Bones of the Ancestors

The Archaeology and Osteobiography of the Moatfield Ossuary

Edited by
Ronald F. Williamson and
Susan Pfeiffer

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Inset: Andrew Clish mapping remains using the recording grid.

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ABSTRACT

During the summer of 1997, the renovation of a public soccer field, situated in North York (now Toronto), Ontario, resulted in the accidental discovery of pre-contact aboriginal artifacts and associated human bone. Examination of the distribution and nature of the artifacts recovered from the surface of the soccer field, particularly fragments of ceramic vessels, suggested that the site represented a village that had been occupied between circa A.D. 1280 and A.D. 1320, during the early Middle Ontario Iroquoian period. Once it was determined that the bone had originated from a disturbed ossuary pit on the periphery of the site, the City of North York retained Archaeological Services Inc. to investigate the village and to expose, record and exhume the human remains in accordance with the wishes of Six Nations Council of Oshweken.

An outline of what is currently known of the evolution of ossuary burial in the Northeast and of multiple burial practice among southern Ontario Iroquoians was prepared to provide a framework within which to view the Moatfield ossuary. The ossuary contained the remains of at least 87 individuals of whom 58 were adults, 5 were adolescents, 1 was juvenile, 17 were young children, and 6 were infants. While many of these remains were bundled, most were commingled. Through an analysis of detailed mapping of the skeletal elements, on a layer by layer basis, the method and sequence for the placement of the bodies within the ossuary was reconstructed.

The skeletal analyses include a demographic profile of the people in the ossuary, focussing on the presence of a higher proportion of older (>50 yr) adults and slightly fewer newborns than would be expected, a study of cranial genetic markers suggesting that the Moatfield women were more genetically variable than the Moatfield men, as well as more focussed studies on the diet and health of the population.

While most of the skeletal remains were re-buried in a protected setting, a small sample was retained for analysis, with the permission of Six Nations. Chemical analyses of the diet demonstrated a generational difference in maize consumption, indicating a rapid intensification of the consumption of this important food among the population in question. While the chemical analyses also indicated a strong dietary contribution of certain fish species for protein, the physical attributes of the teeth augmented the evidence for a diet focussed on sticky maize gruel. An examination of the juvenile remains even revealed periods of growth arrest after infancy, and a less than expected accumulation of bone mass, all consistent with dietary reliance on maize.

There was also an examination of the indicators of ill-health among the populationincluding the evidence for healed skeletal trauma, proliferative and lytic bone lesions, anaemia, developmental abnormalities, age-related chronic pains, and possible cancer. Maxillary sinusitis, probably caused by constant exposure to smoky wood fires, was common among the Moatfield people, a condition that may have compromised immune function more generally. On the other hand, an analysis of adult long bones, focussing on estimates of stature and body mass, argued for relatively long lives and generally good nutrition among the Moatfield people.

In these ways, this volume is an account of the day-to-day lives of the inhabitants of one of these villages.

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Detailed Mapping of the Ossuary Feature by Level and Theme
Database of Skeletal Elements
Selected Images of Skeletal Pathological Conditions and Developmental Traits
Moatfield Village Artifact Catalogues

FOREWORD

THEIR BONES ARE HERE: RAOTIHSKIONH

THE "MOATFIELD OSSUARY" IN INDIGENOUS CONTEXT

William Woodworth Raweno:kwas

The discovery and examination of the remains of my native relations in the upper reaches of the Don River, reported upon so thoroughly in *Bones of the Ancestors,* recalls once again the equivocation with which such exhumation comes. We remember the disrespect inherent in the settlement and development that has taken place on our lands over the past five hundred years or more. We remember the ways in which our remains have been handled and collected in the early years of archaeology. We also recall our ancestral responsibilities to welcome, comfort, and advise newcomers to our land. The recovery of the evidence of our ancestors comes as a deep form of this advice.

In respect for these Ancestors, I say in our native Mohawk language: *Ionkwaianehson kenha ne raotihskionh. Saiakwahtsaton akionkwetaokon kenha ta? noh*[1] "The ones who have gone on before us, their bones are here. We have buried them; they are here now, these bones of our people and our leaders".

A respected Elder who passed away in the Spring of 2001, was known affectionately as *Bones* Green. This is, in fact, a cognomen that comes up from time to time at Six Nations of the Grand River. Albert Green, a Mohawk Sub-Chief, was, like myself, a student of the great Hotinonshon:ni teacher Jacob Ezra Thomas. Jake is gone now too, so we who are left here must now speak for our Ancestors the way these two good men did. Now they, too, are our Ancestors.

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[1] Prepared with the assistance of Isabel Maracle *Kahnekotionhta* "she is dipping water" (1934-2001), Clan Mother, Deer Clan, Cayuga Nation, Six Nations of the Grand River, Ontario.

Bones of the Ancestors: The Archaeology and Osteobiography of the Moatfield Site, edited by Ronald F. Williamson and Susan Pfeiffer. Archaeological Survey of Canada Mercury Series Paper 163.

During one of my first extended encounters with archaeology, Ron Williamson began sharing with me the story of the recovery, examination, and re-interment of a pre-contact native ossuary in north Toronto. This place, known as the Moatfield site, was discovered in the aftermath of an act of unconscious disrespect. A fence post had been placed directly through this ancient burial, disturbing a place of aboriginal sanctity. Ron expressed his own reservations about conducting this work as instructed by Six Nations Council. Yet he told me that he had asked permission to offer tobacco, as they carried out the aesthetically compelling, scientifically thorough, and culturally respectful investigation of the bone emplacement that is reported in this important addition to the archaeological literature and cooperative historical record. After reading this report, I can now say on behalf of all us, "Thank you. *Nai:wen.*"

On first seeing for myself the photographs of the excavation process, I was profoundly moved. The discovery of this compacted community of the Ancestors violently punctured by the post hole footing for a fence to surround a soccer field was like a personal wound I now carried for the Ancestors. The remains of Clan and Nation of the *onkwehon:we*—those we call the "real people" of this land—unburdened as they were returned to Our Mother, the Earth, were now shattered.

Later I was able to examine the many beautiful and detailed drawings of the bones themselves, as prepared by Andrew Clish, April DeLaurier, and Kathy Mills of the excavation team. These acts of respectful recording engaged me completely on an aesthetic level as an architect and resonated with information for me as an indigenous scientist. Finally, the photograph of the pipe marked with the shamanic image of the turtle's back reconnected me to our Creation story. The Ancestors had positioned this effigy beneath the skull of an elder—the initiatory respectful act of placing the bones in the ossuary.

The discovery of bones has a particular meaning for us who are descended from these Ancestors. Today, most burial discoveries are treated with sanctity and urgency, surrounded by racially charged issues and a desire by us to leave them untouched. These actions speak of the profound esteem with which these remains are still held in our own minds, native and migrationist. How inviolable were bones to the Ancestors? I ask, "Were the bones of those who came before us any more sacred than the trees, the stars, her body, the Mother we call Earth?" We remind ourselves that we are in an integrated relationship with all things in our Thanksgiving addresses. I wondered if the bones themselves are ever mentioned in the lengthy and respectful speeches still conducted in the Hotinonshon:ni longhouses of today at Six Nations. These questions will linger wistfully in our veiled memories and in our native hearts. We will remember.

From my research and conversations with old people, I understand that traditional burials were more visceral than those of today. Bodies were often loosely dressed in supple skins, placed in bark envelopes, and barely covered by loose earth so that we were returned quickly to the matrix from which we came. Sometimes we were buried in a crouched position, face downward, in a kind of earth womb. Other times, the bodies of our dead were laid on open biers of wood, placed high on stacks or in the treetops, offered back to creation. In time, the bones would be recovered and placed in bundles together, returned in this way to the community from which we came. These structural remains, freed of the flesh, are respected because they continue to carry the lingering spirit. When the bundles became burdens too great to carry in the respectful movements of the people, they were returned to the body of our Mother the Earth, together, in what is referred to by the archaeological community, as an *ossuary*. The bones were handled often. One, among many, of these ancient bone burial pits is the Moatfield site. Here the bones were obviously sorted and arranged according to an integrated understanding of communal relationship, and placed in rituals and speeches which we can hardly know now.

The unanticipated return of these bones—the Moatfield discovery—has come to teach us something, to remind us of the good ways of our Ancestors, and to give the opportunity to show respect for them once again. This is what is meant in the recitation of the Great Laws of Peace[2] when we hear the phrase "the bones are rattling once again." They beckon us to listen, and to listen carefully. The archaeological and osteobiographical record of the Moatfield ossuary represents an important and respectful portrait of the lives of my thirteenth century forebears—acts of "listening" carried out here in this report in the protocols and rites of the western scientific community today.

The sheer depth and breadth rendered by the analysis of the remains of this simple village located in the upper reaches of a Don River tributary empower our sense of inheritance in a form of spiritual land claim for us native people. What we are able to deduce in the scientific method is remarkable. We can know the numbers and ages of the buried community. Details of the diet and health of the people become evident, as do aspects of burial practice. This report is most impressive of all for me in setting the larger context for this site, commencing in the introduction with Brebeuf's first record. The natural setting comprehensively described in the paleoecology section, together with the expansive overview of burial practices in the archaeological record are a vibrant description for me of the integrated and pervasive ways in which my Ancestors conducted themselves on these lands.

What we cannot know, however, is poignant. These people spoke, sang and danced. They had meaningful names. They wore clothes and adornments on their bodies, and carried their sexual identities and relationships in diverse ways. They had daily routines and seasonal practices complemented by ceremonial duties. These can never be recovered in material evidence. As much as we can consult the contemporary oral traditions of our people and examine the early records made by

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[2] The Great Laws of Peace *Kaianerenko:wa,* were delivered almost a thousand years ago by a Huron spiritual messenger called the Peacemaker. Sophisticated forms of individual and communal conduct were taught to peoples north and south of our sacred waters called Ontar:io, and included responsibilities to the dead. The great Iroquois Confederacy (Mohawk, Onieda, Onondaga, Cayuga, and Seneca Nations) was formed by the Peacemaker. A form of this confederacy and the legacy of the Great Law continues today at Six Nations of the Grand River, Ontario.

the peoples of alien cultures who first visited us, so much is lost in a form of amnesia wrought by our modern consciousness and our colonization.

However, the modern equivalent of these burial practices is intact in the longhouse burial tradition of my own community at Six Nations of the Grand River. The death of one of the people there still initiates our deepest ceremonial practice, the Condolence. The body is taken to a discreet open field. There a hand-dug grave is prepared to receive the body, which is dressed in simple native clothes, and placed in an unfinished wood box. A small triangular notch is cut in the coffin edge at the head to allow the spirit to release itself. The grave is then filled in by the men, while the ceremonial speeches are given. The ends of the plot are marked by simple, hand-hewn, wooden paddles. Then a meal of traditional food is served and shared with the Ancestors. These Feasts of the Dead are regular events held every Spring and Fall, which are the only times that the graves are visited. The grounds are tended at the same time to remove any grasses and plants that have grown there. In time, even the markers are returned to the body of Mother Earth, and the grave places, in essence, become unmarked—held only in the memory of the people and the bones.

There is a lesson in these contemporary practices for the handling of discoveries like the ossuary at Moatfield. In our duties today, we, the many peoples who now inhabit and share this land together, are called upon to handle the bones of those generations, modern and ancient, who have come before us. We should not be distressed that this is so, and that it will always be this way as long as we are here, walking about on the body of Our Mother, the Earth.

My adopted Clan Mother responded this way when I shared the Moatfield discovery with her, "We are extending our greetings to be compassionate to our people who have gone on before us, those who are our leaders, and for what they have shown us: 'the way that you led your lives shows us how we should lead our lives'."

Tekwanonweraton akionkwetaokon?a tsinikaien sewatonhehtstonh
tanonsewaianehson ohnahoten skwanatoni.
Akewkon nohoten nisewaiere naionkwario? tonhake.[3]
Onen.

---

[3] Isabel Maracle *Kahnekotionhta*.

STUDYING THE BONES OF THE ANCESTORS

1

Ronald F. Williamson
Susan Pfeiffer

INTRODUCTION

In 1636, the Jesuit priest, Jean de Brebeuf, who had been residing with the Huron in what is now south-central Ontario, recorded an event known as "The Feast of the Dead", the most renowned ceremony among the Hurons:

> Twelve years or thereabouts having elapsed, the Old men and Notables of the Country assemble, to deliberate in a definite way on a time at which the feast shall be held...they display before you all these corpses, on the spot, and they leave them thus exposed long enough for the spectators to learn at their leisure, and once and for all, what they will be some day. The flesh of some is quite gone, and there is only parchment on their bones; in other cases, the bodies look as if they had been dried and smoked, and show scarcely any signs of putrefaction; and in still other cases, they are still swarming with worms.... About five or six o'clock, they lined the sides and bottom of the pit with large new robes, each of ten beaver skins, in such a way that they extended more than a foot out of it.... At seven o'clock, they let down the whole bodies into the pit. We had the greatest difficulty getting near...on all sides you could have seen them letting down half-decayed bodies;...they turned back over the bones the robes which bordered the edge of the pit, and covered the remaining space with mats and bark.... Some women brought to it some dishes of corn; and that day and the following days, several cabins of the village provided nets quite full of it, which were thrown upon the pit (Thwaites 1896-1901:10:279-299).

Bones of the Ancestors: The Archaeology and Osteobiography of the Moatfield Site, edited by Ronald F. Williamson and Susan Pfeiffer. Archaeological Survey of Canada Mercury Series Paper 163.

In 1946, a team from the Royal Ontario Museum, directed by Kenneth E. Kidd, began the scientific excavation of this very ossuary, known as Ossossané, whose creation was described by Brebeuf. When they did so, they believed it to be one of only half a dozen such sites to have survived a century of destruction and looting by early European settlers (Kidd 1953:359). While that may have been true of the larger contact period Huron ossuaries, Kidd was unaware of the antiquity of the ceremony and of similar dramas that had occurred along the north shore of Lake Ontario nearly four hundred years previously.

This is the story of the discovery, scientific exhumation, and reburial of one of those early ossuaries. It is also an account of the day-to-day lives of Iroquoians during a period of dramatic economic, social and political transition from relatively autonomous communities to the elaborate political confederacies recorded by the first European explorers and missionaries to visit the Great Lakes region. In the fifty years that have passed since Kidd's excavation of Ossossané, a wealth of newly unearthed data, as well as technological developments in archaeology and biological anthropology have resulted in extraordinary advances in our understanding of the evolving kinship, subsistence and settlement systems of pre-contact Iroquoians. We will attempt to place the Moatfield community in that transition using data generated from some of these new analytical techniques, some of which have even been successfully applied to the skeletal remains from Ossossané. In this way, the project will have contributed significantly to an enhanced understanding of Iroquoian cultural evolution.

It is also the story of the ways in which thirteenth century Iroquoians viewed death and the afterlife. Through a detailed analysis of the exact position of the skeletal remains within the burial pit, we have reconstructed some of the events leading up to its creation. We have even attempted to differentiate the ways in which varying segments of the community, such as infants or older men, were treated in the hope that such patterns might lead to inferences about specific ideological beliefs held by the site's inhabitants. These analyses were possible only because of the carefully prepared drawings of each layer of bone in the pit accompanied by a database that provides identifications for all of the major elements, an unprecedented level of documentation for an Iroquoian ossuary. Given the context of our current understanding of the evolution of Ontario Iroquoian mortuary behaviour, the nature and extent of this thirteenth century ossuary suggests that it is one of the earliest, intact community ossuaries to have been documented.

THE DISCOVERY

During the summer of 1997, the renovation of a public soccer field (Figure 1.1), situated in North York (now Toronto), Ontario, resulted in the accidental discovery of pre-contact aboriginal artifacts and associated human bone. Examination of the artifacts recovered from the surface of the soccer field, particularly the remains of ceramic vessels, suggested that the site had been occupied between circa A.D. 1280 and A.D. 1320, during the early Middle Ontario Iroquoian period.

Figure 1.1. View east across the Moatfield site. The settlement area is now occupied by the soccer field. The ossuary was found on the fence line along the southern edge of the park.

The human bone was discovered during the installation of a fence around the perimeter of the soccer field when augering for a post hole resulted in the displacement of a small quantity of bones. These items were collected in July by Mr. Glenn Penoyer, a local avocational archaeologist, who subsequently took the material to the Archaeology and Heritage Planning Branch of the Ontario Ministry of Tourism, Culture and Recreation (now the Ministry of Culture). Ministry staff identified the bones as human, a conclusion that was confirmed later by Dr. Jerry Melbye, formerly of the Department of Anthropology, Erindale College, University of Toronto and a forensic consultant to the Toronto Police Department. Based on the small sample available, Melbye concluded that the elements represented the remains of a single, likely aboriginal individual. Metropolitan Toronto Police and the Regional Coroner were informed of the discovery, but due to the antiquity of the remains, both agencies concluded that no further action was required on their part.

This conclusion meant that the discovery was the responsibility of the City of North York. Encounters with unmarked, pre-contact aboriginal burials present unique legal and ethical questions. While some of these questions can only be resolved through an understanding and appreciation of the pre-contact cultural contexts in which aboriginal peoples lived, died, and were buried, they must also be addressed in the context of current legislation, in this case, the Ontario Cemeteries Act. This legislation outlines consultation, permission, investigative, and disposition processes for such discoveries, which at times are at odds with the complexities of contemporary aboriginal societies, not to mention the original wishes of the deceased. Simply, who was to speak for these ancestors?

As required by law, the City first contacted officials with the Cemeteries Regulation Unit of the Ministry of Consumer and Business Services (then Consumer and Commercial Relations), who advised the City that they needed to undertake an archaeological investigation to determine the extent and origin of the human remains. Naturally, the City also wanted to define the nature and boundary of the settlement so as to protect it from further impacts during the re-development process. They were also instructed by the Cemeteries Regulation Unit to consult with the appropriate First Nation regarding the discovery and any subsequent investigations of the human remains. While this role is often assumed by the band that is geographically closest to a find, the fact that the site had been determined to be Iroquoian, led representatives of the Chiefs of Ontario, the Mississaugas of the New Credit, and the Native Canadian Centre of Toronto, to advise the City to consult with the closest Iroquoian band, Six Nations Council of Oshweken, Ontario.[1] The City sought the direction and permission of Six Nations to continue with the investigation of the skeletal deposit.

