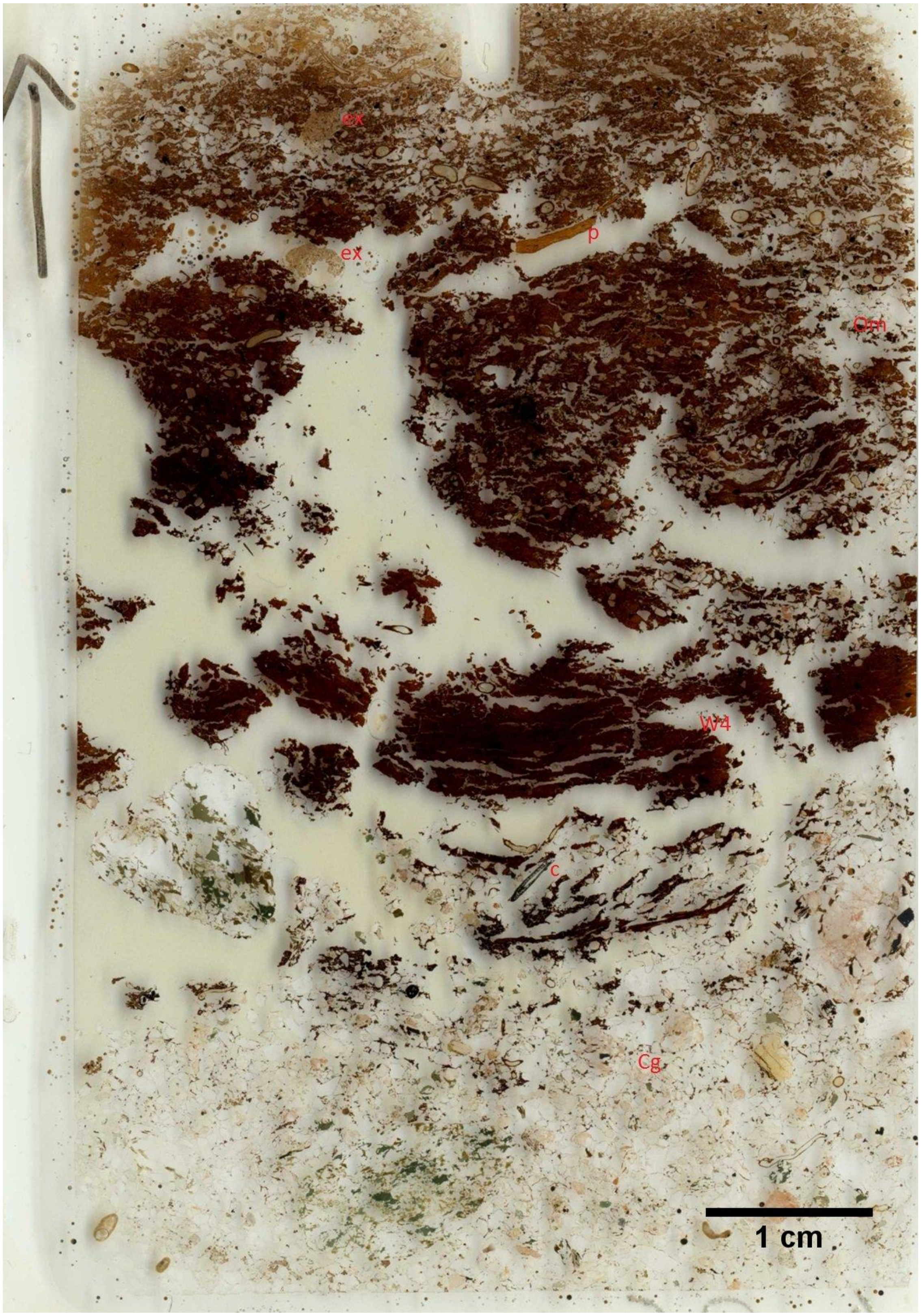

Figure C.10. Thin section MM10 displaying C_g horizon, with organic layer W4 mainly consisting of wood fragments with an amorphous aspect, and the O_m horizon with visible coalescences of Enchytraeid worm fecal matter (ex) and a *Picea* stemwood fragment inclusion (p).

MM11, FkBg-3 (field label S15E33NA)

Provenience: Tent Ring 1-East, against south wall

Horizons present: C_g, O_m

C_g horizon:

Coarse mineral fraction (>63 µm): medium to very coarse sand, gravel and pebble-sized (>500 µm, 500 – 250 µm) monomineralic and polymineralic grains, unoriented, poorly to moderately sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: close to single-spaced enaulic

Organic components: brown polymorphic organic fine mass;

Decomposition features: none

Fungal material: none observed

Charcoal: none observed

Pedofeatures: organic hypocoatings present on mineralic grains, consisting of polymorphic fine organic mass.

Voids: simple packing voids

O_m horizon:

Coarse mineral fraction (>63 µm): medium to coarse sand-sized (500 – 250 µm) monomineralic grains, unoriented, monderately to well sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

C/F$_{63\ \mu m}$: N/A

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposing root cavities, strips of phlobaphene-containing cells; Fine (<10 interconnected cells): mainly strips of phlobaphene-containing cells, punctuation, dark reddish brown to dark brown polymorphic organic soil matter, locally impregnated by a limpid-yellow fine-speckled organic fine mass (g);

Decomposition features: spheroidal microstructures, high chromas and birefringence of organic tissue in XPL, dissolution and associated porosity, colonization by fungi, replacement of organic tissue by plectenchyma, occassional blackening, solubilization of decomposing organic matter, infilling with soil organic matter.