In September, Archaeological Services Inc. (ASI) was retained by the City of North York to determine the nature and extent of both the site and the associated human bone deposit. Further investigation demonstrated that the feature originally struck by the post hole auger was a small ossuary or mass grave, likely representing the final event in the occupation of the village. Upon submission of an interim report, the Cemeteries Regulation Unit, defined the site, in their somewhat offensive cemetery typology, as an "unapproved aboriginal peoples cemetery" under the Ontario Cemeteries Act (Revised) R.S.O 1990. At the written, subsequent instruction of Six Nations Council of Oshweken and Mr. Gary DeMers, Registrar, Cemeteries Regulation Unit, the City of North York subsequently retained ASI to expose, record and exhume all of the remains in the ossuary pit in order that they could be re-buried in a nearby protected setting. The instructions from Chief Wellington Staats to Dr. Ron Williamson were explicit: "We understand that there are probably more human remains still located on the site, and are writing to you to indicate that the position of the Six Nations of the Grand River is that *all* of the human remains located in the area must be recovered before any construction work is carried on." Starting in the first week of October, it took until the end of the second week of December to remove all of the deposit. All construction activity on or near the site was halted until the archaeological work was completed and the site was secured 24 hours a day, seven days a week throughout the entire project period.

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[1] This course of action is often followed in southern Ontario when Iroquoian skeletal remains are found despite the fact that the remains that are usually encountered are of the ancestors of Ontario Iroquoians (i.e., Neutral or Huron) and not the Six Nations Iroquois. The Six Nations, who in precontact times had occupied lands south of Lake Ontario, moved to the Grand River region of southern Ontario in the 1780s and now constitute the population of Six Nations Reserve. While there are perhaps people of distant Neutral ancestry living among the Wyandot peoples of Kansas and Oklahoma or Six Nations, the closest Huron (also Wyandot) reserve is in Lorette, near Quebec City.

At the time of the excavation, permission was also sought from Mr. Ervin Harris, the Six Nations councillor responsible for burials affairs to undertake chemical analyses on small tissue (mainly teeth) samples taken from the remains. It was related that such samples would probably provide a considerable amount of information concerning the diet and lifeways of the deceased and that these results would be incorporated into our final report. Upon consultation with elders and faithkeepers, Mr. Harris provided permission and emphasized Six Nations' interest in learning of the results once they were available. With the exception of these samples, all of the skeletal remains were re-buried on December 18, 1997. The ceremony was officiated by Senior Faithkeeper Barry Longboat from Six Nations.

THE PEOPLE

As the most populous group and that most involved in the development of an agricultural life-style, Iroquoian society often forms a distinct focus of Late Woodland archaeology in Ontario; hence the Late Woodland period is often subdivided into Early (A.D. 900-A.D. 1300), Middle (A.D. 1300-A.D. 1400) and Late Iroquoian periods (A.D. 1400-A.D. 1650).

Only a few centuries prior to the occupation of the Moatfield site, aboriginal people in Ontario still relied, to a considerable degree, on hunting, fishing and gathering of plant foods for their subsistence needs. They followed an annual cycle of activities based on the seasonal availability of naturally occurring resources. In the spring and early summer, a number of related families would come together at or near the mouth of a river to fish, harvest wild rice, and collect other plants and berries while in the fall and winter, the larger band would split into smaller family groups, which would then move inland to collect nuts and other wild edibles and to hunt and trap.

Although maize was introduced into Ontario by the mid-sixth century (Crawford et al. 1997), its adoption was clearly gradual (Warrick 2000:427-434; Williamson 1990:312-320). Indeed, it would appear that early horticulturalists sought to reduce the risk of crop failure through a diverse economy (see, for example, Kent 1989; Rindos 1984). By the eleventh century, people were living, at least in winter, in small, semi-permanent, base settlements that were sometimes protected by palisades (e.g., Pihl [ed.]1999). Around these base settlements, camps and hamlets were strategically placed in order to facilitate the traditional exploitation of naturally occurring food resources by the community, while maize horticulture continued to assume greater importance in subsistence systems (Williamson 1990).

By the beginning of the fourteenth century (Dodd et al. 1990), most Ontario Iroquoians were inhabiting 0.4 to 1.2 hectare villages, such as Moatfield (Figure 1.2). The inhabitants of these villages, which were sometimes fortified, were involved in fully developed maize-bean-squash agriculture and widespread similarities in pottery and smoking pipe styles point to increasing levels of inter-community communication and integration. It is likely that the development of inter-village

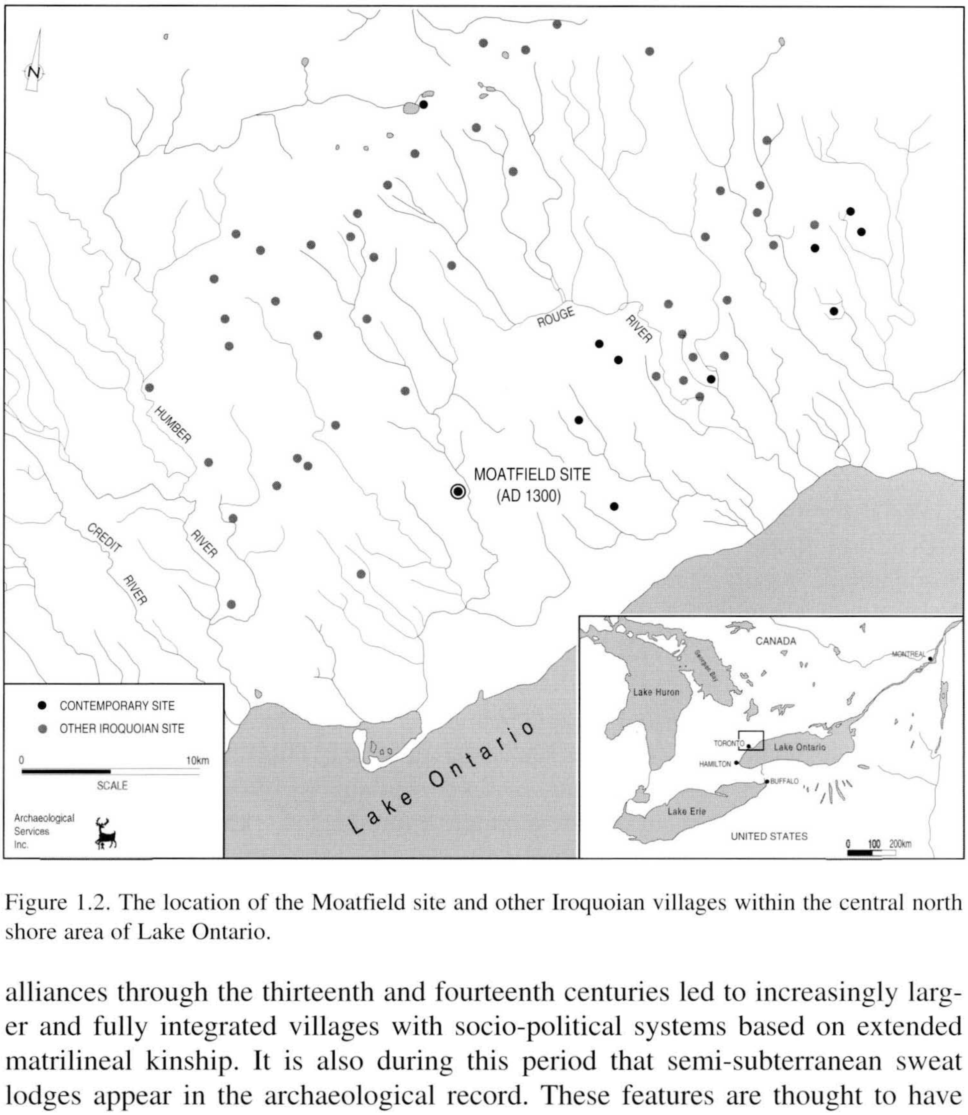


Figure 1.2. The location of the Moatfield site and other Iroquoian villages within the central north shore area of Lake Ontario.

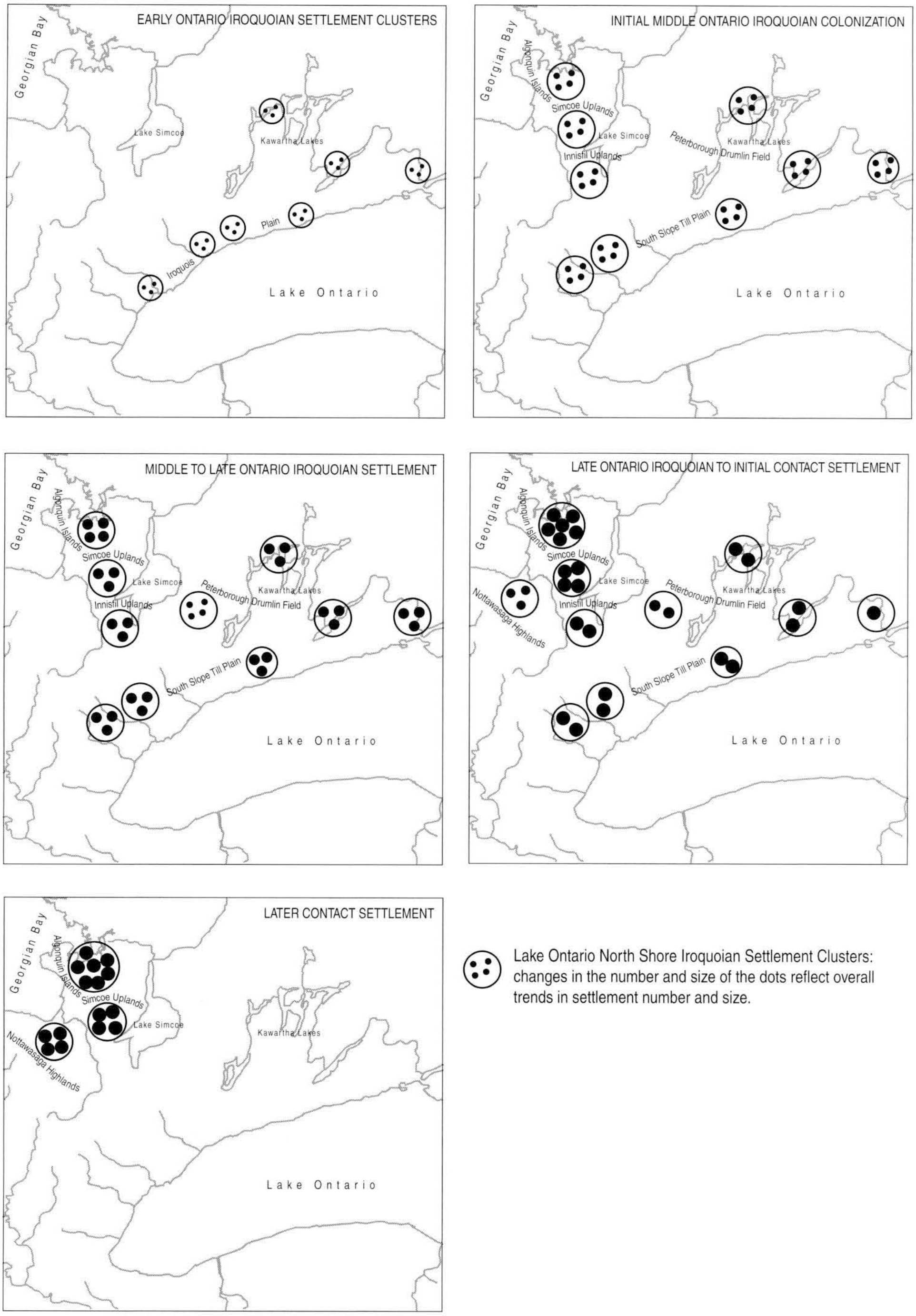
alliances through the thirteenth and fourteenth centuries led to increasingly larger and fully integrated villages with socio-political systems based on extended matrilineal kinship. It is also during this period that semi-subterranean sweat lodges appear in the archaeological record. These features are thought to have functioned to integrate the men of different families in growing settlements. Community ossuaries also appear at about this time, another reflection of the evolving nature of village life.

While subsistence patterns appear to have remained relatively stable during the Late Iroquoian period, the most noticeable changes are in the socio-political organization of villages. These changes are clearly evident in the community settlement patterns. Through the fifteenth century, for example, certain village households appear to have been consistently larger and more variable in membership than others within the same community. This trend peaks with some longhouses reaching lengths of over 120 metres with three or more extensions evident. Moreover, many villages, probably through community amalgamation and population increases, reached sizes of over four hectares. It is thought that these settlements represent the genesis of many of the tribal systems that later form the political confederacies witnessed by the first European visitors. At the same time, however, these villages became more heavily palisaded, which along with certain occurrences of human remains suggest increasing levels of inter-group conflict, often with neighbouring populations (e.g., Robertson and Williamson 1998).

During the sixteenth century, longhouses became shorter again. This modification of residential patterning suggests that changes had occurred in the kin-based political system perhaps reflecting the increased importance of clans over lineages. Since clan membership cut across related communities, this aspect of kinship was an important source of tribal integration (Lennox and Fitzgerald 1990; Ramsden 1990). When European explorers and missionaries arrived in Ontario at the beginning of the seventeenth century, Iroquoian villages were under the direction of various chiefs elected from the principal clans. In turn, these villages were allied within powerful tribal confederacies. Intertribal warfare with the Five Nations Iroquois of New York State during the seventeenth century, exacerbated by the intrusion of Europeans, resulted in the dispersal of all of the Ontario Iroquoian groups, the Huron, Petun, and Neutral, by 1651.

In summary, the occupation of the Moatfield site may be viewed in the context of an evolving land-use pattern originating at least as early as the Middle Woodland period and culminating in the coalescence of Late Woodland tribal groups during the seventeenth century (Figure 1.3). Most, if not all, of the Lake Ontario north shore communities, such as Moatfield, eventually migrated to Huronia and the Nottawasaga Highlands by the turn of the seventeenth century. While the outline of this trend has been known for decades (e.g., Wright 1966), two recent studies have addressed its socio-cultural (Sutton 1996, 1999) and ecological (MacDonald 2002) workings in more detail. By comparing settlement locations with physiographic features, MacDonald (2002) has described the following sequence: (1) Early Iroquoian period settlement on the Iroquois Plain that shows continuity with the preceding Middle Woodland period; (2) abandonment of the Iroquois Plain and initial colonization of the South Slope Till Plain, Simcoe Uplands, Innisfil Uplands, and Algonquin Islands during the fourteenth century; (3) settlement contraction on the South Slope Till Plain, settlement expansion in the northern Algonquin Islands and Penetang Peninsula, and colonization of the Peterborough Drumlin Field during the fifteenth century; (4) a continuation of the fifteenth century trends and initial colonization of the Nottawasaga Highlands during the sixteenth century; and (5) settlement expansion in the Penetang Peninsula, northern Algonquin Islands, and Nottawasaga Highlands, and abandonment of virtually all other occupied physiographic features during the seventeenth century. The age and location of the Moatfield site corresponds well with the second stage of this sequence.

The fourteenth century abandonment of the Iroquois Plain has been attributed to population growth, community fission, and the resulting need for repositioning and expansion of village catchment areas. Given a continuing heavy reliance on the resources of the north shore estuaries, however, MacDonald (2002) has argued that catchment areas assumed an increasingly linear character over time, as communities migrated progressively upstream within their respective watersheds. An interesting feature of the Moatfield site is its location at the northern end of a large patch of



EARLY ONTARIO IROQUOIAN SETTLEMENT CLUSTERS

INITIAL MIDDLE ONTARIO IROQUOIAN COLONIZATION

MIDDLE TO LATE ONTARIO IROQUOIAN SETTLEMENT

LATE ONTARIO IROQUOIAN TO INITIAL CONTACT SETTLEMENT

LATER CONTACT SETTLEMENT

Figure 1.3. A schematic summary of the broad-scale settlement patterns leading to the ultimate concentration of Lake Ontario north shore populations in Huronia. Changing land-use trends examined by MacDonald (2002) resulted in complex sequences of movement, expansion and contraction within each of the various physiographic regions occupied by these Iroquoian groups.

glacio-lacustrine sand. Together with the embayment of glacial Lake Algonquin, which carried the Iroquois strand about four kilometres north of its main course, this patch of glacio-lacustrine sand may have effectively carried certain environmental attributes of the Iroquois Plain eight kilometres farther inland. This would have served to buffer the adaptive transition from life on the Iroquois Plain to life on the South Slopes till plain. In particular, it may have broken up the relatively monotonous expanse of closed-canopy northern hardwood forest that blanketed the uplands of the latter region. These environments and the continuing use of the lower Don River estuary are further explored in the following chapter.

THE ORGANIZATION OF THE VOLUME

The first section of the volume provides an analysis of the environmental setting and archaeology of both the village and the ossuary. While detailed excavations of the village were not undertaken, the extent of the site was assessed. In that process, a sizable material culture assemblage was recovered from a number of test areas. The assemblage includes over thirty analysable ceramic vessels, numerous lithic tools and bone artifacts as well as significant floral and faunal remains. These data, as well as an analysis of the radiocarbon dates, are presented by Ronald Williamson, Stephen Cox Thomas, and Robert MacDonald in Chapter 2.

The next chapter, by Williamson and Debbie Steiss, outlines what is currently known of the evolution of ossuary burial in the Northeast and of multiple burial practice among southern Ontario Iroquoians. They present a table providing details of every occurrence of a professionally documented multiple burial on an Iroquoian site. These data were collected from the Ontario Archaeological Sites Database and the professional literature and provide, along with a few key previous studies, an evolutionary framework for mortuary behaviour within which to view the Moatfield ossuary.

In Chapter 4, Williamson, Andrew Clish, George Clark and Susan Pfeiffer present the archaeology of the ossuary. Through an analysis of detailed mapping of the skeletal elements, on a layer by layer basis, they propose a sequence for the placement of the bodies within the ossuary. Observations about the treatment of various segments of the community are also presented along with a detailed examination of the one significant artifact found at the bottom of the pit. Over 100 drawings, as well as the bone database have been included on the accompanying CD-ROM, which can be used to view the full extent and structure of the ossuary. These drawings will also allow for detailed analyses of any particular skeletal element or community segment by future researchers.

The second section of the volume presents the skeletal biology of the Moatfield people. In the introductory chapter to this section, Susan Pfeiffer establishes the context and the conceptual approach that was used for the skeletal analysis. She outlines the ways in which the rapid analysis was organized, then discusses how the minimum number of individuals (87) was determined. The fact that there were slightly more crania than bodies, among both adult and juvenile subsets is discussed, as is the fact that hands and feet were included less consistently than were torsos. These observations are considered in light of the ossuary construction sequence presented in Chapter 4.

In Chapter 6, Deborah Merrett explores the number, age and sex of the Moatfield ossuary sample. She compares the analyses of dentitions, crania, pelvic bones and long bones in order to construct a life table. Moatfield is distinctive, among Iroquoian ossuaries, in showing that a higher proportion of older (>50 yr) adults may be linked to less inclusive methods of age assessment used in earlier studies. There are slightly fewer newborns than would be expected on the basis of probable population structure. Sex ratios suggest that the "extra" crania were likely from men.

In the next chapter, Pfeiffer uses the methods of paleopathology to look for indicators of ill-health. She quantifies the evidence for healed skeletal trauma, proliferative and lytic bone lesions, evidence of anaemia, developmental abnormalities, age-related chronic pains, and possible cancer. In many categories, the people of Moatfield show few problems. Particularly relevant to understanding broader regional developments is the apparent presence of tuberculosis. Bone lesions that are consistent with tuberculosis were noted for a minimum of four individuals.

Nikolaas van der Merwe, Pfeiffer, Williamson, and Stephen Cox Thomas present a chemical analysis of the diet of the Moatfield people in the next chapter. One posterior maxillary tooth from each adult was analyzed for $\delta^{15}N$ (dentin) and $\delta^{13}C$ (enamel and collagen) values, to reconstruct aspects of diet. Using a dietary signal from those years during which the teeth were forming, it was possible to determine that peak maize consumption occurred among the 20-29 year age group, indicating a rapid intensification of the consumption of this important food among the population in question. Nitrogen results also indicated a strong dietary reliance on certain fish species for protein. The implications of these results are presented in the concluding chapter.

In Chapter 9, Catherine Crinnion, Deborah Merrett, and Pfeiffer provide a description of the teeth from the perspective of additional efforts to reconstruct the health and diet of the Moatfield people. Maxillary and mandibular data provide a picture of a high caries rate (approximately 40%), high rates of pre-mortem loss, considerable calculus, and no evidence of regular dental hygiene. While there is variability through time, the pattern at Moatfield is very similar to that seen in much later contact period ossuaries, like Kleinburg. Dental patterns are consistent with a diet that focussed on sticky maize gruel.

In Chapter 10, Deborah Merrett provides an analysis of maxillary sinusitis among the Moatfield people. The floor of the maxillary sinus was studied in 23 juveniles and 51 adults. The onset of chronic sinusitis is age-dependent, with 60% of the adults showing characteristic bone changes. About half of these cases are independent of any dental abscess. This high prevalence was probably caused by smoky wood fires, and the condition may have compromised immune function more generally.

The following chapter, by April DeLaurier and Michael Spence, is a study of cranial genetic markers with implications for post-marital residence patterns. Non-metric cranial variants were used (N=73, 43 traits), in the context of a mean measure of distance, to explore the relationships of adults within the community and to compare the Moatfield people with four other roughly contemporary samples of people. Their results indicate that, while there is general homogeneity among the regional samples, the Moatfield women are more genetically variable than the Moatfield men, suggesting possible patrilocality at Moatfield.

In Chapter 12, Tosha Dupras discusses the juvenile remains, both relatively complete remains and loose elements, to determine MNI and explore health indicators. Growth arrest lines and measures of cortical bone growth are quantified. Her conclusions are that after infancy, periods of growth arrest occurred, and accumulation of bone mass was less than expected, in comparison with modern standards. Dietary reliance on maize is proposed as a possible cause. Most causes of death were likely to be acute conditions.

Jay Stock and Katherine Willmore illustrate, in Chapter 13, the many ways that adult long bones can contribute information, even under the constraints of commingled remains. After exploring the probable sex ratio through metric analysis of femora and humeri, they address estimates of stature and body mass, noting that Iroquoians are considerably more homogeneous than earlier Archaic peoples. They demonstrate that percent cortical area among Moatfield adults is high, that asymmetry associated with handedness is low, and that variance is low. These approaches corroborate analyses in the other chapters, arguing for relatively long lives and generally good nutrition among the Moatfield people.

In the final section of the volume, Pfeiffer and Williamson provide a summary of the analyses and discuss the implications of these data for both Iroquoian cultural evolution generally and, more specifically, our evolving understanding of Ontario Iroquoian mortuary practice.

The epilogue is an account, drawn from Beverly Garner's personal journal, of the reburial of the Moatfield people in a landscape setting designed to prevent them from ever being disturbed again.

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THE ARCHAEOLOGY OF MOATFIELD

THE ARCHAEOLOGY OF THE MOATFIELD VILLAGE SITE

2

Ronald F. Williamson
Stephen Cox Thomas
Robert I. MacDonald

THE PALEOECOLOGY OF THE MOATFIELD SITE

Physiography and Soils

The Moatfield site is situated immediately west of the brow of the scarp which overlooks the entrenched floodplain of the Don River east branch, on the south side of Deerlick Creek, a small tributary which flows easterly into the Don River. The site is about 12 kilometres from Lake Ontario at an elevation of 130 metres asl and about 55 metres above the lake (Figure 2.1).

The Quaternary deposits in the vicinity are predominantly clayey to silty Halton till. Overlying the till plain is a discontinuous veneer of glacio-lacustrine sediment, including both deep-water clays and shallow-water sands, laid down by the Peel meltwater pondings. Moatfield is located at the northern end of one such deposit, comprising a large (approximately three by five kilometre) area of glacio-lacustrine sand. Approximately 4.5 kilometres south of the site, between Eglinton and Lawrence Avenues, is the beach ridge of glacial Lake Iroquois, which traces the outline of a large relic embayment within the Don River valley (Hewitt 1969; Sharpe 1980).

The soils at the site are mapped as Brady sandy loam. Within a one kilometre radius of the site, the mapped soils are approximately as follows: 40% Cashel clay, 25 % Brady sandy loam, 20% Woburn loam, 10% bottomland, and 5% Fox sandy loam. Cashel is an Orthic Gray Brown Luvisol which has developed on lacustrine clay underlain by clay till. Topography is characteristically smooth and moderately sloping with good drainage. In the vicinity of the site, it is rated 70%

Bones of the Ancestors: The Archaeology and Osteobiography of the Moatfield Site, edited by Ronald F. Williamson and Susan Pfeiffer. Archaeological Survey of Canada Mercury Series Paper 163.

NOTE:
Base map digitized from the
York Township map in the
1878 Historical Atlas of
York County.

Figure 2.1. The location of the Moatfield site (AkGu-65) on the Don River.

Class 1 and 30% Class 2 for agriculture, with moderate limitations arising from adverse topography in the more dissected parts of the landscape. Brady is a Gleyed Brunisolic Gray Brown Luvisol which has developed on well sorted sandy outwash. Topography is typically smooth, gently sloping with imperfect drainage. In the vicinity of Moatfield, it is rated Class 2 for agriculture, with moderate limitations arising from low natural fertility. Woburn is a Brunisolic Gray Brown Luvisol which has developed on medium-textured shale and limestone till. Topography is characteristically smooth, moderately to steeply sloping with good drainage. In the vicinity of the site, it is rated 70% Class 1 and 30% Class 2 for agriculture, with moderate limitations arising from adverse topography in the more dissected parts of the landscape. Fox is a Brunisolic Gray Brown Luvisol which has developed on well-sorted sandy outwash. Topography is smooth, gently sloping with good drainage, and it is rated Class 1 for agriculture. The soils mapped as bottomland are immature soils which have developed on recent alluvium along streams and rivers. Topography is typically level and drainage is variable, although it tends to be poor with seasonal innundation. Bottomland is not rated for agriculture (Hoffman and Richards 1955; Ontario Institute of Pedology n.d.).

Paleoecology

The site is situated in Forest Site Region 7E, near the interface with Site Region 6E (Burger 1993). Although located within an urban area not rated for forestry, the zone with similar soils which begins approximately two kilometres north of the site is rated 50% Class 1 and 50% Class 2 for forestry (Williams 1971). The slight limitations for forestry arise from localized soil moisture excess and physical restrictions to rooting by dense or consolidated layers other than bedrock. The mesic forests in this region tend to be dominated by hard maple and beech, often in association with basswood, red and white oak, and shagbark and butternut hickory. Pioneering species include eastern cottonwood and black cherry. Cooler and wetter areas, such as the bottomlands, might also include white elm, red and black ash, red maple, eastern hemlock, white spruce, balsam fir, yellow and white birch, and eastern white cedar. Drier substrates tend to support white and red oak, shagbark hickory, white pine, and white elm (Burger 1993; Farrar 1995). Wood charcoal recovered from a large refuse deposit at the site (Feature 1; see below) exhibits frequencies that are consistent with firewood collected from a mesic northern hardwood forest co-dominated by maple (28%) and beech (37%). The strong representation of elm (22%) suggests nearby soils outside of the mesic range, typically wetter substrates where competition of elm with maple and beech is enhanced. The low frequencies of ash (1%), ironwood (1%), and unidentified taxa (11%) suggest that local forests were late successional in character at the time the site was occupied.

The preponderance of fish in the Moatfield faunal assemblage, together with turtles, waterfowl, and a variety of both terrestrial and aquatic mammals, indicates an economic focus on the resources of the lower Don River from the site downstream to Lake Ontario. This reach was dramatically altered during the late-nineteenth and twentieth centuries, and an understanding of its original character must be gleaned from historical records.

The Don River rises along the southern margins of the Oak Ridges Moraine approximately 38 kilometres from Lake Ontario. The majority of the watershed traverses the South Slope Till Plain, maintaining a relatively steep gradient of seven metres per kilometre for the first 10 kilometres and tapering to 4.2 m/km for the next 24 kilometres. From the forks, where the west and east branches join, to Lake Ontario, the gradient falls to about 1.25 m/km (Martin-Downs 1988:5). The reduced gradient of the lower reach is partly the result of the river's descent across the glacial Lake Iroquois strand. In addition, since the end of the Pleistocene, isostatic uplift has continued to gradually elevate the Lake Ontario outlet, thereby raising lake levels and flooding river mouths around the Ontario basin (Anderson and Lewis 1985; Chapman and Putnam 1984:104). Many of these estuarine river mouths, including the Don prior to historic remodelling, are characterized by extensive coastal wetlands.

A legacy of the once-lower water levels that immediately followed the draining of glacial Lake Iroquois, and the resulting lower erosional base levels, is the deeply entrenched valley of the lower Don. This entrenchment is on the order of 30 metres below the surrounding upland in places. The higher base levels that have resulted from the re-filling of the Lake Ontario basin have caused the river to meander, widening the floodplain in the lower reaches to a maximum of around 750 metres. In contrast, the valley adjacent to the Moatfield site is approximately 200 metres in breadth and just over 10 metres in depth.

A map compiled in 1788 by surveyor Alexander Aitkin notes that the Don was navigable by boat for two or three miles (Sauriol 1981:65). The head of commercial navigation on the Don River was near Danforth Avenue, where there was a ford that was part of a trail leading to Montreal (Sauriol 1981:57). Sauriol (1981:143) notes that, during the nineteenth century, there was considerable traffic of schooners and smaller vessels to factory wharves in the vicinity of Gerrard Street. He also reports (Sauriol 1981:72-73) that pioneer records refer to the forks of the Don as the "boatbuildery", alluding to some degree of navigability farther upstream. Indeed, in the late eighteenth century, the North-West Company used the lower Don as part of their fur trade route to Lake Simcoe and Georgian Bay. Small, shallow-draft boats were rowed upstream to the forks and then up the west branch to the newly created Yonge Street where it intercepted the river at Hogg's Hollow (York Mills). From there the boats were lashed onto wheels and pulled overland to the Holland River (Sauriol 1981:73; Scadding 1966:160-161). As Hogg's Hollow is roughly the same distance upstream on the west branch as the Moatfield site is on the east branch, Moatfield may well have had downstream canoe access to the lower Don and Lake Ontario.

The original character of the lower Don is captured in the following description by Pearson (1914):

> The river was so very serpentine that one would have to go about three miles to go in a straight line. There were long stretches of meadow land between the windings of the river, and a good deal of marsh. This, as well as the marsh between the harbour and Ashbridge's Bay, was a great place for muskrats, and numbers were trapped.

Scadding's 1873 history of Toronto (1966:167) indicates that, as one progressed upstream, the marshes gave way to meadow at about the present position of Riverdale Park, approximately two kilometres inland. He too made note of the "morasses" which characterized Ashbridge's Bay and the contiguous marshes through which the Don flowed into Lake Ontario (Scadding 1966:3-4). The riparian marsh he describes as "one thicket of wild willow, alder, and other aquatic shrubbery," including witch hazel, dogwood, highbush cranberry, wild grape, blue iris, reeds, and cattails (Scadding 1966:153, 159). He also refers to an island near the mouth of Castle Frank brook where wild rice grew plentifully (Scadding 1966:167). Pearson (1914:116) mentions "many stately elms" on the river flats, as well as wild plum, butternut, gooseberry, and currants in abundance.

At their confluence, the east and west branches of the Don are deflected westerly by a large relic baymouth bar that was formed at the mouth of the embayment in glacial Lake Iroquois. In addition to this extensive deposit of sand and gravel, most of the Iroquois Plain that flanks the lower Don Valley was capped by nearshore deposits of glacio-lacustrine sand. This porous substrate seems to have had considerable influence on the upland forest that surrounded the lower Don Valley. In the late eighteenth century, travelling to their summer retreat of "Castle Frank" near present-day Bloor and Bayview Streets, Governor and Mrs. Simcoe followed a trail along Yonge Street and then easterly to the Don through shady pine plains covered with ferns (Sauriol 1981:61). The summer home itself was situated on the edge of a plateau overlooking the Don Valley that was covered with white pines of huge girth (Sauriol 1981:62). Mrs. Simcoe also reported visiting a farm at the current location of the Don Valley Brick works which she described as being under a hill covered with pine (Sauriol 1981:66). Scadding (1966:157) also notes a predominance of mature pine in the uplands surrounding Castle Frank Brook, Todmorden Mills, and at the forks of the Don (see also Pearson 1914:118), and he completes the picture with this description:

> Northward [from the Queen Street bridge], while many fine elms would be seen towering up from the land on a level with the river, the bold hills above them and beyond were covered with lofty pines. Southward, in the distance, was a great stretch of marsh, with the blue lake along the horizon. In the summer this marsh was one vast jungle of tall flags and reeds. . . (Scadding 1966:154).

These historical descriptions indicate that the Moatfield community would have had access to three principal fish habitats: the pool and riffle sequences that would have characterized the upper and middle reaches of the Don River, the riparian and coastal wetlands of the lower reach, and the deepwater habitat of Lake Ontario. Although it is likely that all of these habitats would have been exploited, fish productivity would have been highest in the estuary and coastal marshes of the lower Don. The high fish productivity of Great Lakes coastal wetlands is attributable to several factors, including their high primary production, which is among the most productive of all known ecosystems, the diversity of the habitat structure, and the rejuvenating effects of natural fluctuations in lake water levels. Similar features pertain to the riparian wetlands of the Great Lakes estuaries, which also exhibit aquatic-terrestrial food webs that concentrate potential prey species within fairly constrained areas (Jude and Pappas 1992:661-662).

Two groups have been identified within the fish remains of the Moatfield site faunal assemblage (see below). The first group, comprising American eel, Atlantic salmon, lake whitefish, and lake trout, are typically harvested during spawning runs in the fall. Scadding (1966:161) reported that hundreds of salmon were annually taken in the Don. A favourite fishing technique was jack lighting, using torches made from resinous pine knots mounted on the front of fishing skiffs to attract the salmon. On one such fishing expedition, Scadding and friends speared twenty large salmon in an hour. Sauriol (1981:92) similarly reports on a settler of 1793 having harvested ninety salmon near Castle Frank. The distance to which the salmon ran upstream can be gauged by a newspaper advertisement of 1798, listing for auction a farm on Yonge Street about twelve miles (20 km) from York, which boasted "an excellent salmon fishery large enough to support a number of families" (quoted in Sauriol 1981:93-94).

The second group of fish comprises brown bullhead, northern pike, sunfish, yellow perch, and sucker. Of these, resident populations of brown bullhead, sucker, and yellow perch were likely available immediately adjacent to the Moatfield site. Other populations of suckers and yellow perch, which were resident in the lower Don River or the littoral of Lake Ontario, may also have been harvested near the Moatfield site during their spawning runs in the spring. Suckers are one of the few tolerant species that have managed to maintain resident populations in the Don River (Martin-Downs 1988:32), and Sauriol (1981:36) describes the banks of the Don by Pottery Road, within recent memory, being white with the forms of stranded suckers. Brown bullhead, although no doubt available near Moatfield, would have been much more abundant in the marshes of the lower Don and Lake Ontario coast: "Catfish [brown bullhead, etc.] were caught by the tubfull in the lower Don between Queen Street and Riverdale Park (Sauriol 1981:36). Northern pike and sunfish tend to prefer the warmer waters, slower currents, and weedy habitat that characterized the lower Don's estuarine and coastal wetlands. Pearson (1914:114) states that, "Pike, bass, perch, sunfish, and occasionally a maskinonge, were caught off the wharves and were quite plentiful in Ashbridges' Bay and the River Don." Larger pike, which generally prefer the deeper waters of the lake, may have been harvested in the early spring when they migrated into the estuary and marshes to spawn (Scott and Crossman 1979:357-361).

The habitat preferences of the waterfowl and turtles identified in the site faunal assemblage suggest that all were harvested in the vicinity of the Don estuary. The mammalian assemblage is dominated by white-tailed deer, which is a browser that prefers open habitat of secondary growth. Neither the closed-canopy northern hardwood forest that surrounded the Moatfield site, nor the mature pine forests that flanked the lower Don Valley, would have been prime deer habitat. Instead, deer would have been attracted to substantial openings in the forest of catastrophic origin, including blow-downs, or abandoned horticultural fields, and especially to the meadows and scrubby terrain of the lower Don River floodplain. Raccoon, the second-most common mammalian taxon identified in the assemblage, is a species that would have been relatively ubiquitous within the Don River watershed. The most dense populations of the primary aquatic species such as beaver and river otter, however, were also likely to be found in the lower Don valley.

IROQUOIAN SETTLEMENT IN THE DON RIVER VALLEY AND AREA: PREVIOUS ARCHAEOLOGICAL RESEARCH

While evidence of pre-contact aboriginal occupations in the lower Don River valley has largely been eradicated by land development, settlement trends in the upper Don and parallel watersheds along the north shore of Lake Ontario suggest the likelihood that such occupations were formerly present (Figure 2.2). Approximately 15 kilometres to the west of Moatfield, for instance, archaeologists have been able to reconstruct century-long settlement sequences for at least two Iroquoian communities in the Humber valley during Iroquoian times: one in the middle Humber-Black Creek area and the second at the headwaters of the Humber.