Fungal material: fungal hyphae, plectenchyma

Charcoal: none observed

Pedofeatures: organic hypocoatings on mineral grains, impregnative redox features (rounded, subrounded and subangular Fe/Mn nodules and hypocoatings)

Voids: complex packing voids, vughs, moderately accommodating planar voids

Microstructure: vughy and spongy, lenticular platy overprint

Figure C.11. Thin section MM11 displaying C_g and O_m horizons, with visible area where solubilized organic matter associated with the decomposition of cellulose based tissue impregnates soil organic matter (g), in association with a decomposing organic structure.

MM12, FkBg-3 (N29E18NB)

Provenience: Tent Ring 4, against south wall

Horizons present: O_f

O_f horizon:

Coarse mineral fraction (>63 µm): medium to coarse sand-sized (>500 µm, 500 – 250 µm) monomineralic and polymineralic grains, unoriented, moderately to well sorted, subangular to subrounded. Banding of widely spaced grains within bands located mostly at the top of the section.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: open enaulic (with a banded basic distribution)

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposed root cavities, decomposing organ fragments of vascular plants (including two potential seed pods, 0.85 and 1.95 mm in diameter), tissue fragments (parenchyma); Fine (<10 interconnected cells) mainly phlobaphene-containing cell strips, punctuation, organic pigment (abundant staining); dark brown polymorphic organic fine mass occasionally impregnated by a limpid-yellow fine-speckled organic fine mass;

Decomposition features: spheroidal microstructures, blackening, colonization by fungi, replacement of organic tissue by plectenchyma, dissolution and associated porosity, high chromas and birefringence of organic tissue in XPL, solubilization of decomposing organic tissue

Fungal material: fungal hyphae, coalescences of plectenchyma

Charcoal: none observed

Pedofeatures: organic hypocoatings on some of the mineral grains, organic hypocoatings around coarse organic inclusions, infilling of vascular plant cavities with coalescences of fecal matter of

Enchytraeidae (ex), with other fecal coalescences in secondary context, embedded within the groundmass

Voids: complex packing voids, vughs, planar

Microstructure: vughy, spongy subangular blocky

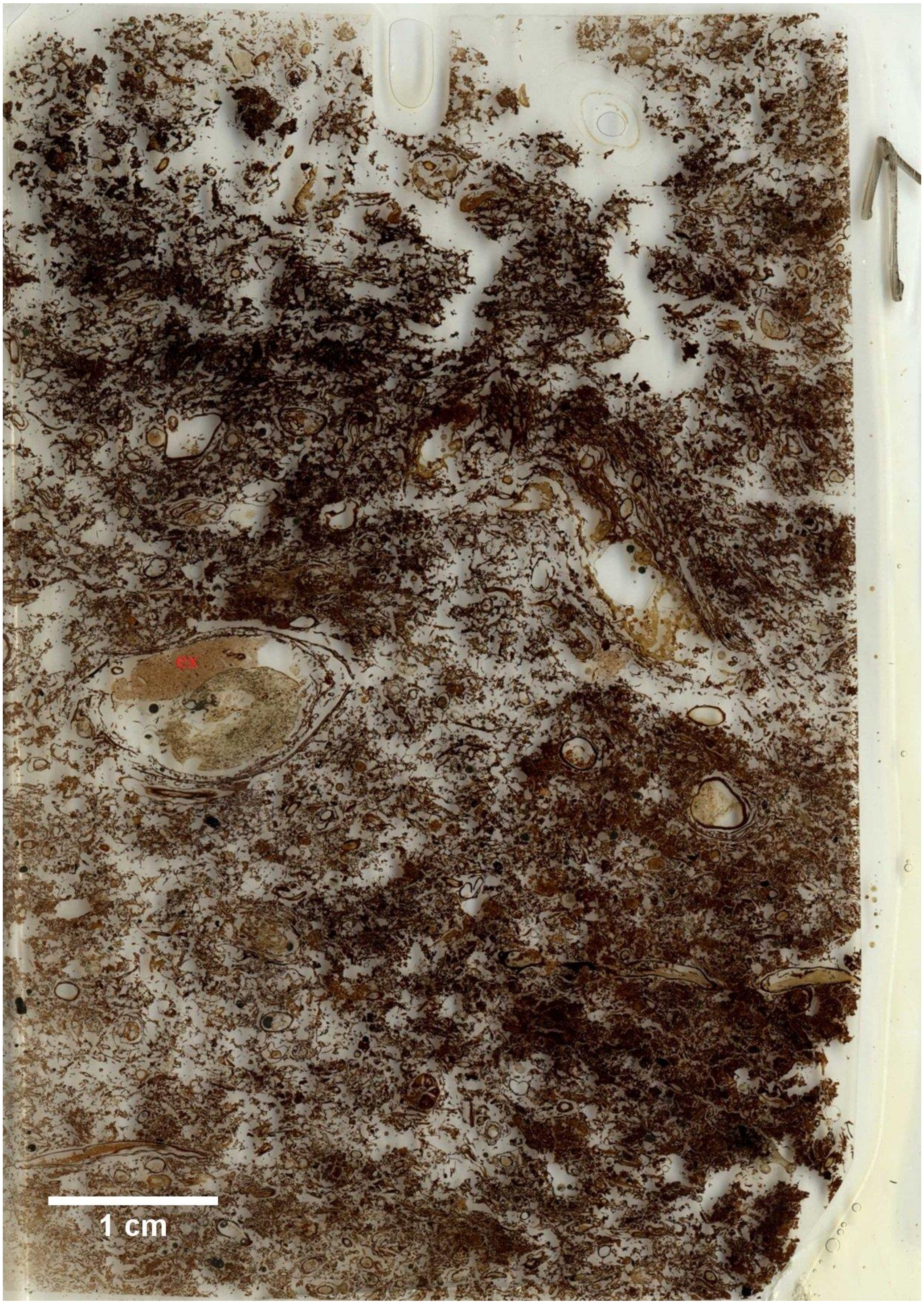

Figure C.12. Thin section MM12 displaying O_f horizon with decomposing organic structures, one of which has an infilling of coalesced Enchytraeid worm fecal matter (ex).