The earliest of the sites in the middle Humber area is Black Creek (AkGv-11), which may have been occupied in the early fifteenth century. The Black Creek population may have then relocated to the Downsview site (AkGu-13) and eventually to the Parsons site (AkGv-8), a large village situated near the campus of York University (Williamson et al. 1998). Since Parsons is almost twice the size of the earlier villages, there may have been two or more villages contributing to the Parsons community, perhaps in response to growing conflict. This is evidenced by elaborate defensive systems and scattered human bone on a number of these communities (cf. Finlayson 1985:440). It is also possible that a nearby village represented by the Riseborough site (AkGu-10), situated on the upper Don River, was one of the contributing villages. The Parsons site may, therefore, represent the agglomeration of people from two or more of these earlier communities and relate to the initial formation of a tribal system, perhaps one of the tribes that eventually migrated north to participate in the historic Huron confederacy (Williamson et al. 1998). The fourteenth century predecessor villages for this sequence were likely located along the lower Humber. As is the case with the lower Don, these sites were destroyed by land development prior to their documentation by archaeologists.

It would appear that a similar but later coalescence of local villages in the upper reaches of the Humber Valley resulted in the establishment of the McKenzie-Woodbridge site (AkGv-2), a large village situated near Kleinburg. European metal goods from well-documented archaeological contexts on the site further indicate that the community was occupied during the mid-to-late sixteenth century when European goods were first available among aboriginal populations in southern Ontario. An ossuary, now destroyed, is reported to have been situated within one kilometre of the site (Wright 1966:70).

While Parsons and other sites such as Draper (AlGt-2) (Finlayson 1985) appear to have formed in the mid-to-late fifteenth century, the emergence of McKenzie-

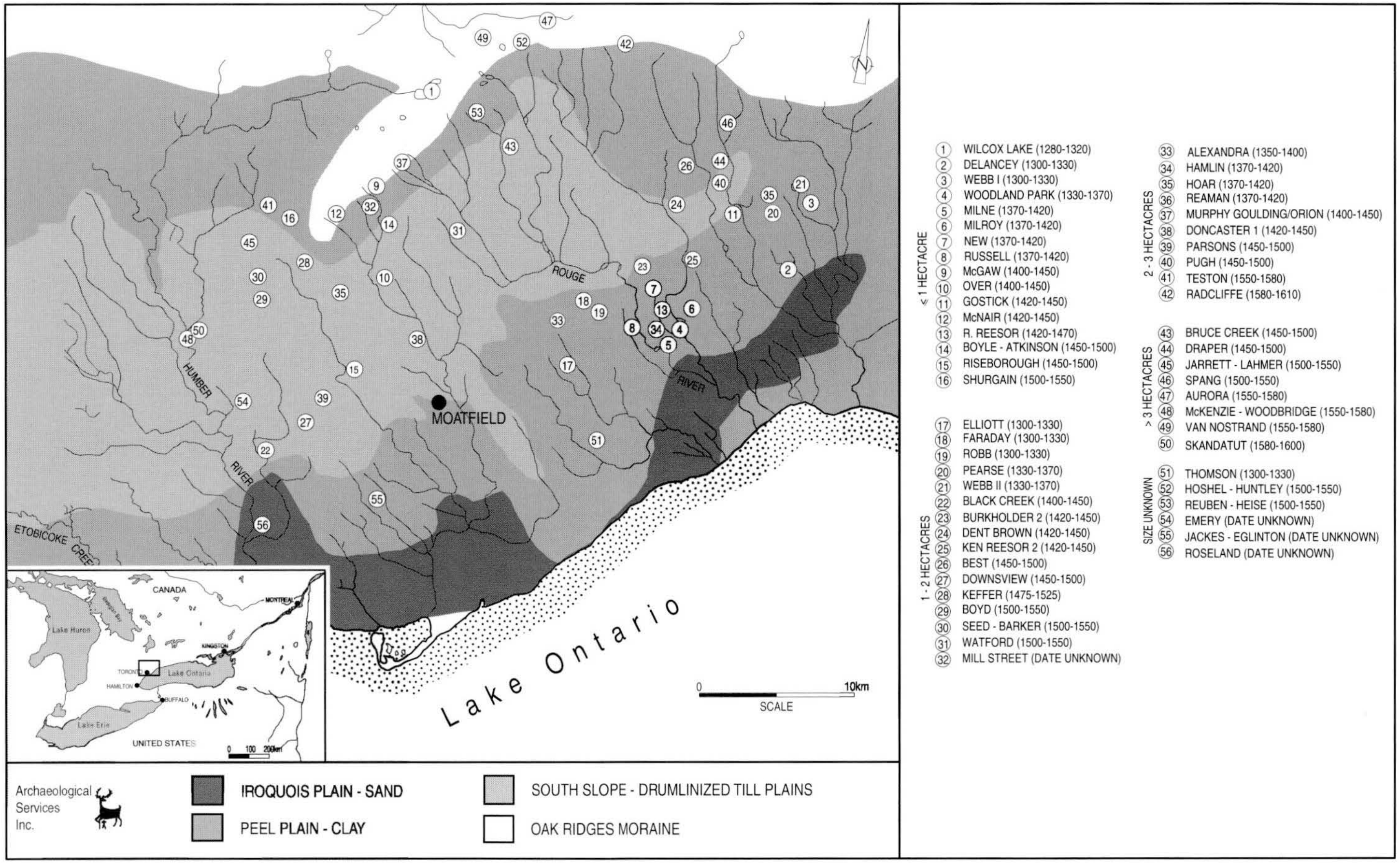

Figure 2.2. Iroquoian villages and their physiographic settings on the central north shore of Lake Ontario.

Woodbridge in the mid-to-late sixteenth century suggests that these developments in social and political structures did not occur simultaneously in all Iroquoian communities. Indeed, change of this nature in one local group may have effected change in neighbouring regions, especially if feuding among various regional networks was escalating (Williamson et al. 1998).

There is far less archaeological evidence for aboriginal communities in the Don drainage system. Anecdotal evidence, however, is suggestive (Scadding 1966:167-168):

> Along the flats, remains of Indian encampments were often met with, tusks of bears and other animals, with fragments of coarse pottery, streaked or furrowed rudely over, for ornament.

and Sauriol (1981:141):

> The remains of Indian encampments have been frequently found along the banks of the Don and in the flats in the neighbourhood of Riverdale Park... Withrow Avenue east of the Don was the site of an Indian village... Indian relics have been picked up in the Valley, including a stone plough, a tomahawk blade, a flint skinning knife, an egg-shaped stone used to pound corn in a wooden vessel.

The Withrow Avenue site (AkGt-1) to which Sauriol referred was a village and ossuary, situated on the east side of the Don River, 11 kilometres south of Moatfield. It was investigated by David Boyle in 1880 resulting in the recovery of one hundred skeletons and many projectile points and scrapers. Boyle was a self-taught archaeologist and former school principal, who went on to fill the position of curator, from 1896 to 1911, at the Ontario Provincial Museum, the collections of which later became part of the Royal Ontario Museum. His provincial *Archaeological Reports for Ontario*, which, it can be argued, laid the foundation upon which Canadian scientific archaeology was based (Killan 1983), are still an essential reference and source for Ontario archaeologists. Unfortunately, there is no further available information concerning this site.

Evidence of other Iroquoian occupations in the general vicinity of the Moatfield site was examined in the site record forms for provincially registered sites[1] and the published and unpublished archaeological and historic research literature. An approximate ten kilometre radius around the Moatfield village, extended to include the lands within one kilometre of the lower Don, was reviewed for registered Iroquoian sites.

The closest known site is located one kilometre west of Moatfield along Deerlick Creek, on private property along Bannatyne Drive. Known as the Hill-Milner site (AkGu-45), it was test excavated in 1989 and 1990 by Mima Kapches of the Royal

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[1] In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database (O.A.S.D.), a database maintained by the Ministry of Culture.

Ontario Museum. There are several occupations at the site, including an Archaic period campsite dated to 4,700 B.C. from which a small stone pebble with a human effigy was recovered. An isolated 2,700 year old, exquisitely flaked biface was also recovered from the campsite. In a backyard adjacent to these early finds, two shallow concentrations of Early Iroquoian pottery (circa A.D. 1000) were found, one of which included a miniature clay smoking pipe. Based on the location of this site in a small ravine near the creek, the absence of any settlement features and the lack of any contemporary artifacts other than the pottery, Kapches suggested that the Hill site represents a pottery manufacturing and firing campsite (Kapches 1990).

Two other campsites, known as the Ladies Golf Course site (AkGu-18) and the East Don site (AkGu-19) were reportedly discovered eight kilometres northwest of Moatfield. The former was situated on the north bank of the east branch of the Don River on the Ladies Golf Course. While a few analyzable ceramic sherds were recovered from the site, it is assumed that the landscaping operations of the golf course have largely destroyed the site. The East Don site was situated on the west bank of a tributary of the east branch of the Don River. The site was reviewed by A.J. Clark in the 1920s and in the 1970s by Victor Konrad. A small collection of a few analyzable ceramic sherds was recovered by Konrad. The site, however, has been destroyed by grading.

A number of nearby villages and possible ossuaries have also been documented, including the Black Creek and Riseborough villages, both of which may have been ancestral to the Parsons community discussed above.

The early fifteenth century Black Creek site (AkGv-11) was situated on a low terrace of the Black Creek floodplain, on the west side of Jane Street, to the northeast of Black Creek Pioneer Village. Professor Norman Emerson, of the University of Toronto, carried out limited excavations at the site in 1948, yielding evidence of a large palisaded community, perhaps two hectares in extent. An unusual double palisade was documented along the west side of the site, adjacent to the creek. One row was placed at the base of the terrace, while the other lay approximately halfway up the slope. A similar pattern was observed at the Parsons site with one row at the top of slope and the other halfway down (Robertson et al. 1998). Unfortunately, the Black Creek site was destroyed by development. Its significance, however, can be found in its prominent role in the formation of the first hypothesized culture-history model for southern Ontario (Wright 1966), and in the fact that it was one of the initial excavations of the Toronto Department of Anthropology, which was the first Canadian program to train professional archaeologists.

Much less is known about the Riseborough site (AkGu-10), a fifteenth century Iroquoian village located on a bluff northeast of the confluence of the Don River and a small tributary south of the University of Toronto Connaught Laboratories, in G. Ross Lord Park, about eight kilometres northwest of Moatfield. The site was investigated in 1971 by Arthur Roberts and in 1972 by Mima Kapches of the Royal Ontario Museum. Kapches concluded that the site is largely intact, despite the construction of the adjacent Finch Reservoir.

The Markham Ossuary (AlGu-25) was located within Lot 6, Concession 4, Markham, approximately eight kilometres northeast of the Moatfield site along a tributary of German Mills Creek, which flows into the east branch of the Don River. The site was discovered in 1881, while workers on Mr. James Drewery's farm were building a fence adjacent to Woodbine Avenue. This discovery was reported in the *Toronto Globe* on Tuesday, May 24, 1881 in an article entitled "'The Red Man' Evidence of His One Time Residency North of Toronto Unearthed." The discovery captured the attention of Sir Daniel Wilson, one of David Boyle's senior contemporaries. Wilson had come to Canada from Scotland, accepting the post of professor of history and English literature at the new University College of Toronto in 1853. By promoting a scientific approach in his extensive writings about pre-contact history, Wilson contributed significantly to the professionalization of Canadian archaeology (Trigger 1989:120). Wilson collected fifteen skulls from the site, which were later transferred to the University of Toronto. Other officials and nearby residents also retained collections of the remains, most of which were observed to be in a fair state of preservation, although some were recorded as being "very much decayed". No artifacts were recovered in association with the remains. The site was recorded as being large in extent, and was perhaps mounded.

In the 1930s, Woodbine Avenue was widened to four lanes at which time workers apparently encountered human remains. In 1986, a pedestrian survey of the ploughed fields west of Woodbine Avenue was conducted by Robert Pearce of the London Museum of Archaeology. A backhoe and bulldozer were also used in the area adjacent to the road to search for evidence of the ossuary. Despite removal of topsoil from an extensive area, no evidence of pre-contact cultural remains was encountered. Pearce concluded that the site may now lie under the south bound lanes of Woodbine Ave.

The Doncaster 2 site (AkGu-17) is another late Iroquoian village and possible ossuary situated six kilometres northwest of Moatfield. The site was situated west of a tributary of the East Branch of the Don River, and was investigated in 1889 by David Boyle of the Provincial Museum. The site was further investigated in the 1920s by A.J. Clark, a noted avocational archaeologist whose notes include details regarding the location and stratification of the middens on the site. Based on an analysis of ceramic vessel fragments recovered from the site, J.V. Wright (1966) suggested that the site dated to the mid-fifteenth century. Unfortunately, the site was destroyed by residential development in the 1960s and no further details are known about the site or associated ossuary.

The Jackes site (AkGu-3) is located on Lot 2, Concession 1, York Township, formerly the B. Jackes Estate, seven kilometres southwest of Moatfield. The site is situated near the intersection of Roselawn Avenue and Avenue Road, perhaps extending into the grounds of Allenby Public School at Castlefield Avenue and Avenue Road. Its size is estimated to be between 1.2 and 2.0 hectares (Konrad 1973). The site has been known since 1887, when David Boyle investigated an artificial mound on the Jackes Estate. Boyle (1889:9) reported finding considerable quantities of charcoal, ash, bone, chert and pottery, although the current location of this material is unknown. The J. E. Case collection recovered from the site between 1930 and 1950, however, was analyzed at McMaster University by W.C. Noble, who concluded that the site was a mid-to-late fifteenth century Iroquoian village (Noble 1974).

The Alexandra site (AkGt-53) is a late Middle Iroquoian village dating to A.D. 1350-1400, situated seven kilometers northeast of Moatfield The site was discovered in the summer of 2000, during a pre-development archaeological assessment conducted by Archaeological Services Inc. (ASI 2000). Located in an agricultural field adjacent to a minor tributary of the West Highland Creek, a systematic surface collection resulted in the recovery of approximately 500 artifacts distributed over an area of approximately two hectares. The site was completely excavated in 2000 and 2001 yielding evidence of 17 house structures, of which 15 represent permanent or year-round dwellings. Over 600 subsurface cultural features, situated within and between the houses and including some 40 semi-subterranean sweat lodges, were excavated at the site. The site middens and features yielded an assemblage of approximately 19,000 artifacts.

A portion of another earlier village, the Elliot site (AkGt-2), was excavated in a woodlot and agricultural field on the west side of McCowan Avenue, north of Sheppard Avenue, about eight kilometres east to northeast of Moatfield. During 1960 and 1961, a crew under the supervision of William Donaldson excavated about 360 square metres revealing several pit features. At least two middens were documented. The recovered artifact assemblage includes nearly 2000 animal bones (65% fish) and ceramic vessels and pipes characteristic of the thirteenth century. The site would appear to be contemporaneous with Moatfield.

While other pre-contact aboriginal sites have been documented within the site environs and along the lower Don, there are no reliable data upon which to base their temporal or cultural affiliations. There is, nevertheless, sufficient evidence with which to suggest that the Moatfield site was one of a continuum of thirteenth through late-fifteenth century settlements along the lower and middle reaches of the Don River, perhaps representing the movement of one community through time, and that neighbouring drainage systems were similarly occupied.

ARCHAEOLOGICAL INVESTIGATIONS AT THE MOATFIELD VILLAGE

Controlled Surface Collection

In order to understand the extent of the settlement with which the bone deposit was associated, the City of North York was requested to re-schedule and re-design their planned renovations and improvements to the soccer field to allow for its cultivation prior to re-sodding and the undertaking of a systematic archaeological surface collection. This survey, as well as other test excavations within and adjacent to the field, were undertaken in August and September of 1997.

Once the field had been ploughed and allowed to weather through several rainfalls, visibility was considered excellent for the purposes of pedestrian survey. Following the initial survey of the field at transect intervals of five metres, the area was re-examined at one to two metre intervals. The location of each of the surface finds was then mapped with the aid of a tape measure and transit (Figure 2.3). A total of 72 surface artifacts was discovered, distributed over an area of approximately 0.8 hectare (two

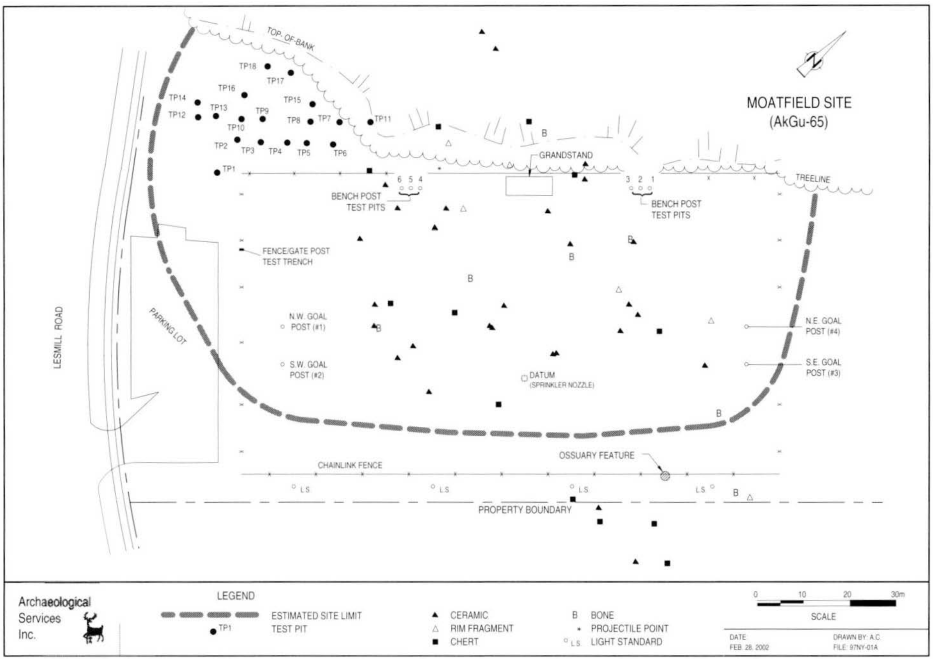


Figure 2.3. Surface artifact distribution, test pit locations and the location of the ossuary.

acres). The survey was not restricted to the surface of the field but also to any exposed soil along the top-of- bank along the north edge of the site. Overall, the surface finds were distributed in a light, diffuse scatter and no concentrations were noted that might correlate with the locations of middens. The recovered artifact assemblage included two ceramic rim sherds, three fragmentary rim sherds, five decorated neck sherds, 41 body sherds, two or three juvenile vessel fragments, a ceramic pipe bowl fragment, one re-worked Archaic projectile point, four bifaces, 10 flakes, and seven pieces of pre- and post-contact animal bone (e.g., a beaver phalanx, a deer rib and an ox molar), all of which provided sufficient data to confirm the initial identification of the site as a late thirteenth century Iroquoian village.