MM13, FkBg-3 (N31E16EB)

Provenience: Tent Ring 4, bench

Horizons present: O_f

O_f horizon:

Coarse mineral fraction (>63 µm): medium and coarse sand-sized (>500 µm, 500 – 250 µm) mono- and polymineralic grains, unoriented, moderately sorted, subangular to subrounded. Banding of widely spaced grains within bands located mostly at the top of the section.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: enaulic-porphyric (with a banded basic distribution pattern)

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposing root cavities, decomposing organ fragments, consisting of parenchyma tissues forming intact seed pod structures (0.9 and 1.1 mm in diameter), and those of an unidentified Bryophyte; organic layer W5, consisting of fragments of *Abies* stemwood (described separately), strips of phlobaphene-containg cells; Fine (<10 interconnected cells): phlobaphene-containing strips of cells, punctuation, organic pigment (abundant staining); dark brown polymorphic organic fine mass;

Decomposition features: spheroidal microstructures, comminution by soil fauna, dissolution and associated porosity, shrinkage, colonization by fungi, replacement of tissue by plectenchyma

Fungal material: fungal hyphae, plectenchyma

Charcoal: none observed

$C/F_{10\ cells}$: double spaced fine and equal enaulic

Pedofeatures: organic hypocoatings are present on some mineralic grains, excremental pellets of *Oribatida* mostly in association with organic layer W5 and inside a decomposing organic structure at the top of the section.

Voids: complex packing voids, vughs

Microstructure: spongy

organic layer W5: discontinuous layer consisting of fragments of undecomposed *Abies* stemwood tissue, with infillings of excremental pellets of *Oribatida;*

Comments: poor development of soil organic matter in the context of Tent Ring 4, which consists of highly polymorphic fine organic matter, forming cappings, links and hypocoatings around coarse organic inclusions and fine aggregates. A C/F distribution for organic inclusions to fine inclusions, with a limit of 10 interconnected cells has been used to describe the fabric of this soil.

Figure C.13. Thin section MM13 displaying O_f layer, with discontinuous organic layer W5, consisting of fragments of *Abies* stemwood, undergoing comminution by *Oribatid* mites and colonization of tissue by cellulophagic soil fungi.

MM14, FkBg-3 (field label N31E18WA)

Provenience: Tent Ring 4, proximity to the centre of the feature and the workbench

Horizons present: C_g and O_f

C_g horizon:

Coarse mineral fraction (>63 µm): coarse and medium sand-sized (>500 µm, 500 – 250 µm) monomineralic and polymineralic grains, mainly quartz, unoriented, moderately to well sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: single-spaced fine enaulic distribution

Organic components: Coarse (>10 interconnected cells): fresh roots; light brown, polymorphic organic fine mass

Decomposition features: none

Fungal material: none observed

Charcoal: none observed

Pedofeatures: organic hypocoatings on mineralic grains

Voids: packing voids

O_f horizon:

Coarse mineral fraction (>63 µm): coarse and medium sand-sized (>500 µm, 500 – 250 µm) monomineralic and polymineralic grains, unoriented, moderately to well sorted, subangular to subrounded. Banding of widely spaced grains within bands located mostly at the top of the section.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: N/A (with a banded basic distribution pattern)

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposing root cavities assortment of holo-organic inclusions, fragment of unidentified Bryophyte, mid-section (b), *Abies* stemwood fragment, parenchyma tissue forming intact seed pods (2 seed pods, 0.95 mm and 0.9 mm), strips of phlobaphene-containing cells; Fine (<10 interconnected cells): strips of phlobaphene-containing cells, punctuation, organic pigment (strong staining, predominantly at the top of the section), dark brown polymorphic organic fine mass, occasionally impregnated by a limpid-yellow fine-speckled organic fine mass;

Decomposition features: spheroidal microstructures, dissolution and associated porosity, high chromas and birefringence of organic tissue in XPL, comminution by soil fauna

Fungal material: fungal hyphae

Charcoal: none observed

$C/F_{10\ cells}$: single spaced porphyro-enaulic

Pedofeatures: excremental pellets of *Oribatida,* within primary context, as infillings inside the cavities of decomposing vascular plant structures, infillings of soil organic matter

Voids: complex packing voids, vughs

Microstructure: spongy

Figure C.14. Thin section MM14 displaying C_g and O_f horizons, feature (b) is a buried Bryophyte component.

MM15, FkBg-3 (field label N30E19NA)

Provenience: Tent Ring 4, eastern section of tent floor, close to the centre of the feature

Horizons present: O_f

O_f horizon:

Coarse mineral fraction (>63 μm): medium sand-sized (500 – 250 μm) mainly monomineralic grains, unoriented, moderately to well sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: open enaulic

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposed root cavities; organic layer W6 (described below); parenchyma tissue within intact seed pods, strips of phlobaphene-containing cells; Fine (<10 interconnected cells): strips of phlobaphene-containing cells, punctuation, organic pigment (staining soil organic matter but also dissolution material and fecal pellets), brown and dark brown polymorphic organic fine mass occasionally impregnated by a limpid-yellow, fine-speckled organic fine mass

Decomposition features: spheroidal microstructures, colonization by fungi, replacement of tissue by plectenchyma, comminution by soil fauna, dissolution and associated porosity.

Fungal material: fungal hyphae

Charcoal: none observed

Pedofeatures: organic hypocoatings on some of the mineralic grains, infillings of excremental pellets and fecal coalescences of *Oribatida* mainly in primary context, within cavities inside organic tissues, some stained by organic pigment or embedded in soil matrix.