Test Excavations

The subsequent test excavations focussed on the grassed area adjacent to the top-of-bank to the north of the soccer field and parking lot, the footprint of the new grandstand and associated players' benches on the north side of the field, the location of a new fence/gate post on the west end of the chain-link fence, which surrounds the field, and the locations of four goal posts within the field. All shovel test pits and subsequent one metre square units were referenced to permanent site datum stakes. Each unit was hand excavated to sterile subsoil and the soil contents were screened through six millimetre wire mesh in order to maximize the recovery of small artifacts. In addition, all subsurface features and stratigraphic profiles were mapped and photographed.

North Test Pits

Eighteen shovel test pits were excavated north of the parking lot and soccer field, adjacent to the top-of-bank and immediately east of Lesmill Road. These pits were placed strategically in order to determine if there was any surviving evidence that the site extended into this landscaped and grassed area (Figure 2.3). All but three of the test pits were positive, yielding an assemblage of 33 ceramic sherds, most of which were fragmentary, as well as three chert flakes. Six of the test pits also yielded faunal remains including fish vertebrae and medium to large mammal bone fragments.

Although the surface scatter of artifacts appeared to end before the east end of the field, the grassed and landscaped area to the east of the soccer field was, nevertheless, test-pitted randomly. Ten test pits were excavated, but no artifacts were recovered. The distribution of the positive test pits suggests that the site extended originally to, or beyond, Lesmill Road on the west. Given these data and the extent of the surface scatter, it is estimated that the site encompassed a one hectare (2.4 acre) area (Figure 2.3).

Grandstand Test Units

Forty test units were excavated, in one metre intervals, within the footprint for the new grandstand along the north edge of the soccer field adjacent to the top-of-bank. While a number of these units, especially those on the south side of the tested area, yielded recent artifacts such as coal slag, pieces of asphalt, bottle caps, plastic, tin foil and coinage, all indicating of some form of modern disturbance, almost all of the units also contained pre-contact artifacts. Indeed, collectively the units yielded one rim sherd, five fragmentary rim sherds, four juvenile vessel fragments, 148 ceramic vessel sherds, most of which were fragmentary body portions, one ceramic pipe fragment, one biface (probably a preform for a projectile point), 43 flakes (two of which had been modified into tools), two core fragments, one hammer-stone and 41 pieces of animal bone, one of which was a deer distal phalanx that had been fashioned into a projectile point and another, an awl fragment made from a deer metapodial. The general faunal assemblage included a mollusk fragment, mussel remains, fish vertebrae (including bullhead), mammal (including dog and large mammal, probably deer) and bird remains. None of the units yielded an unusually large quantity of artifacts and all of the units were characterized by 20 to 25 centimetres of topsoil over subsoil. No midden deposits or subsurface settlement patterns were encountered.

Bench Post Test Units

Six test units were excavated for two players' benches, three for each bench leg on either side of the grandstand. While the three eastern units yielded only a few ceramic sherds and flakes, at least two of the three western units appear to have been placed within a midden. The profiles of these units were characterized by recent topsoil overlying 20 centimetres of rich, black (10YR 2/1) organic soil. Significant quantities of artifacts were recovered from the dark organic soil. While Test Unit 6 yielded only a few artifacts, Test Unit 4 contained a fragmentary rim sherd, a juvenile rim sherd, 95 ceramic vessel sherds, some of which are decorated, a small faceted pipe mouthpiece with a red slip, 11 chert flakes, a worked deer antler tine, and perhaps most indicative of midden deposits, 24 pieces of animal bone including whitefish vertebrae, bullhead and sunfish elements, painted turtle fragments, grey squirrel and woodchuck remains, and deer long bone fragments. Test Unit 5 contained one fragmentary rim sherd, 17 ceramic vessel sherds, three chert flakes, and two large mammal bones, one of which is a fragment of a polished bone tube. No further investigation of this midden was necessary as the installation of the benches would not result in subsurface disturbance beyond that required for sinking the bench legs.

Fence/Gate Post Test Unit

As the installation of a new gate along the west chain-link fence involved the placement of a new fence post, a one metre by 50 centimetre test trench was excavated in the proposed area of the post (Figure 2.3). The trench contained a small post mould and ovate plan-shaped feature, both of which were devoid of cultural remains (Figure 2.4). The overlying plough zone, however, yielded one primary thinning flake, two secondary knapping flakes, and one ceramic vessel body sherd.

Goal Post Excavations

Four one metre square units were also excavated in the locations of the four goal posts on the field. While the units for Posts 2, 3, and 4 were placed in disturbed contexts with soils or fills containing only recent artifacts, the unit for Goal Post 1 was undisturbed and perhaps situated within a longhouse corridor. Indeed, the original one metre square unit was enlarged to accommodate the excavation of a large feature (Feature 1) that encompassed parts of at least seven adjacent one metre square units, one of which also yielded evidence of a hearth (Figure 2.5). Given that the objective of the excavation was to mitigate only those impacts resulting from the placement of the goal post, the entire feature was not exposed.

There was sufficient exposure of the feature, however, to determine that it was at least 240 centimetres in length and 220 centimetres in width. Upon excavation of the exposed section, a profile was prepared of its west wall (Figure 2.5:A-B; Figure 2.6). The feature was approximately one metre deep and was stratified. A bone awl, made from a sandhill crane sized bird element, was found on the floor of the feature. The size of the feature, the presence of a distinct basal layer comprised of organic soil, the proximity of a hearth, the artifact contents and the location of the

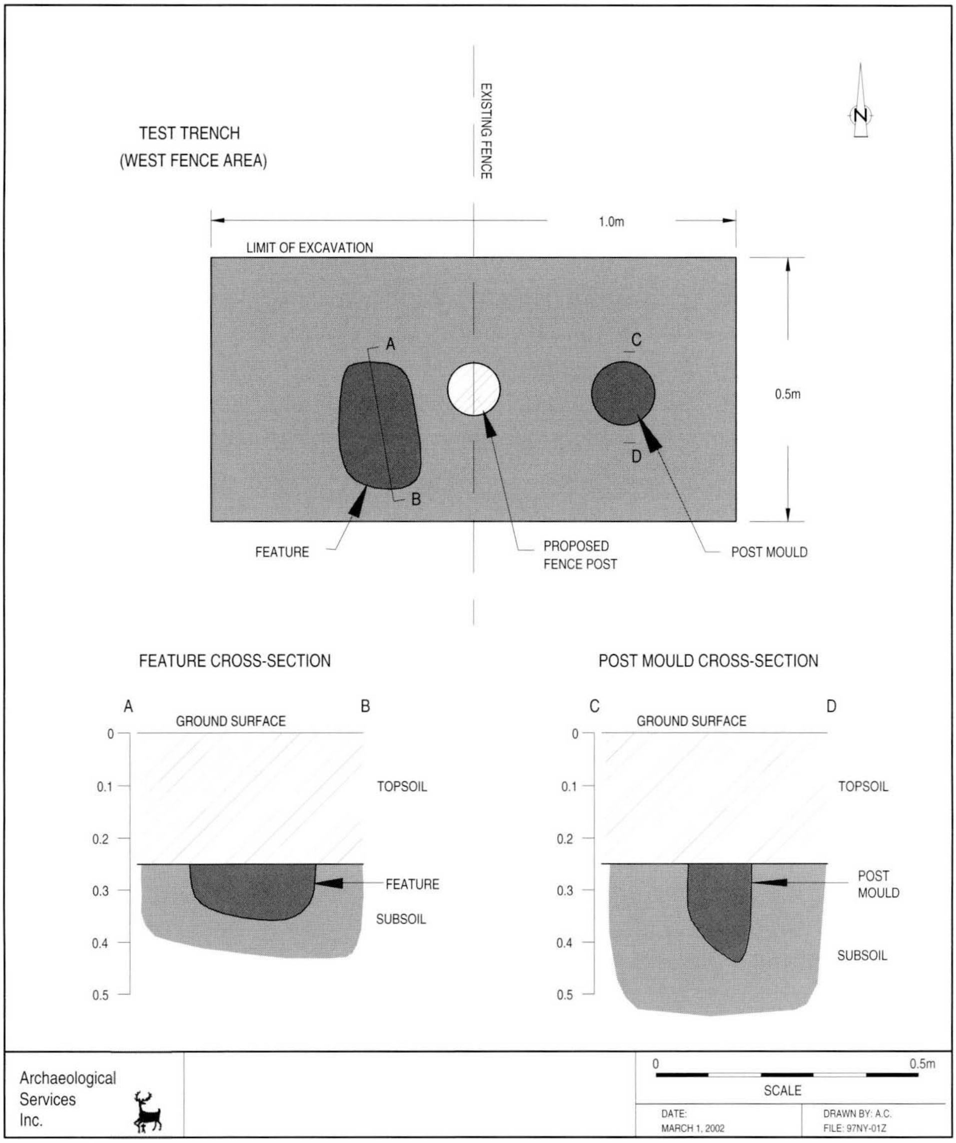


Figure 2.4. Plans and profiles of the settlement patterns in the west fence area test trench.

bone awl, together suggest that the feature represents the main body of a semi-subterranean sweat lodge, often found on early Middle Iroquoian sites in significant numbers (MacDonald and Williamson 2002; Williamson [ed.] 1998). Given the profile, it is likely that the ramped entrance to the structure was to the west of the excavated area. Unfortunately, no structural posts were documented during the excavation of the exposed portion of the feature.

As is the case with most such features, the various lenses and layers contained substantial quantities of artifacts. Indeed, the majority of the artifact assemblage recovered from the site is derived from Feature 1, including rim sherds from 21 different ceramic vessels, 3 fragmentary rim sherds, 17 decorated upper vessel

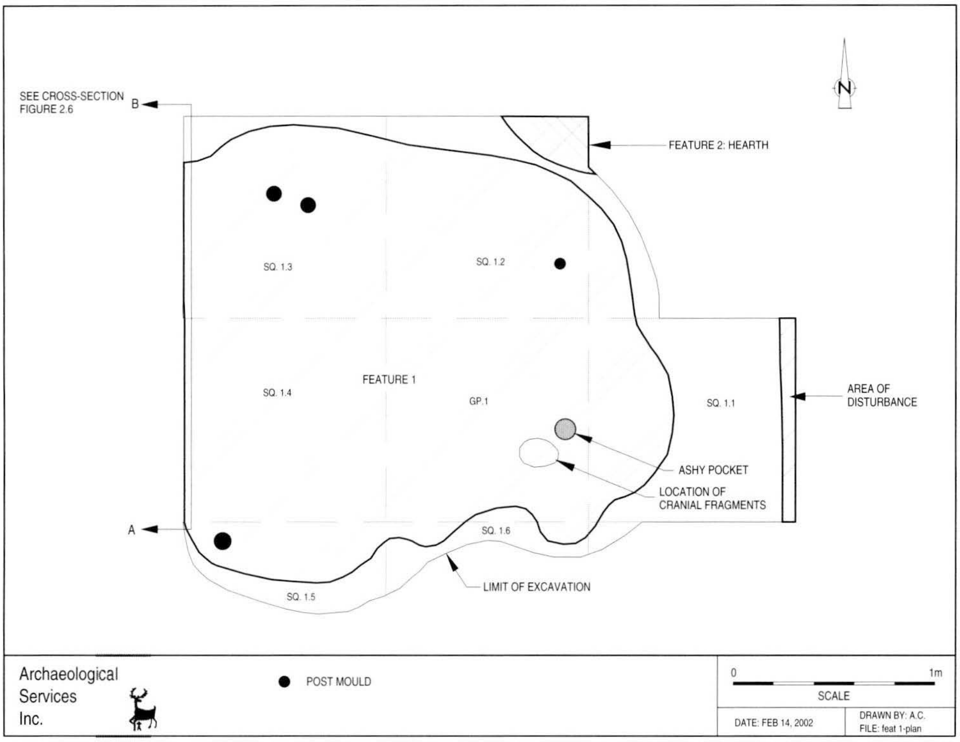
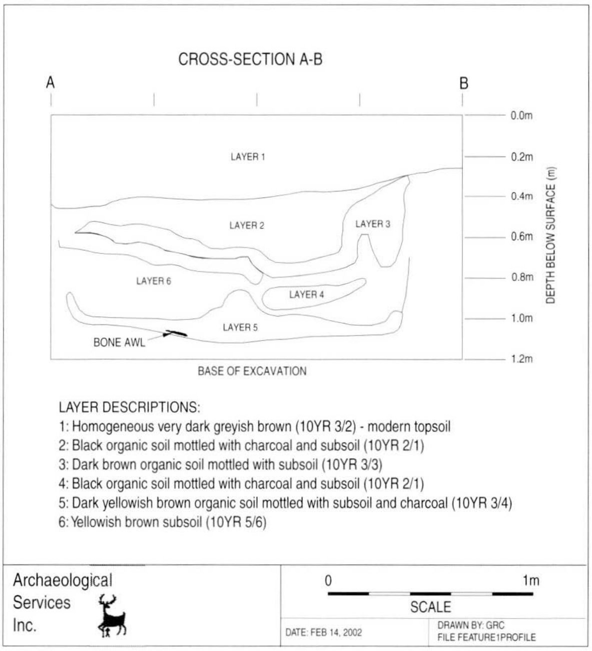


Figure 2.5. Plan view of Feature 1 in Goal Post Test Unit 1.



LAYER DESCRIPTIONS:
1: Homogeneous very dark greyish brown (10YR 3/2) - modern topsoil
2: Black organic soil mottled with charcoal and subsoil (10YR 2/1)
3: Dark brown organic soil mottled with subsoil (10YR 3/3)
4: Black organic soil mottled with charcoal and subsoil (10YR 2/1)
5: Dark yellowish brown organic soil mottled with subsoil and charcoal (10YR 3/4)
6: Yellowish brown subsoil (10YR 5/6)

Figure 2.6. Profile of Feature 1 in Goal Post Test Unit 1.

sherds, portions of eight juvenile vessels, 264 fragmentary body sherds, two pipe fragments, one biface, 19 chert flakes, two worked human cranial fragments, and one etched fragment of ground black slate. The largest faunal assemblage from the site was also recovered from above and within the ashy deposit visible on the surface of the feature (Figure 2.5). The two human cranial fragments were perhaps altered to form a rattle. No other human remains were encountered in the feature. These artifacts as well as the plant and faunal remains are analyzed in the following sections.

ARTIFACT ANALYSIS

A total of 2,930 artifacts was recovered during the investigations. Complete catalogues and inventories are provided on the accompanying CD-ROM. Table 2.1 provides a breakdown of the assemblage by class. Those artifacts and faunal elements found within the burial pit will be discussed in Chapter 4, but have been included in Table 2.1.

Table 2.1. Moatfield site artifact classes.

Ceramics	**n**
Rim Sherds	35
Upper Vessel[1]	71
Body	657
Juvenile	22
Pipes	7
Flaked Lithics	
Projectile Point	1
Knife	1
Bifaces	5
Scraper	1
Scraper-graver	1
Graver	1
Core fragments	2
Debitage	120
Ground Stone	4
Worked Bone	12
Faunal	1990
Total	**2930**

[1] Fragmentary rim, collar and neck sherds.

Ceramics

A total of 785 sherds forming portions of vessel rims, necks, shoulders, and bodies, individually or in various combinations, constitute the ceramic vessel assemblage from the excavations. There are 35 rims, 71 upper vessel (collar/neck/shoulder) sherds, and 657 body sherds. Two hundred and thirteen body sherds display evidence of decoration or surface treatment, in the form of plain (112), ribbed paddling (67), smoothed over cord (25), cord marked (7) and stamped (2). The remainder are unanalyzable.

The 32 identifiable vessels were analyzed using attribute and traditional typological approaches in order to facilitate future inter-site comparative studies. Rims were considered analyzable when they exhibited both interior and exterior surfaces, the lip and sufficient exterior collar-neck area to ascertain decorative styles and attributes. Summary descriptive statistics of individual attributes and metrics are presented in Table 2.2.

Most of the vessels in this assemblage are incipiently collared (71%). There are five collarless and two collared vessels. Lip forms are predominantly flat (97%), although one vessel lip is pointed. Rim orientations are vertical (50%) and outflaring (47%). Only one vessel is insloping. While a few rims exhibit complex

Table 2.2. Summary of Moatfield ceramic vessel attributes.