Voids: complex packing voids, vughs, planar voids

Microstructure: subangular blocky, spongy

Organic layer W6: a discontinuous layer consisting of horizontally oriented fragments of P*icea* stemwood, undergoing comminution by soil fauna followed by colonization by fungi (the fecal pellets are also consumed by fungi) and replacement of tissue by plectenchyma. Infillings of *Oribatida* fecal pellets and coalesces of fecal matter are present both in primary context, inside cavities in the organic tissue.

Figure C.15. Thin section MM15 displaying O_f horizon with discontinuous organic layer W6 consisting of *Picea* stemwood, undergoing comminution by *Oribatid* mites and colonization of tissue by Basidiomycetes.

MM16, FkBg-3 (field label N31E20NA)

Provenience: Tent Ring 4, eastern wall

Horizons present: O_f

O_f horizon:

Coarse mineral fraction (>63 µm): medium and coarse sand-sized (>500 µm, 500 – 250 µm) mono- and polymineralic grains, unoriented, moderately sorted, subangular to subrounded.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: N/A

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposing root cavities, decomposing organ fragments, tissue fragments of an unidentified Bryophyte, decomposing structures consisting of vascular plant tissues; Fine (<10 interconnected cells): mainly phlobaphene-containing strips of cells, punctuation, organic pigment; dark brown polymorphic organic fine mass;

Decomposition features: spheroidal microstructures, dissolution and associated porosity, shrinkage, blackening, colonization by fungi.

Fungal material: fungal hyphae, plectenchyma

Charcoal: none observed

Pedofeatures: organic hypocoatings are present on some mineralic grains and on holo-organic fragments.

Voids: complex packing voids, vughs, planar

Microstructure: spongy, subangular/subrounded blocky

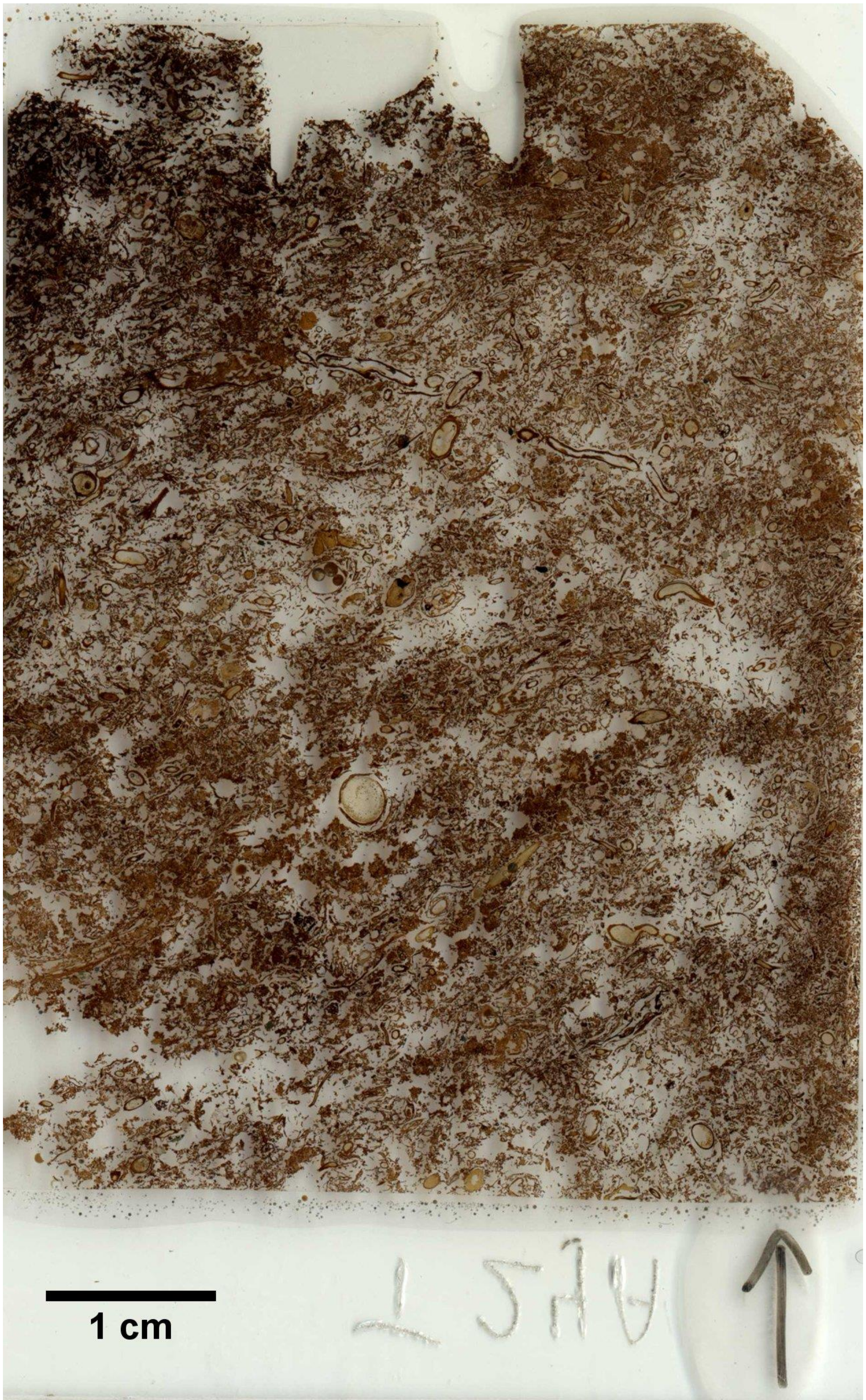

Figure C.16. Thin section MM16 displaying O_f horizon with uniform spongy microstructure and with decomposing holo-organic inclusions.

MM17, FkBg-3 (field label N34E19SB)

Provenience: immediately outside north wall, Tent Ring 4

Horizons present: O_f

O_f horizon:

Coarse mineral fraction (>63 µm): coarse sand-sized (>500 µm) monomineralic and polymineralic grains, unoriented, moderately to well sorted, subangular to subrounded. Banding of widely spaced grains within bands located mostly at the top of the section.

Biogenic inorganic inclusions: none observed

Fine fraction: organic

B-fabrics: amorphous, undifferentiated.

$C/F_{63\ \mu m}$: open enaulic (with a banded basic distribution)

Organic components: Coarse (>10 interconnected cells): fresh roots and decomposing root cavities, strips of phlobaphene-containing cells; Fine (<10 interconnected cells): strips of phlobaphene-containing cells, punctuation, organic pigment (strongly staining soil organic matter at the top of the section) light to dark brown polymorphic organic fine matter, occasionally impregnated by a limpid-yellow, fine-speckled organic fine mass (g).

Decomposition features: spheroidal microstructures, solubilization of decomposing organic tissue, dissolution and associated porosity, colonization of tissue by fungi, comminution by soil organisms.

Fungal material: fungal hyphae

Charcoal: none observed

Pedofeatures: organic hypocoatings present on some of the mineral grains, excremental pellets of *Oribatida* in primary context, inside cavities in organic tissue and secondary context, embedded in soil matrix, solubilized fecal matter coming from soil organisms

Voids: compound and complex packing voids, vughs

Microstructure: Crumb, spongy

Figure C.17. Thin section MM17 displaying O_f horizon, with visible area where solubilized organic matter associated with the decomposition of cellulose based tissue due to fungal activity impregnates soil organic matter (g).

Appendix D. Results of the Soil Chemical Analysis

All results are reported for 100 mg of dry soil.

Table D.1 Results of soil chemical analysis, house set.

Sample	Prov.	Description	pH	Nitrate Nitrogen (NO_3) (ppm)	P(av) (ppm)	K^+ (ppm)	Exchangeable Al (Al^{3+}) R	Exchangeable Ca^{2+} (ppm)	Iron (Fe^{2+}, Fe^{3+}) (ppm)	Exchangeable Mg (Mg^{2+}) R	Exchangeable (Mn^{2+}, Mn^{3+}) R
N15E1	H2	Floor	6.04	1250	2500	1500	125	8750	1562.5	625	0
N12W3	H2	Entrance passage	5	1875	1875	0	2000	3750	1562.5	250	0
N9W4	H2	Outside entrance	5.75	125	2500	0	125	3750	1562.5	250	300
N31W29	H4	Sleeping platform	5.73	500	937.5	1250	2000	3750	1562.5	125	125
N34W27	H4	Floor	5.45	1875	1250	1250	125	8750	1562.5	250	125
N37W24	H4	Entrance passage	5.3	1250	1875	0	125	3750	1562.5	250	125

Table D.2 Results of soil chemistry, background set.

Sample	Provenience	Description	pH	Nitrate Nitrogen (NO_3) (ppm)	P(Av) (ppm)	Exchange-able K^+ (ppm)	Exchange-able Al (Al^{3+}) R	Exchange-able Ca^{2+} (ppm)	Iron (Fe^{2+}, Fe^{3+}) (ppm)	Exchangeable Mg (Mg^{2+}) R	Exchangeable (Mn^{2+}, Mn^{3+}) R
Terr 2 (TP 2 S31E32)	Terrace	B	5.14	125	125	0	125	3750	625	125	0
Terr 3 (S30E32)	Terrace	B	5.2	125	1250	0	125	3750	625	125 (2 feathers)	0
Terr 4 (TP1 SW corner)	Terrace	B	5.25	125	625	0	125	3750	625	625 (in prox to Terr 6)	0
Terr 6 (TP1 NE corner)	Terrace	B	5.11	250	937.5	0	125	3750	625	2000 (9 bird feathers)	0
N35E25	Transitional	B	7.21	125	1875	0	125	3750	1562.5	250	0
S0E72	Rocky shore	B	5.58	125	937.5	0	125	3750	625	250	0
S1E76	Rocky shore	B	6.62	125	937.5	0	125	3750	1562.5	2000(?)	0
	Modern kitchen	Control	6.62	0	2500	0	125	3750	0	125	0

Table D.3 Results of soil chemical analysis, tent ring 1 set.

Sample	Provenience	Description	pH	Nitrate Nitrogen (NO_3) (ppm)	P(Av) (ppm)	Exchange-able K^+ (ppm)	Exchange-able Al (Al^{3+}) R	Exchange-able Ca^{2+} (ppm)	Iron (Fe^{2+}, Fe^{3+}) (ppm)	Exchange-able Mg (Mg^{2+}) R	Exchange-able (Mn^{2+}, Mn^{3+}) R
S10E27	TR1-west	Floor	6.6	125	1250	0	125	3750	625	2000	0