Rim Form	**n**	**%**	**Lip Form**	**n**	**%**
Incipient collared	17	71	Flat	31	97
Collarless	5	21	Pointed	1	3
Collared	2	8	Total	32	100
Total	24	100			
Rim Orientation	**n**	**%**	**Interior Profile**	**n**	**%**
Vertical	16	50	Concave	28	88
Outflaring	15	47	Straight	3	9
Insloping	1	3	Convex-Concave	1	3
Total	32	100	Total	32	100
Collar Motifs	**n**	**%**	**Collar Techniques**	**n**	**%**
Interrupted Horizontal	10	31.3	Linear Stamped	10	31.2
Horizontal	9	28.1	Incised	8	25
Oblique	6	18.8	Dragged Linear Stamped	6	18.8
Oblique / Horizontal	3	9.4	Dentate Stamped	2	6.3
Alternating Oblique	1	3.1	Linear Stamped / Incised	2	6.3
Horizontal Crossed by Oblique	1	3.1	Dentate Stamped / Dragged Linear Stamped	1	3.1
Oblique / Interrupted Horizontal	1	3.1	Linear Stamped / Dragged Linear Stamped	13.1	3.1
Vertical Simple / Horizontal	1	3.1	Incised / Linear Stamped	1	3.1
Total	32	100	Smoothed Dragged Linear Stamped	1	3.1
			Total	32	100
Neck Motifs	**n**	**%**	**Neck Techniques**	**n**	**%**
Oblique	12	46.2	Linear Stamped	12	46.2
Horizontal	6	23.1	Incised	5	19.2
Plain	1	3.8	Dragged Linear Stamp	3	11.5
Bosses	1	3.8	Plain	1	3.8
Opposed Oblique/ Interspaced Bosses	1	3.8	Bosses	1	3.8
Hatched	1	3.8	Dentate Stamped/ Bosses	1	3.8
Interrupted Horizontal	1	3.8	Dentate Stamped	1	3.8
Vertical	1	3.8	Linear Stamped/ Bosses	1	3.8
Bosses/Obliques	1	3.8	Bosses/Linear Stamped	1	3.8
Obliques/Bosses	1	3.8	Total	26	100
Total	26	100			
Interior Techniques	**n**	**%**	**Interior Motifs**	**n**	**%**
Plain	11	35.5	Oblique	12	38.7
Linear Stamped	10	32.3	Plain	11	35.5
Punctate	4	12.9	Punctate	4	12.9
Linear Stamped/ Punctate	3	9.7	Oblique/ Punctate	3	9.7
Dentate Stamp	2	6.5	Interrupted Horizontal/ Oblique	1	3.2
Incised	1	3.2	Total	31	100
Total	31	100			
Lip Motifs	**n**	**%**	**Lip Techniques**	**n**	**%**
Oblique	23	74.2	Linear Stamped	17	54.8
Plain	6	19.4	Plain	6	19.4
Horizontal	1	3.2	Dentate Stamped	4	12.9
Interrupted Horizontal	1	3.2	Suture Stamped	2	6.5
Total	31	100	Dragged Linear Stamp	1	3.2
			Incised	1	3.2
			Total	21	100
Lip Width	**(n=31)**		**Ceramic Types**	**n**	**%**
Mean	7.6		Iroquois Linear	11	34.4
			Ontario Horizontal	10	31.3
			Ontario Oblique	7	21.9
			Middleport Oblique	2	6.3
			Iroquois Linear Dentate	2	6.3
			Total	32	100

interior collar profiles, most are concave (88%). Only four vessels exhibit castellations, of which three are rounded and one is pointed.

The most common collar decorative motifs consist of interrupted horizontals (31%), horizontals (28%), obliques (19%), and some form of oblique or vertical over horizontal (16%). Although there is a fairly diverse array of techniques used, sometimes in combination, to decorate the vessels, linear stamped (31%), incising (25%) and dragged linear stamped (19%) are most common. Dentate stamps occur in some fashion on about 9% of the vessels.

Necks are predominately characterized by linear stamped obliques (46%), incised or dragged linear stamped horizontals (23%) or some combination of obliques, verticals, horizontals and bossing.

Many vessel interiors are plain (36%) although linear stamped and dentate stamped obliques are most common (39%). Seven of the vessels (23%) have punctates executed on the interior, in some cases in combination with obliques.

The majority of lips have linear stamped obliques (55%), although dentate stamped obliques (13%) and suture stamped obliques (7%) are also present. Six vessels (19%) have plain lips. The mean lip width is 7.6 mm.

Table 2.2 provides the frequencies and percentages of traditional types following the type definitions established by MacNeish (1952). Figures 2.7-2.11 illustrate the recovered vessels. The combined frequencies of Ontario Oblique, Iroquois Linear and Ontario Horizontal vessels (88%) are consistent with the Uren sub-stage (A.D. 1280-1330) of the Middle Iroquoian period (Dodd et al. 1990:330-332; Wright 1966:54). All of the fragmentary rims are also likely to be derived from Uren-type vessels.

The ceramic smoking pipe assemblage includes one bulbous -shaped bowl fragment (Figure 2.12), which has at least two encircling incised lines over opposed lines of small punctates, three round stem fragments, two of which are mouthpieces, two rectangular faceted stem fragments, one with two incised obliques on either side of the stem four millimetres from its end and the other, a possible juvenile pipe with red slip. A complete pipe was recovered from the bottom of the burial pit and will be described in detail in Williamson et al. (Chapter 4, this volume).

The juvenile ceramic vessel sample consists of 15 rim sherds, seven of which are plain. The others include: one collared specimen with a row of linear stamped obliques; two sherds from the same vessel characterised by a single incised horizontal line on a rounded lip; one incipient collared sherd with two interrupted horizontals over incised obliques on the upper neck and an interrupted horizontal on the lip representing an Iroquois Linear design variant; another has two incised horizontal lines on a collar and at least one incised horizontal on the neck representing an Ontario Horizontal type; another is plain with incised obliques on the exterior of a pointed lip; another is plain with incised horizontals on the neck; and another has a linear stamped collar (Figure 2.13).

Two fragmentary juvenile rim sherds were also found, one plain and the other with fingernail impressions on the collar and small obliques on the lip. Five body sherds were also recovered, one with incised striations.

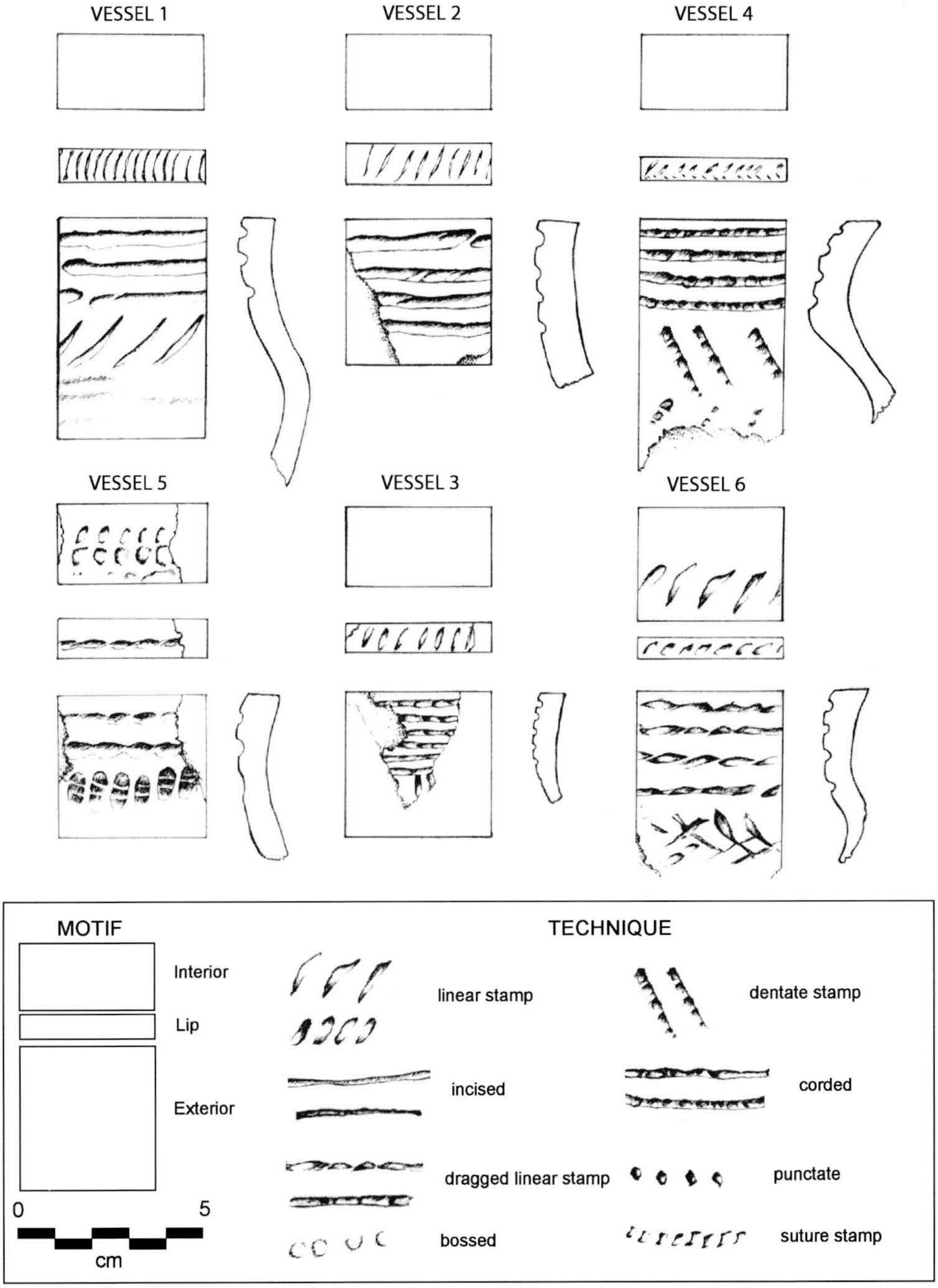


Figure 2.7. Vessels 1-6 recovered from the Moatfield site settlement.

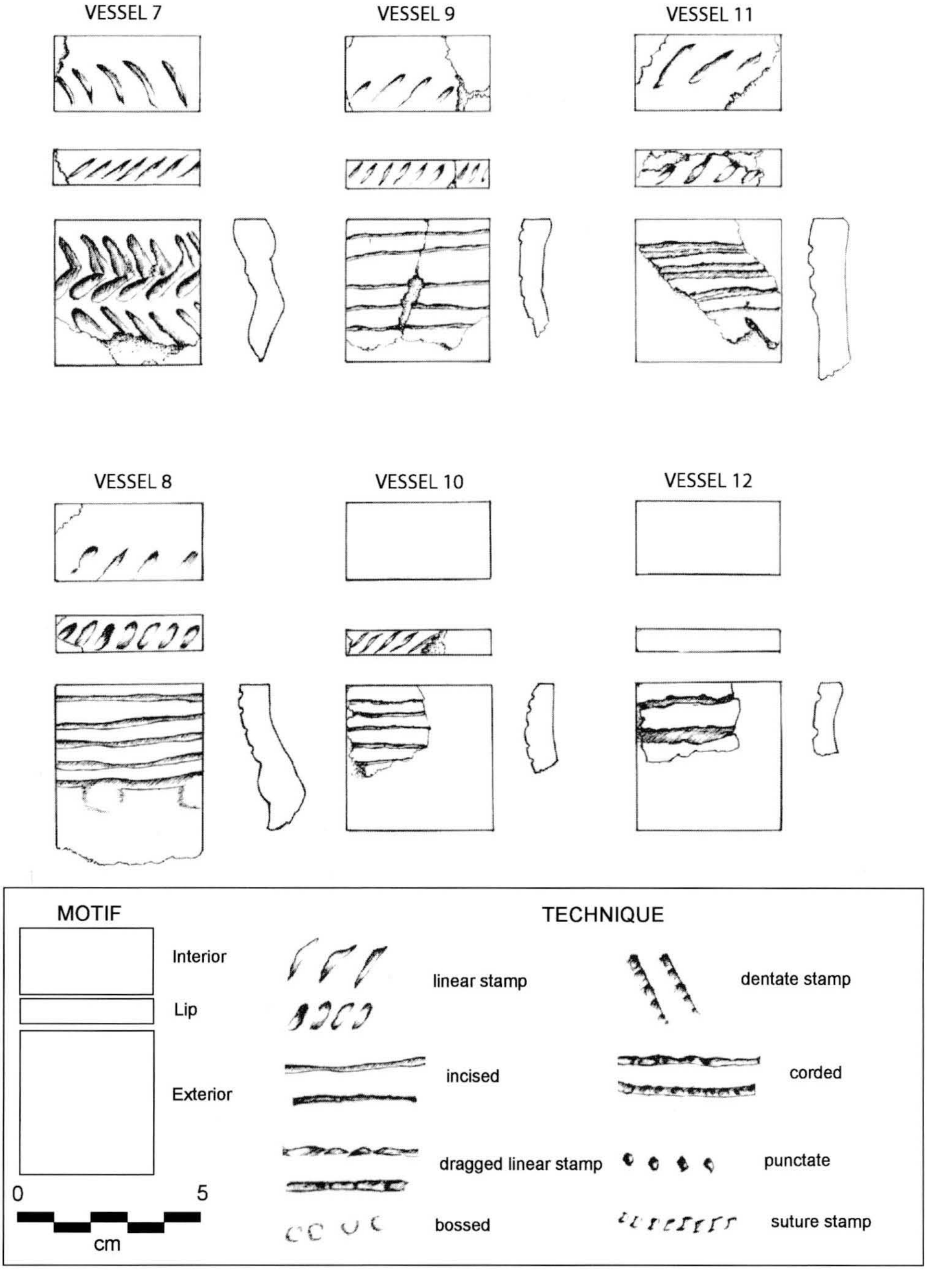


Figure 2.8. Vessels 7-12 recovered from the Moatfield site settlement.

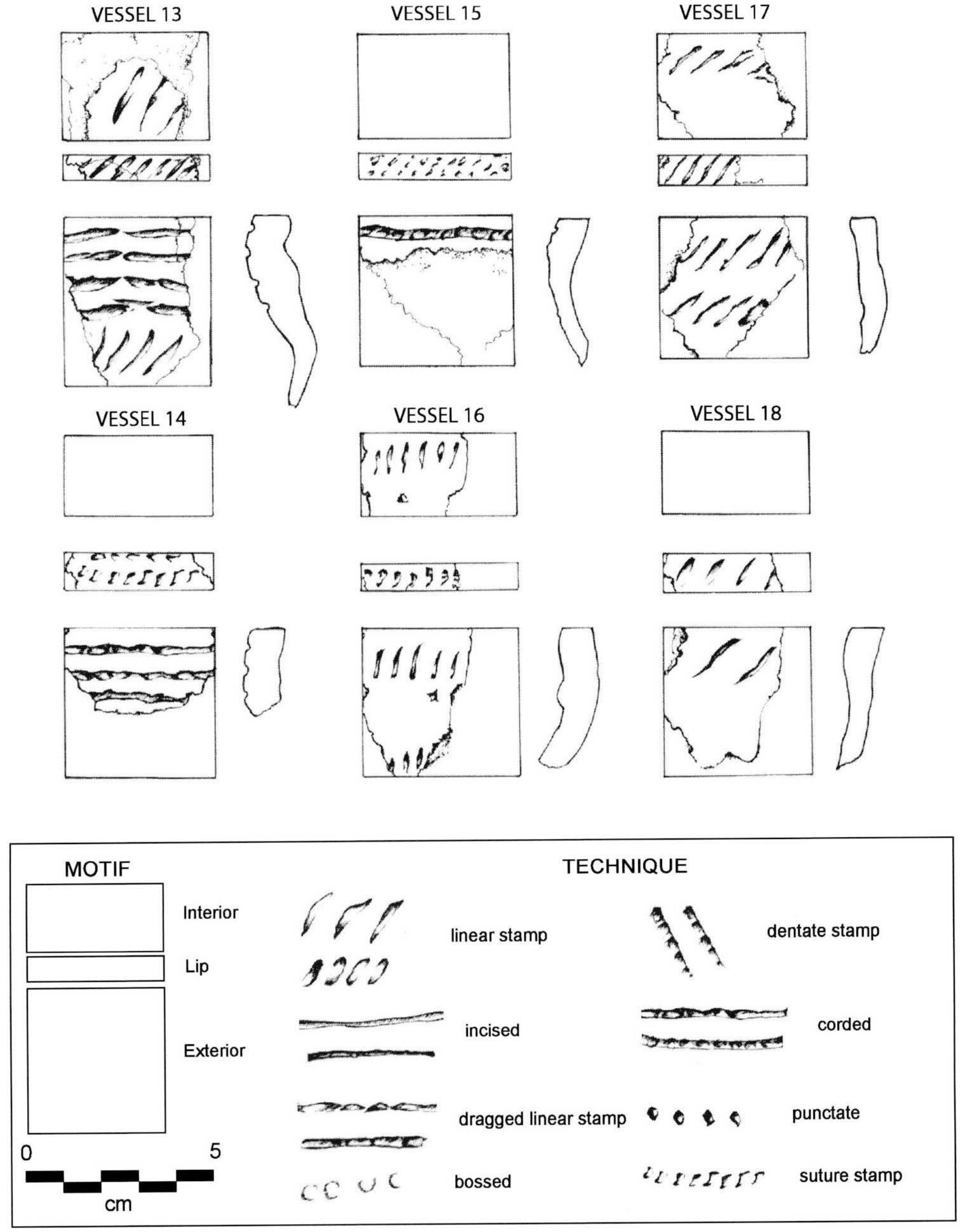


Figure 2.9. Vessels 13-18 recovered from the Moatfield site settlement.

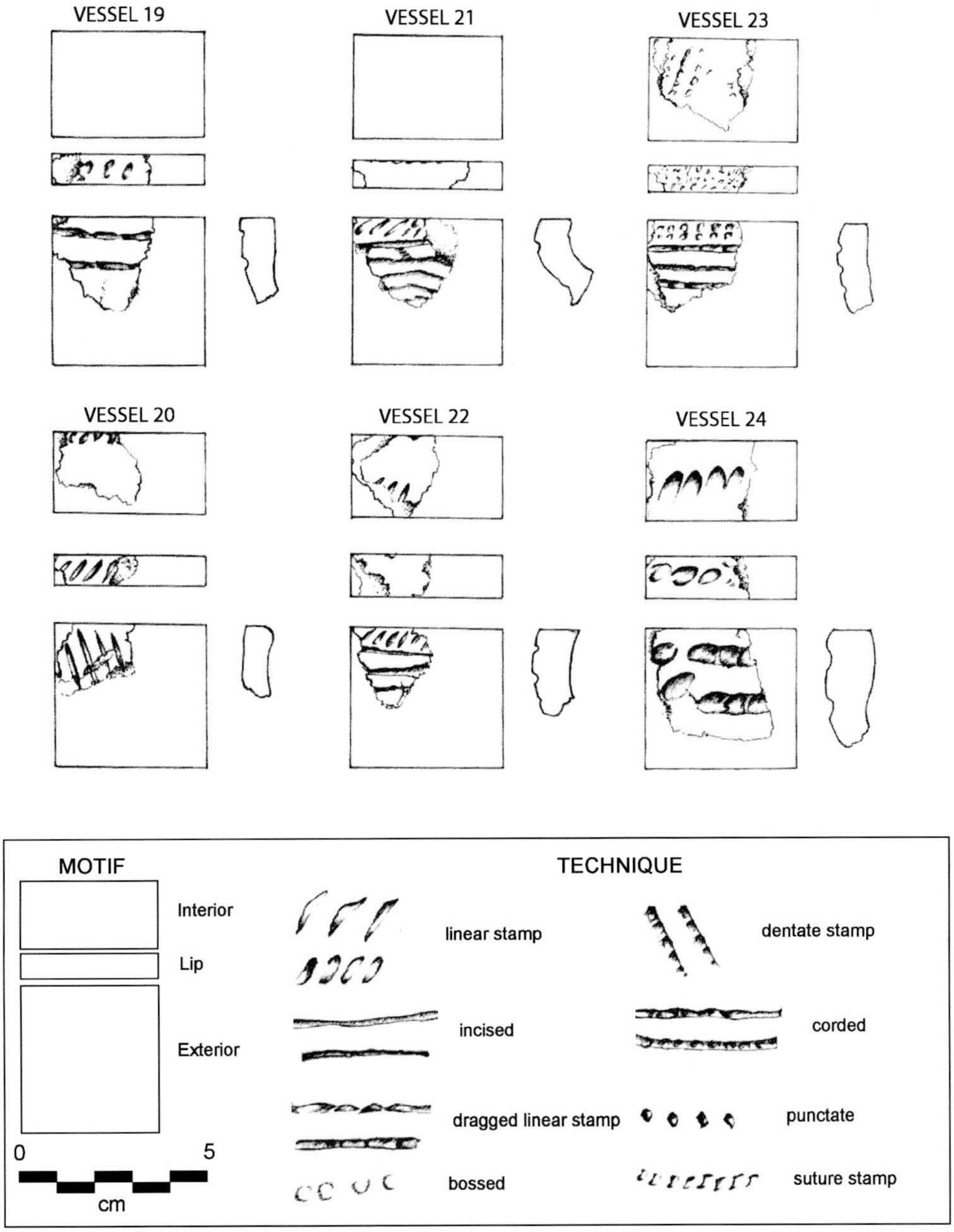


Figure 2.10. Vessels 19-24 recovered from the Moatfield site settlement.