S8E26	TR1-west	Outside/Wall	4.86	250	937.5	0	125	3750	625	625	0
S8E28	TR1-west	Floor	5.31	125	1250	0	125	3750	625	625	0
S8E29	TR1-west	Floor	5.6	125	1250	0	125	8750	625	2000	0
S10E29	TR1-west	Hearth	5.67	125	1250	1250	125	8750	625	2000	0
HS1 (Cg)	TR1-west	Hearth	5.85	750	1250	0	2000	3750	625	250	0
HS2 (Cg)	TR1-west	Hearth	6.01	1250	1875	0	250	3750	625	125	0
S11E30	TR1-west	Hearth	5.11	125	1250	0	125	3750	625	250	0
S11E29	TR1-west	Hearth	5.75	125	1875	0	125	3750	187.5	625	0
S10E30	TR1-west	Hearth	5.7	125	937.5	0	125	3750	62.5	625	0
S7E28	TR1-west	Wall/outside	5.5	125	1250	0	125	17500	625	2000	0
S11E27	TR1-west	Floor	5.38	125	1875	0	125	8750	1562.5	625	0
BC	TR1-west	Floor	5.59	0	1250	0	2000	8750	1562.5	250	0
BC (Cg)	TR1-west	Floor	6.02	125	1875	0	125	8750	625	125	0
S10E26	TR1-west	Floor	5. 26	125	937.5	0	125	17500	625	625	0
S9E30	TR1-west	Floor	4.94	250	1875	0	125	3750	187.5	625	0
S8E27	TR1-west	Floor	5.65	0	1875	0	125	3750	1562.5	250	0
S7E26	TR1-west	Wall/outside	5.7	0	1875	0	125	3750	1562.5	625	0
S7E29	TR1-west	Wall/outside	5.8	0	1875	0	125	8750	1562.5	625	0
S14E32	TR1-east	Floor	5.27	125	1250	0	125	3750	625	125	0
S14E34	TR1-east	Floor	5.8	0	1250	0	125	8750	1562.5	2000	0
S13E36	TR1-east	Floor	5.5	125	937.5	0	125	8750	625	125	0
S12E34	TR1-east	Floor	5.8	125	1875	0	125	35000	1562.5	125	0
S12E32	TR1-east	Floor	5.14	125	937.5	0	125	3750	625	625	0
S12E31	TR1-east	Floor	5.16	250	937.5	0	125	3750	187.5	2000	0
S11E32	TR1-east	Cooking cluster	5.64	125	937.5	0	125	8750	625	125	0
S10E32	TR1-east	Wall/floor	5.2	125	1875	0	125	3750	187.5	625	0
S10E33	TR1-east	Workbench	5.17	250	937.5	0	125	3750	625	2000	0
S10E34	TR1-east	Workbench	5.23	125	1250	0	125	8750	625	250	0
S10E35	TR1-east	Workbench	4.86	125	1250	0	125	0	625	625	0

P1	TR1-east	Post hole	6.8	125	125	0	2000	3750	0	2000	0
S9E32	TR1-east	Wall/outside	5.81	125	937.5	0	125	8750	625	250	0
GCS-81	TR1-east	Floor	5.55	125	125	0	125	0	625	125	0
GCS-90	TR1-east	Floor	5.4	125	125	0	250	3750	0	2000	0
GCS-96	TR1-east	Floor	5.5	125	125	0	2000	3750	0	2000	0
GCS-104	TR1-east	Door	5.2	125	125	0	2000	3750	0	2000	0
S11E31	TR1-east	Cooking cluster	5.2	125	937.5	0	125	8750	625	250	0
S10E31	TR1-east	Floor/wall	5.3	125	937.5	0	125	3750	625	250	0
S9E31	Indent	Outside/wall	5.1	250	1875	0	125	3750	625	625	0
CC	TR1-east	Cooking cluster	5.14	125	937.5	0	125	8750	625	2000	0

Table D.4 Results of soil chemical analysis, tent ring 4 set.

Sample	Description	pH	Nitrate Nitrogen (NO_3) (ppm)	P(av) (ppm)	Exchange-able K^+ (ppm)	Exchange-able Al (Al^{3+}) R	Exchange-able Ca^{2+} (ppm)	Iron (Fe^{2+}, Fe^{3+}) (ppm)	Exchange-able Mg (Mg^{2+}) R	Exchange-able (Mn^{2+}, Mn^{3+}) R
N30E18	Workbench	6.4	125	1875	0	125	8750	1562.5	250	0
N29E18		6.38	125	937.5	0	125	3750	1562.5	2000	0
N31E17	Workbench	6.3	125	937.5	0	125	8750	1562.5	2000	0
N29E20		6.62	125	1250	0	125	3750	1562.5	625	0
N32E21		6.45	125	937.5	0	125	8750	1562.5	625	0
N31E19		6.5	125	1250	0	125	3750	625	250	0
N30E16	Outside	6.54	125	937.5	0	125	3750	0	625	0
N30E20		6.55	125	1250	0	125	3750	1562.5	625	0
N30E19		6.4	125	937.5	0	125	8750	1562.5	2000	0
N30E17	Workbench	6.67	125	1250	0	125	8750	0	625	0
N31E21		6.7	125	125	1250	125	35000	625	125	0
N33E19		6.7	250	937.5	0	125	8750	625	625	0
N29E16		6.55	125	937.5	0	125	3750	1562.5	625	0
N32E20		6.34	125	937.5	0	125	8750	1562.5	250	0
N32E18		5.75	125	1875	0	125	25000	625	250	0

Appendix E. Results of the Paleoethnobotanical analysis (raw)

Table E.1. Paleoethnobotanical analysis results (raw).

	S10 E27 W	S8 E26 W	S8 E28 W	S8 E29 W	S10 E29 W	HS1 W	HS2 W	S11 E30 W	S7 E28 W	S11 E27 W	S10 E26 W	S9 E30 W	S8 E27 W	S7 E26 W	S11 E29 W
Berries:															
E. nigrum	54	40	7	1	9	3	3	4		9	44	1	7	13	28
E. nigrum charred (out of total)		2		1	1	3	3	2		1	3		1		
E. nigrum leaf (charred)	15		1	1	8	29	87		1		15			1	
R. chamaemorus	2	1			3		1							1	
*R. chamaemorus (*charred out of total)							1								
V. caespitosum															
*V. caespitosum** fruit (desiccated)		1								1	4		1		
Unident' fruit (desiccated)															
Sedges:															
Carex spp. (1)								1							
Carex spp. (2)															
Carex spp. husk (charred)											1				
Subshrub:															
C. Canadensis															
Conifers:															
Abies sp. needles															
Abies sp. needles (charred)	2				2	40	73	3		13	3				1
Picea sp. needles															
Picea sp. needles (charred)				1		4	21	1		3					
Pinaceae needles															
Pinaceae buds*															
Shrubs:															
*Calluna**															

Salix sp. leaf					3										
Salix sp. leaf (charred)	1					1	1				3		1		
Weeds:															
D. fruticosa															
P. anserina															
C. maculatum															
*Heracleum**															
Apiaceae sp.															
Unidentified:															
Unident' seeds	4	1			2			20	2	1	6	1	1		15
Unident' seeds (charred)	1		2		1	2	2				2		1		
Unident' wood charcoal (g)	0.4		1		0.5	3.8	1.1	1		6			2.2		0.4
Fungi:															
C. graniforme sclerotia	3	11	20	14	2	10	35	2	9		49		3	5	1
Controls:															
Mustard seeds (out of 100)		47													
Totals															
Total seed count	61	42	9	1	15	5	6	25	2	10	52	2	6	14	43
Total seed adjusted	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0
Total seed (regrowth)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Total seed (charred)	1	2	2	1	2	5	6	2	0	1	5	0	1	0	0
Total macroremains	18	0	1	2	10	74	182	4	1	16	23	0	1	1	1

Species noted with an asterisk represent tentative identifications; total seed adjusted represents total seed counts excluding regrowth species; total seed regrowth represents the total seed count for species labeled as regrowth based on ecological data; total charred seeds represents the total count of charred seeds; total charred macroremains represents total counts of charred macroremains identified to the species, consisting of leaves (*Empetrum* or *Salix)* and needles (*Abies* or *Picea*), and excluding wood charcoal.

Table E.1. Continued

	S10 E30 W	S7 E29 W	S14 E32 E	S14 E34 E	S13 E36 E	S12 E34 E	S12 E32 E	S12 E31 E	S11 E32 E	S10 E32 E	S10 E33 E	S10 E34 E	S10 E35 E
Berries:													
E. nigrum		54		3	9	2	114	5		14	12	4	14
E. nigrum charred (out of total)													
E. nigrum leaf (charred)	1	2		1			5				1		
R. chamaemorus		1	1					2					

R. chamaemorus charred													
*V. caespitosum**													
*V. caespitosum** fruit (desiccated)	1				10		12					3	1
Unident' fruit (desiccated)													
Sedges:													
Carex spp. (1)													
Carex spp. (2)													
Carex spp. husk (charred)											1		
Subshrub:													
C. canadensis													
Conifers:													
Abies sp. needles													
Abies sp. needles (charred)						1							
Picea sp. needles													
Picea sp. needles (charred)				2					2	1			
Pinaceae needles													
Pinaceae buds*													
Shrubs:													
*Calluna**													
Salix sp. leaf													
Salix sp. leaf (charred)													
Weeds:													
D. fruticosa													
P. anserina													
C. maculatum													
*Heracleum**													
Apiaceae sp.													
Unidentified:													
Unident' seeds	1	13			3		4	1			4	1	1
Unident' seeds (charred)					2	2			5				

Unident' wood charcoal (g)	0.2												
Fungi:													
C. graniforme sclerotia	3	14		4	16	1	5	1	33	1		2	
Controls:													
Mustard seeds													
Totals:													
Total seed count	1	68	1	3	14	4	118	8	5	14	16	5	15
Total seed adjusted	0	0	0	0	0	0	0	0	0	0	0	0	0
Total seed regrowth	0	0	0	0	0	0	0	0	0	0	0	0	0
Total seed charred	0	0	0	0	2	2	0	0	5	0	0	1	0
Total macroremains charred	1	2	0	3	0	1	5	0	2	1	2	0	0

Table E.1. Continued

	P1 E	S9 E32 E	S11 E31 E	S10 E31 E	S9 E31 ind.	CC E
Berries:						
E. nigrum	1	5	22	6	10	1
E. nigrum charred (out of total)	1		5			
E. nigrum leaf (charred)			47			144
R. chamaemorus						2
R. chamaemorus charred						1
*V. caespitosum**						
*V. caespitosum** fruit (desiccated)						2
Unident' fruit (desiccated)						
Sedges:						
Carex spp. (1)						
Carex spp. (2)						
Carex spp. husk (charred)						
Subshrubs:						
C. canadensis						
Conifers:						

Abies sp. needles						
Abies sp. needles (charred)						
Picea sp. needles						
Picea sp. needles (charred)						
Pinaceae needles						
Pinaceae buds*						
Shrubs:						
*Calluna**						
Salix sp. leaf						
Salix sp. leaf (charred)		1	1			
Weeds:						
D. fruticosa						
P. anserina						
C. maculatum						
*Heracleum**						
Apiaceae sp.						
Unident':						
Unident' seeds			5		1	
Unident' seeds (charred)			1			1
Unident' wood charcoal (g)			1	0.5		2.1
Fungi:						
C. graniforme sclerotia	14	1			8	6
Controls:						
Mustard seeds						
Totals:						
Total seed count	1	5	27	6	11	4
Total seed adjusted	0	0	0	0	0	0
Total seed Regrowth	0	0	0	0	0	0
Total seed Charred	1	0	6	0	0	2
Total macroremains charred	0	1	48	0	0	144