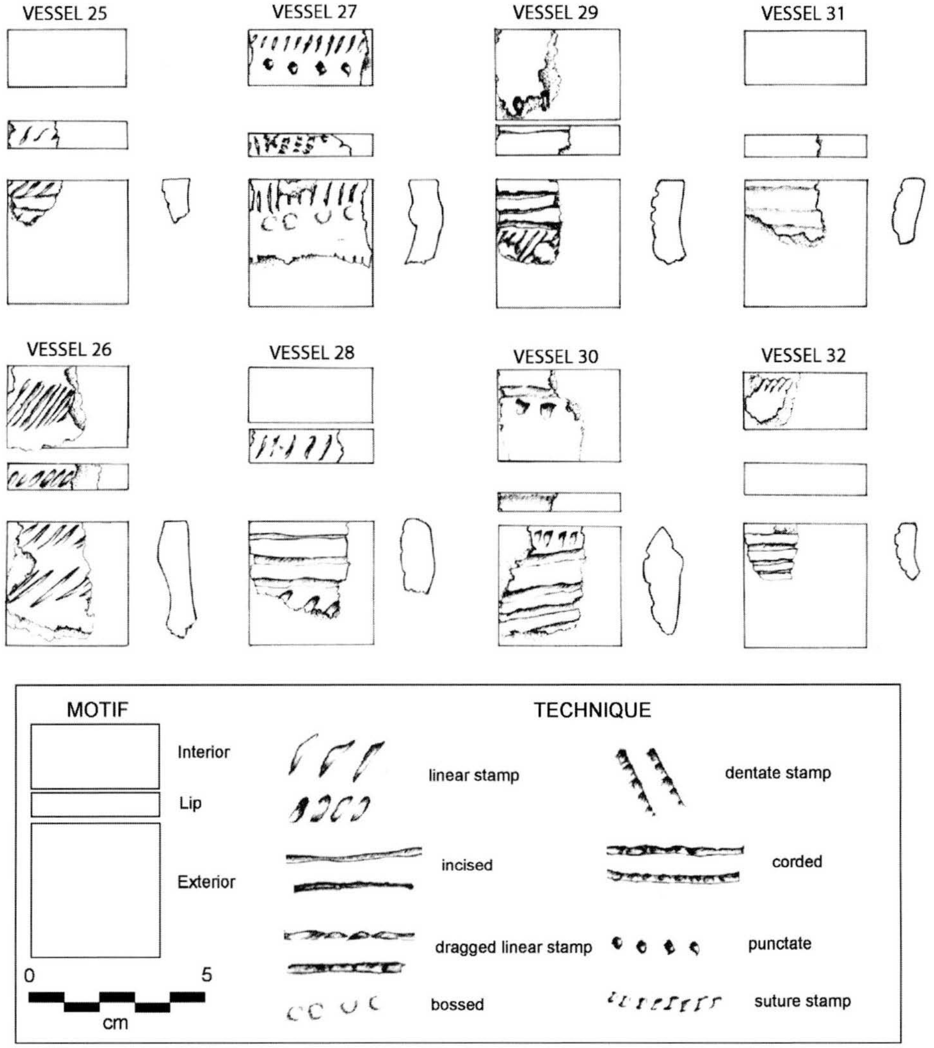


Figure 2.11. Vessels 25-32 recovered from the Moatfield site settlement.

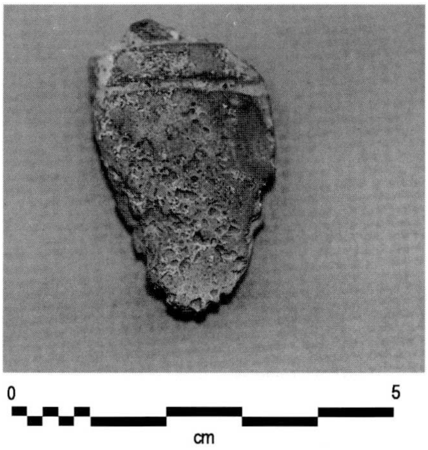


Figure 2.12. Ceramic smoking pipe bowl fragment recovered from the Moatfield site settlement.

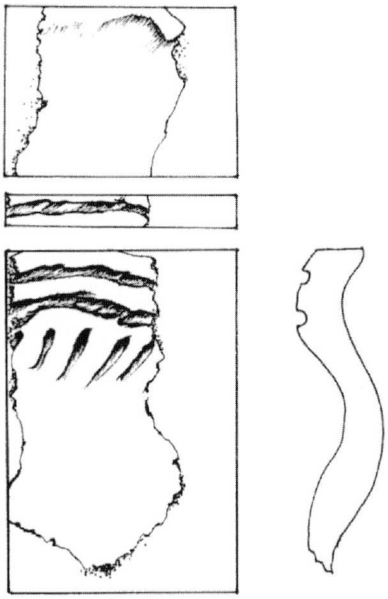


Figure 2.13. Juvenile vessel recovered from the Moatfield site settlement.

Flaked Lithics and Ground Stone Artifacts

Flaked lithics recovered from the site include a reworked Middle Archaic projectile point (Figure 2.14:a), one possible projectile point preform which is thermally altered (Figure 2.14:b), one probable knife (Figure 2.14:c), one complete biface, three biface fragments, one of which is thermally altered, one graver (Figure 2.14:d), one multi-edged scraper made from a secondary knapping flake, one multiple-surface scraper-graver made from a piece of shatter, one bipolar core fragment, one core fragment of Bois Blanc chert, 49 pieces of shatter, five of which are thermally altered, seven primary thinning flakes, one of which is thermally altered, one core trimming flake, 58 secondary knapping flakes, one of which is thermally altered and five secondary retouch flakes, one of which is thermally altered. Four of the secondary knapping flakes have been retouched/utilized, as have two of the shatter fragments. With the exception of three flakes of Trent Valley chert, three flakes of Bois Blanc, two flakes of Lockport chert, one flake of Balsam Lake chert, and one flake of Fossil Hill chert, all of the material is Onondaga chert.

A sandstone pebble with a groove on one side, one possible abrader fragment, one small piece of black ground slate with finely etched lines and one large granitic hammerstone with pitting at both ends were recovered.

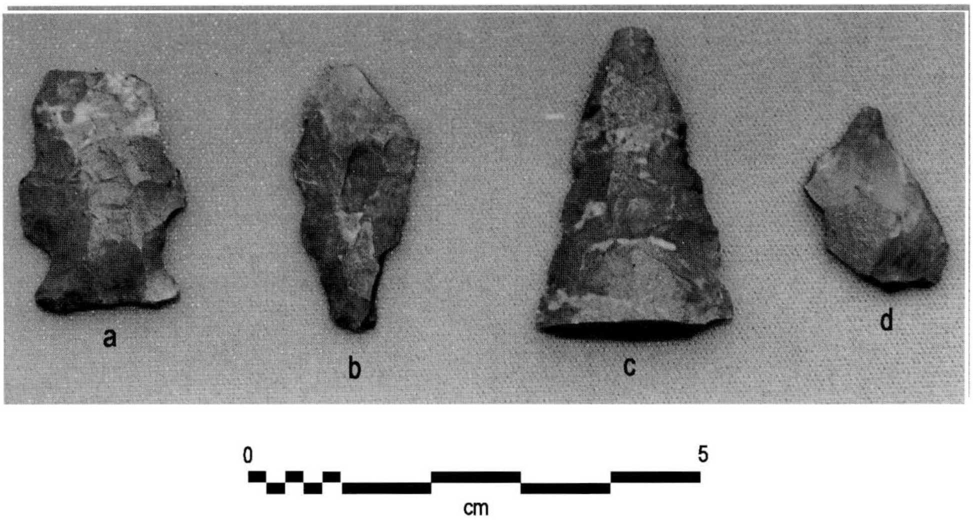


Figure 2.14. Selected lithic tools from the Moatfield site settlement. Reworked Middle Archaic projectile point (a), probable projectile point preform (b), probable knife (c), and graver (d).

Worked Bone Artifacts

A few pieces of worked bone were recovered from the topsoils of the test units excavated across the site, including a possible projectile point made from a deer distal phalanx (Figure 2.15b), a worked deer antler tine that is five centimetres long, with its tip and proximal ends removed by whittling, a butt and shaft section of a bone awl made from a sandhill crane sized fragment of bird bone (Figure 2.15a), a large mammal long bone tube fragment, and two polished fragments of deer metapodial.

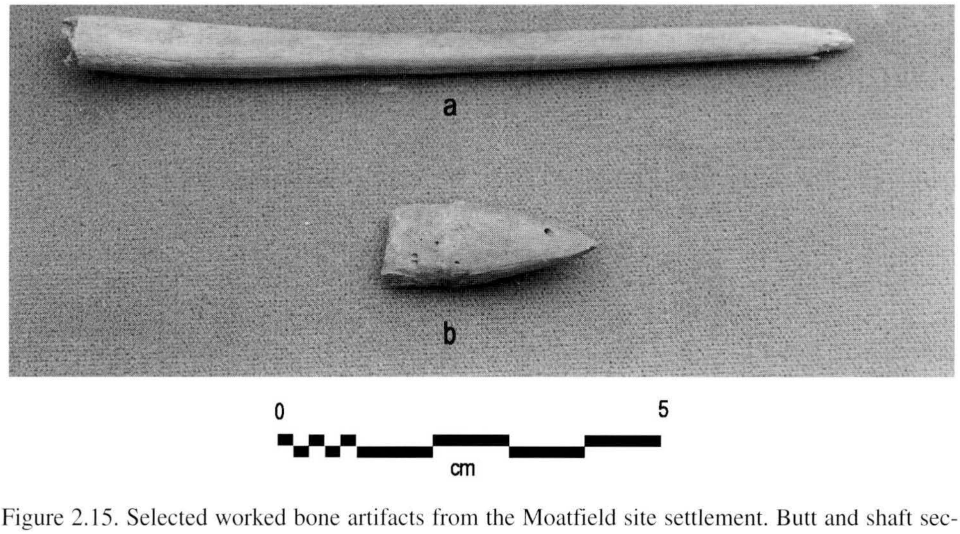


Figure 2.15. Selected worked bone artifacts from the Moatfield site settlement. Butt and shaft section of a bone awl (a), tip portion of a probable projectile point (b).

An additional four specimens of worked animal bone were recovered from Feature 1, the faunal remains from which were subject to detailed analysis (see below). One is a chisel made from the right mandibular incisor of a beaver. The second item is possibly an expedient chisel made from a minimally modified woodchuck left mandibular incisor. An elongated worked object made of large mammal bone may represent part of an awl handle. The final item from Feature 1 is the antler pedicle area of a white-tailed deer frontal bone. The pedicle is encircled by deep chopping cuts, and the antler snapped off with a fresh bone (perimortem) fracture.

Feature 1 also yielded two modified human cranial bone fragments that are likely derived from a rattle. Human skull rattles occur on Iroquoian sites throughout southern Ontario and New York State. Almost all of these items, however, have been found on Late Iroquoian (circa A.D. 1400-1650) sites. A modified skull piece was allegedly found at the Middle Iroquoian Uren site in southwestern Ontario, however, both the identification of this item and its origins are somewhat suspect (Cooper 1985). The example from Moatfield, therefore, may represent the earliest example recovered from an Ontario site.

Skull rattles consist of two concave discs that are typically derived from opposing parietal bones, usually originating from the same cranium, although the Moatfield example appears to be derived from two individuals. They are manufactured by first removing the triangular section adjacent to the squamosal suture, thus forming a roughly circular shape. The margins, which usually maintain the suture lines, are lightly to heavily ground and polished. Biconical holes are drilled at the lateral margins in order to bind the two halves of the rattle. Skull rattles may have been held in the hand or fastened to a handle, analogous to a turtle shell rattle. While no centrally placed perforations are present on the Moatfield example, some skull rattles possess single or paired holes, suggesting that they may have been hafted.

The two skull fragments found in Feature 1 were subject to detailed examination by Susan Pfeiffer and the following is drawn from her observations. Fragment 1 was from a left parietal (Figure 2.16a). The thickness and endocranial surface anatomy are consistent with adult development, but the sutures exhibited no closure, suggesting a young adult (<30 years). There is some rugosity along what would have been the mid-parietal region (toward the inferior edge of the broken piece). It seems too high and extended to be the temporal line, so it may be postmortem, caused by some rough treatment while the bone was relatively fresh, like pressure administered to that surface.

One hole is positioned mid-bone along the sagittal surface about three centimetres posterior to where the bregma would have been (rather anteriorly along the border). The second hole is about four centimetres inferior to the sagittal suture, and would have been about that distance from the lambdoidal suture as well. Most of the posterior border of this parietal was broken when the bone was dry ("recently") but there is a tiny bit of original broken surface near the hole, and it appears to have been smoothed or polished. Therefore, it appears that the parietal was modified along the posterior edge when the bone was initially modified. The hole would not have been in the middle of the piece of bone, but rather along a newly defined edge.

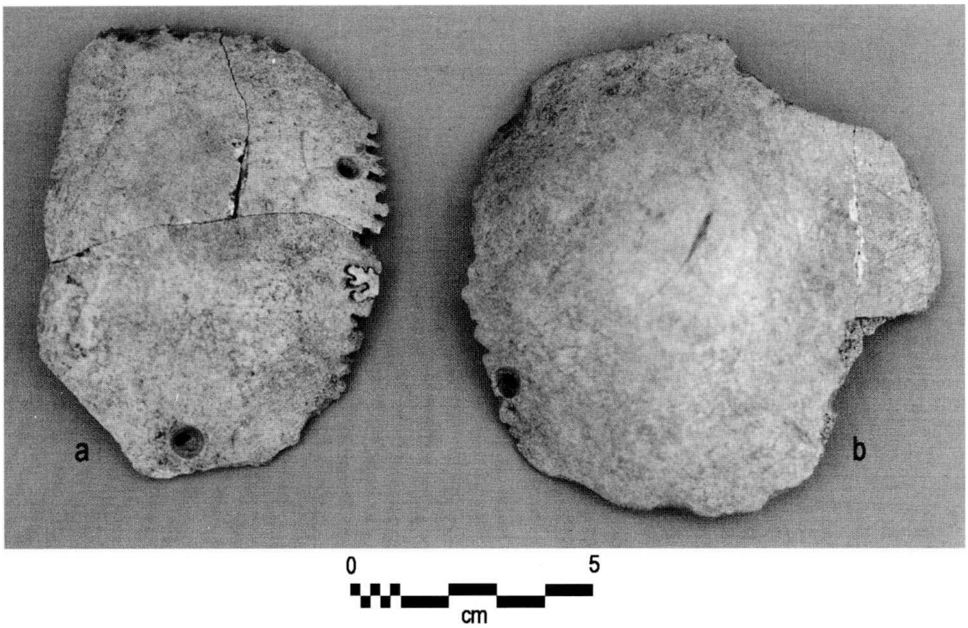


Figure 2.16. Modified human parietal bones from Feature 1 in the Moatfield site settlement.

Each of the two holes was drilled from both endocranial and ectocranial surfaces when the bone was still "fresh", in that there was still a significant lipid and collagen content, so that the bone did not crack or splinter. It could have been any time from immediately after death to perhaps about a year later, depending on how the deceased was handled.

Fragment 2 (Figure 2.16b) is the right parietal of a different, probably larger, person. Both the inner and outer cortical tables are thicker, as is the total bone thickness. The endocranial surface anatomy is not particularly similar to that of Fragment 1, although both are consistent with youth. Sutural edges are not helpful in this case, but the thickness and the simple meningeal grooves argue against old age. On this parietal, because it is broken differently and more of it is extant, the bossing is more prominent.

There are two holes added by human agency, after death. One hole is positioned along the sagittal suture rather posteriorly, just anterior to the parietal foramen. The other is along the coronal suture, just superior to what may be a faint temporal line. In addition to the two drilled holes, there is also polishing of the parietal striae along the squamosal suture (along the inferior border of the parietal). Once again, the holes were drilled when the bone was fresh. These holes show clearer shouldering, and some angle to the penetration. All four holes appear to have been made by the same type of tool, presumably a lithic bow drill. The steep angle to the surface immediately surrounding the hole (like counter-sinking) indicates a pointed tip on a relatively broad drill.

The use of skull rattles seems to have been a widespread phenomenon later in time, coinciding with the appearance of heavily fortified villages during the Late Iroquoian period and the widespread occurrence of scattered human bone on such sites. It likely represents evidence of the emerging system of intertribal or intervillage warfare.

PLANT REMAINS

Three flotation samples were taken from within Feature 1 and were analyzed by Stephen Mockton of Bioarchaeological Research (Table 2.3). These yielded maize (*Zea mays*) kernels and cupules, together with a diverse range of gathered wild plants, such as bramble (*Rubus* sp.), strawberry (*Fragaria* sp.), elderberry (*Sambucus* sp.), and several types of greens/grains that likely flourished along the margins of the settlement and its field clearings (Table 2.4). On the basis of recovered wood charcoal, the settlement and its fields appear to have been established in a maple (*Acer* sp.), beech (*Fagus grandifolia*), and elm (*Ulmus americana*) forest with secondary inclusions of ash (*Fraxinus* sp.) and ironwood (*Ostrya virginiana*) (Table 2.5).