Table E.1 Continued

	N30 E18	N29 E18	N31 E17	N29 E20	N32 E21	N31 E19	N30 E16	N30 E20	N30 E19	N30 E17	N31 E21	N33 E19	N29 E16	N32 E20	N32 E18
Berries															
E. nigrum	192	90	2105	188	39	25		520	28	579	241	434	49	43	31
E. nigrum charred (out of total)			2			1					1	1	2	1	
E. nigrum leaf (charred)															
R. chamaemorus						1		11							
R. chamaemorus charred															
*V. caespitosum**			15	26	22	4		39	18	94	74	114	29	36	57
*V. caespitosum** fruit (desiccated)	1		11	3	2		2	1		7					
Unident' fruit (desiccated)			1	3						8	1	16	1	1	
Sedges:															
Carex spp. (1)								1							
Carex spp. (2)		1						3	1		2	3			3
Carex spp. husk (charred)															
Subshrub:															
C. canadensis															
Conifers:															
Abies sp. needles			2						1						
Abies sp. needles (charred)															
Picea sp. needles										1					
Picea sp. needles (charred)															
Pinaceae needles				3		1		1		5	2	4			
Pinaceae buds*															
Shrubs															
*Calluna**															
Salix sp. leaf										4	1				
Salix sp. leaf (charred)															
Weeds															
D. fruticosa				1				1			2				

P. anserine	2	1	3	2		1					2	3			
C. maculatum												1			
*Heracleum**												2			
Apiaceae sp.												1			
Unidentified															
Unident' seeds	1		4	9				1	2	4	12	9	2	2	3
Unident' seeds (charred)															
Unident' wood charcoal (g)					2							1			
Fungi:															
C. graniforme sclerotia	18	8	3	6	4	5	66	1	4	12	5	15	4	8	7
Controls															
Mustard seeds				62									46		
Totals															
Total seed count	195	92	2127	226	61	31	0	575	49	677	333	567	78	81	94
Total seed adjusted	193	90	2124	223	61	30	0	571	48	677	327	559	78	0	91
Total seed regrowth	2	2	3	3	0	1	0	4	1	0	6	8	0	0	3
Total seed charred	0	0	2	0	0	1	0	0	0	0	1	1	2	1	0
Total macroremains charred	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table E.1. Continued

	N15E1 H2	N12 W3 H3	N9W4H2	N31 W29 H4	N34 W27 H4	N37 W24 H4
Berries:						
E. nigrum	5	2	6	109	25	6
E. nigrum charred (out of total)		1	2	19	3	3
E. nigrum leaf (charred)	1			2		1
R. chamaemorus	16	1	8	1	2	1
R. chamaemorus (charred out of total)						
*V. caespitosum**						
*V. caespitosum** fruit (desiccated)	267		7	1	74	21

Unident' fruit (desiccated)						
Sedges:						
Carex spp. (1)	22	4	110	1	44	16
Carex spp. (2)						
Carex spp. husk (charred)						
Subshrub:						
C. canadensis			4		1	
Conifers:						
Abies sp. needles						
Abies sp. needles (charred)						
Picea sp. needles						
Picea sp. needles (charred)						
Pinaceae needles						
Pinaceae buds*						
Shrubs:						
Calluna sp.					2	
Salix sp. leaf						
Salix sp. leaf (charred)						
Weeds:						
D. fruticosa	4				7	
P. anserine					1	
C. maculatum						1
*Heracleum**						2
Apiaceae sp.						
Unidentified:						
Unident' seeds	2	1	2	28	17	29
Unident' seeds (charred)	5		2		1	
Unident' wood charcoal (g)	0.2	0.1	2.6	0.5	0.8	0.3
Fungi:						
C. graniforme sclerotia	3	1	5	52	11	31
Controls:						
Mustard seeds						
Totals						

Total seed count	54	8	132	138	100	55
Total seed adjusted	28	4	18	137	47	38
Total seed (regrowth)	26	4	114	1	53	17
Total seed (charred)	5	1	4	19	4	3
Total macroremains (charred)	1	0	0	2	0	1

Table E.1 Continued

	Terrace samples	Transitional coast	Rocky shore						
	Terr 1	Terr 2	Terr 3	Terr 4	Terr 5	Terr 6	Coast 1	S0E72	S1E75
Berries:									
E. nigrum	20	2	4	3	4	16	95	24	22
E. nigrum charred (out of total)								4	
E. nigrum leaf (charred)	1				1				
R. chamaemorus	1			1			1		
R. chamaemorus charred									
*V. caespitosum**							239		
*V. caespitosum** fruit (desiccated)	1				1		3		
Unident' fruit (desiccated)							4		
Sedges:									
Carex spp. (1)									
Carex spp. (2)									
Carex spp. husk (charred)									
Subshrub:									
C. canadensis									
Conifers:									
Abies sp. needles							1		1
Abies sp. needles (charred)							1		
Picea sp. needles							4		
Picea sp.				1			2		

needles (charred)									
Pinaceae needles							8		
Pinaceae buds*									
Shrubs:									
*Calluna**									
Salix sp. leaf									
Salix sp. leaf (charred)							2		
Weeds:									
D. fruticosa									
P. anserina							1		
C. maculatum									
*Heracleum**									
Apiaceae sp.									
Unidentified:									
Unident' seeds		2	1				5		1
Unident' seeds (charred)							2		
Unident' wood charcoal (g)									0.3
Fungi:									
C. graniforme sclerotia	1						56	5	16
Controls:									
Mustard seeds							80		58
Totals									
Total seed count	21	4	5	4	4	16	343	24	23
Total seed adjusted	21	4	5	4	4	16	342	24	23
Total seed (Regrowth)	0	0	0	0	0	0	1	0	0
Total seed (charred)	0	0	0	0	0	0	2	4	0
Total macroremains (charred)	1	0	0	1	1	0	1	0	0