ZOOARCHAEOLOGICAL ANALYSIS OF FEATURE 1

The sample of faunal elements recovered from Feature 1 totalled approximately 1,863 specimens. While the following represents a summary of the analysis of this material, a detailed, comprehensive report is available (Thomas 1999). A much smaller amount of material recovered from the topsoil above the feature and from elsewhere on the site was not included in this analysis, but is summarized in the faunal inventory provided on the accompanying CD-ROM.

Description of the Sample

More than two-thirds of the material is well preserved with relatively little predepositional damage. Given these conditions and the sizable fish component in the assemblage, it is not surprising that a considerable quantity of fish scales was also recovered.

The frequency of animal alteration among identified specimens is very low, less than one percent, indicating that the faunal debris had been covered soon after deposition. Seven carnivore-altered specimens were noted: three appear to have been chewed by a dog-sized animal, and two are pitted or polished as from carnivore digestive action (Guilday et al. 1962:65; Lyman 1994:210-212). No evidence of rodent gnawing was noted. Only three specimens, all mammal bone, were burned. One of these is a portion of a worked object.

Although there was some evidence of rodent disturbance in the vicinity of Feature 1, the potential contribution of material introduced by animal disturbance is likely to have been minimal. Indeed, most of the bone appears to have been recovered from an ashy lens in the northwest sector of the feature. It is not known

Table 2.3. Components of the flotation samples from the Moatfield settlement area.

		>2.00mm	**>300µ**	**Total Sample**	**Wood Charcoal**		**Maize (*Zea mays*) Kernels**		**Maize Cupules**		**Unidentified Material**		**Total Object**	
Sample		Wt. (g)	Wt. (g)	Wt. (g)	N	Wt.(g)	N	Wt(g)	N	Wt.(g)	N	Wt.(g)	N	Wt. (g)
1	Light	13.94	42.42	56.36	602	12.02	79	0.72	19	0.15	–	–	700	12.89
	Heavy	97.46	6.72	104.18	197	1.52	26	0.2	1	0.01	–	–	224	1.73
	Totals	111.4	49.14	160.54	799	13.54	105	0.92	20	0.16	–	–	924	14.62
2	Light	10.84	8.18	19.02	471	7.4	12	0.22	–	–	5	0.07	488	7.69
	Heavy	1097.1	36.47	1133.57	136	2.88	–	–	–	–	–	–	136	2.88
	Totals	1107.94	44.65	1152.59	607	10.28	12	0.22	–	–	5	0.07	624	10.57
	Light	34.6	29.19	63.79	1451	12.46	10	0.13	2	0.02	19	0.27	1482	12.88
3	Heavy	1391	12	1403	146	0.31	–	–	1	0.05	–	–	147	0.36
	Totals	1425.6	41.19	1466.79	1597	12.77	10	0.13	3	0.07	19	0.27	1629	13.24
	Feature 1 Total	2644.94	134.98	2779.92	3,003	36.59	127	1.27	23	0.23	24	0.34	3177	38.43
%					94.5	95.2	4.00	3.30	0.72	0.60	0.76	0.88	100.00	100.00

Proveniences: Sample 1–Feature 1, Goal Post 1 Sample 2–Feature 1, ash lens near cranial fragments Sample 3–Feature 1, material from under cranial fragments

Table 2.4. Seed remains from the Moatfield settlement area.

Sample[1]		**Estimated Maize (*Zea mays*) Kernels**	**Strawberry (*Fragaria* sp.)**	**Bramble (*Rubus* sp.)**	**Elderberry (*Sambucus* sp.)**	**Sumac (*Rhus typhina*)**	**Chenopod (*Chenopodium* sp.)**	**Cattail (*Typhia latifolia*)**	**Small Grass**	**Unidentifiable**	**Total**
1	Light Fraction	7	3	17	–	3	–	4	–	17	51
	Heavy Fraction	2	–	1	–	–	–	–	–	1	4
	Total	8	3	18	–	3	–	4	–	18	54
2	Light Fraction	2	–	–	1	–	–	1	–	–	4
	Heavy Fraction	–	–	–	–	–	–	–	–	–	–
	Total	2	–	–	1	–	–	1	–	–	4
3	Light Fraction	1	–	3	–	–	1	–	1	6	12
	Heavy Fraction	–	–	–	–	–	–	–	–	–	–
	Total	1	–	3	–	–	1	–	1	6	12
Feature 1 Total		12	3	21	1	3	1	5	1	24	71
		16.54	4.24	29.71	1.41	4.24	1.41	7.07	1.41	33.95	100.00

[1] see Table 2.3 for sample proveniences

Table 2.5. Wood charcoal remains from the Moatfield settlement area.

	Fragments (N)						
Sample[1]	**Maple**	**Beech**	**Elm**	**Ash**	**Ironwood**	**Unidentified**	**Totals**
	(*Acer* sp.)	(*Fagus* sp.)	(*Ulmus* sp.)	(*Fraxinus* sp.)	(*Ostrya virginiana*)		
1	5	15	5	–	1	1	27
2	11	5	6	–	–	3	25
3	7	11	7	1	–	5	31
Feature 1 Total	23	31	18	1	1	9	83
%	27.71	37.35	21.69	1.20	1.20	10.84	100

[1] see Table 2.3 for sample proveniences

if the bone and ash lens represents a primary, single-event deposition in the sweat lodge fill or a secondary deposition of one or more processing and/or food-consumption events.

While none of the faunal material in the heavy fraction from the flotation samples was examined for the purpose of this analysis, all feature fill was passed through six millimetre screen and some hand-recovery of fine-scale faunal material was undertaken given the large quantity of material in the feature. It is, nevertheless, possible that the exclusive use of six millimetre mesh throughout the feature precluded the recovery of smaller bones, introducing some systematic bias against some species (Gordon 1993:454-455; Waselkov 1984).

Objectives of the Analysis

The goals of the analysis were to provide information on subsistence activities reflected in the Feature 1 deposit. From the results of a preliminary inventory of the material, it had emerged that the assemblage included the remains of some deep water, lacustrine salmonid fish species. Unlike other early to mid-fifteenth century Iroquoian villages located on the South Slope Till Plain, the fish assemblage at the Over site, situated approximately 13 kilometres upstream from Moatfield, included significant numbers of lacustrine salmonids. Thomas (1996b, 1996c) hypothesized that the fall lake fishery was an important means of accumulating food supplies for the winter—perhaps eclipsing the fall deer hunt. Given that the Moatfield site is located much closer to Lake Ontario, it was anticipated that the exploitation of lacustrine salmonid resources may have been important there as well. It was, therefore, hoped that lacustrine resources could be differentiated from locally available resources. It is acknowledged that the Feature 1 assemblage need not necessarily have been representative of the Moatfield village subsistence system and may have been reflective of one or a limited number of specific subsistence events. An analysis of the nitrogen isotope values for the human remains from the ossuary, however, confirmed that lake fish contributed significantly to the diet of the people at the site (see van der Merwe et al., Chapter 8, this volume).

Method of Analysis

All identification work was undertaken by Thomas at the comparative zooarchaeological laboratory of the Department of Anthropology, University of Toronto and at the Department of Paleobiology of the Royal Ontario Museum. The customized data recording and entry systems, which generated catalogues and analytical reports, were developed by Thomas (1984).

Each specimen identified to a useful level was inspected for butcher marks either under direct sunlight, or under high intensity, point source, low angle illumination. This method has proven effective in detecting even faint cuts in bone.

A concerted effort was made to re-fit broken specimens. In general, a specimen formed of joined pieces is easier to identify and contains more cultural and developmental information than might any of the component pieces individually. Pieces of a joined specimen were allocated a single catalogue number. This process would have the effect of decreasing the interdependence factor between elements, thus increasing the validity of NISP as a quantitative unit. This process also reduced the overall specimen count.

Taxonomy used herein generally follows Banfield (1981) for mammals, Conant (1958) for reptiles and amphibians, and Mandrak and Crossman (1992) for fish. Anatomical terminology generally follows Miller et al. (1964) for mammals, Howard (1980) for birds, and Mujib (1967) for fish.

Analysis of fish scales was beyond the scope of this analysis. Fish scale analysis can, potentially, produce information which conventional analysis of fish (cranial) bone cannot, particularly seasonality and the presence of species which might otherwise be overlooked (Casteel 1975; Yerkes 1987). However, Rojo (1987) demonstrates that analysis of fish vertebra can provide virtually the same kinds of information. Within the context of Late Woodland archaeology in the lower Great Lakes, fish vertebra have been used to estimate the age and season of death (Thomas 1997:486) and to identify taxa not detected by conventional cranial bone analysis (Thomas 1996b:13-17).

Fish vertebra analysis was undertaken in the present study using the comparative collections of Bioarchaeological Research and of the Department of Paleobiology of the Royal Ontario Museum. Vertebrae sufficiently intact to furnish length and transverse diameter dimensions were analyzed; smaller fragments were rejected. This procedure ensures that no two catalogue numbers refer to pieces of the same vertebra and limits the difficult identification process to relatively intact specimens. This procedure probably selectively discriminated against salmonid vertebrae as it appeared that salmonid species were somewhat over-represented among the rejected pieces. As fish vertebrae are seldom analyzed from zooarchaeological assemblages collected in the region, the vertebral and cranial results were separated to maintain compatibility with data sets from other sites.

Because this study focuses on the contents of a single feature, both the number of identified specimens (NISP) and the minimum number of individuals (MNI) are used as units of quantification. The MNI calculation methods used herein incorporate developmental traits and size differentiation among elements in order to more accurately estimate the numbers of individuals (cf. Bökönyi 1970:292; Chaplin 1971:75). Indeed, osteometry is useful both in MNI calculations (Chaplin 1971:73-75) and in estimating sizes of animals represented in a faunal assemblage (cf. Casteel 1974; Harcourt 1974).

Despite relatively good preservation, the use of osteometry was severely limited in the Moatfield analysis, since essential measuring points were often removed by bone breakage. Accordingly, a relative sizing technique (Needs-Howarth and Thomas 1994, 1998; Thomas 1996a:134) was used. For each well represented species in the Moatfield assemblage, a key reference skeleton was selected. The size of each sufficiently complete archaeological specimen was estimated to the nearest five percent in relation to the corresponding element in the key reference skeleton. A relative size value of 50% indicates that the archaeological specimen was half as large as the equivalent element in the key reference skeleton; a value of 100% indicates equivalence in size. Bearing in mind the natural variation in the proportions of body parts, the inexactness inherent in such estimates, and the potential for variation in estimates made in different sessions, relative size differences less than 20% were deemed insignificant. Moreover, in some species, such as yellow perch, the relationship between bone length and body length is not necessarily linear, making the calculation of body lengths from incomplete specimens exceedingly complex.

The brown bullhead relative size estimation data represented an effective test of this relative size estimation technique. A major advantage of this procedure is that it can be applied to broken specimens that could not be measured. In the Moatfield project, the degree of fragmentation seems not to have greatly affected relative size estimation. The average relative size is 90.15% for incomplete bullhead specimens (N=40) and 87.15% for complete specimens (N=143). These results, which are similar considering the subjectivity of the technique, underscore the consistency of the relative size estimations and indicate that relative size estimates of partial and complete specimens can be pooled without seriously altering the results.

A comparison of osteometric and relative size data for the brown bullhead supports the soundness of the relative size estimation technique. The operculum is appropriate for this test because it is well represented in the collection; the measuring points are well defined so that inter-observer error is minimized; the robust measuring points tend to resist breakage; and, when broken, the breaks are readily recognized so that a false measurement is not taken. The length of dorsal border (LDB) for key reference skeleton FA985-2 is 17.8 mm. The average LDB measurement for 15 Feature 1 specimens is 15.16 mm, or 85.17% of the key reference skeleton. The average relative size estimate for these 15 specimens is 84.67%. The length of anterior border (LAB) measurement for FA985-2 is 22.5 mm. The average LAB measurement for nine Feature 1 opercula is 18.68 mm, or 83.02% of the reference skeleton. The average relative size estimate for these nine opercula is 85%. As the averaged relative size estimates are consistent with the averaged measurements, they appear to be reasonable approximations.

Results

The quantity of recovered faunal remains is unusually large for a single pit feature. Included in the assemblage were approximately 1,021 fish, 15 turtle, 29 bird, and 127 mammal specimens, as well as two pieces of freshwater mussel shell and four pieces of bone not identified to zoological class. In addition, approximately 658 fish scales were recovered.

A total of 828 specimens was identified to an analytically useful taxonomic level. The predominant zoological class, osteichthyes or bony fish, account for 737 identifications. Other zoological classes combined accounted for just over 10% of the assemblage: 13 reptile (all turtle), 10 bird, and 68 mammal. An additional piece of bone identified only to the level of class Mammalia is included in this analysis because it was worked. The three other worked specimens were identified to species level.

Fish

Identification data for fish head area bones are presented in Table 2.6. Salmonid and eel vertebrae were analyzed initially because of the potential importance of these taxa as storable cold weather food resources. The fish cranial bone assemblage turned out to be so complex, however, that it became necessary to analyze all fish vertebrae (Table 2.7) and to examine body portion representation (Table 2.8).

The fish in the assemblage can be divided into two groups. The first group consists of taxa that are primarily procured during autumn because of habitat preferences and behavioural traits associated with spawning: Atlantic salmon, lake trout, lake whitefish, and American eel. Three species in this category account for one percent of the identified material in the fish cranial bone assemblage. Four definitive and one possible species account for 22% of the identified specimens in the fish vertebra assemblage. The second group consists of species that would generally be available in the Don River system, either nearby or further downstream in the low gradient, slow- flowing portion.

Autumn Procurement Fish Group

It is possible that the reason that salmonid species and American eel are better represented in the vertebral assemblage than the cranial bone assemblage is that the species in this group have more vertebrae than do most other species in the fish assemblage (Table 2.9). Salmonids tend to have from 50 to 65% more vertebrae than species of the families Catostomidae (suckers), Ictaluridae (catfish), Cyprinidae (sunfish), and Percidae (perch). Also, given that the feature matrix was sifted through six millimetre screen, there may have been a systematic recovery bias against vertebrae of smaller fish—lepomid sunfish (pumpkinseed,

Table 2.6. Feature 1 fish assemblage (head area bones).

Common Name[1]	Taxon[1]	NISP	% NISP	MNI
Bowfin	*Amia calva*	12	2.0	2
Lake Trout	*Salvelinus namaycush*	4	0.7	2
Lake Whitefish	*Coregonus clupeaformis*	1	0.2	1
Northern Pike	*Esox lucius*	87	14.1	7
Northern Pike or Muskellunge	*Esox lucius/masquinongy*	1	0.2	–
White Sucker	*Catostomus commersoni*	33	5.4	5
Sucker[2]	*Catostomus* sp	22	3.6	–
Brown Bullhead	*Ameiurus nebulosus*	282	45.9	13
American Eel	*Anguilla rostrata*	1	0.2	1
Rock Bass	*Ambloplites rupestris*	8	1.3	2
Pumpkinseed	*Lepomis gibbosus*	50	8.1	6
Lepomid Sunfish[3]	*Lepomis* sp.	33	5.4	–
Smallmouth Bass	*Micropterus dolomieui*	10	1.6	1
Large- or Smallmouth Bass	*Micropterus* sp.	2	0.3	–
Black or White Crappie	*Pomoxis* sp.	4	0.7	1
Yellow Perch	*Perca flavescens*	64	10.4	7
Walleye or Sauger	*Stizostedion* sp.	1	0.2	1
TOTAL		615	100.3	49

[1] For clarity of expression, identifications to the probable level have been counted as positive identifications. For example, elements identified as probably white sucker (*Catostomus* cf. *commersoni*) have been counted as white sucker (*Catostomus commersoni*).

[2] The MNI based on all sucker specimens (the 33 white sucker specimens together with the 22 sucker specimens identified to genus level, *Catostomus* sp.) would still be 5.

[3] The MNI based on all lepomid sunfish remains (the 50 specimens identified as pumpkinseed combined with the 33 specimens identified to the genus level, *Lepomis* sp.) would be 10. This would bring the total MNI for the fish assemblage up to 51.

Table 2.7. Fish vertebra assemblage. The cranial bone assemblage[1] is presented for comparison.

Common Name[2]	Taxon[2]	Vertebrae		Cranial	
		NISP	%	NISP	%
Atlantic Salmon	*Salmo salar*	2	1.6	0	0.0
Lake Trout	*Salvelinus namaycush*	7	5.7	4	0.7
Lake Whitefish	*Coregonus clupeaformis*	10	8.2	1	0.2
Salmonid, cf. Round Whitefish	*Salmonidae*, cf. *Prosopium*	2	1.6	0	0.0
Northern Pike	*Esox lucius*	31	25.4	88	14.7
Sucker	*Catostomus* sp.	9	7.4	55	9.2
Brown Bullhead	*Ameiurus nebulosus*	28	23.0	282	47.2
American Eel	*Anguilla rostrata*	6	4.9	1	0.2
Rock Bass	*Ambloplites rupestris*	2	1.6	8	1.3
Lepomid Sunfish	*Lepomis* sp.	6	4.9	83	13.9
Smallmouth Bass	*Micropterus dolomieui*	2	1.6	10	1.7
Large-/Smallmouth Bass	*Micropterus* sp.	11	9.0	2	0.3
Yellow Perch	*Perca flavescens*	4	3.3	64	10.7
Walleye	*Stizostedion vitreum*	1	0.8	0	0.0
Walleye/Sauger	*Stizostedion* sp.	1	0.8	1	0.2
TOTAL		122	99.8	599	100.2

[1] The "Cranial" category includes: bones of the cleithral group which are technically classified as pectoral girdle elements; basipterygia which are found just beneath and behind the head but are technically classified as pelvic fin elements; and, in suckers and bullheads, elements of the Weberian apparatus which is a specialized structure composed of the first four trunk vertebrae.

[2] Excluded from this presentation are 16 cranial specimens attributed to two taxa not represented in the vertebra assemblage: bowfin and crappie. All *Esox* specimens are combined into northern pike, *Esox lucius*.

Table 2.8. Fish body portion representation for major taxa.

Element	**Fish Species Listed In Order of Frequency**									
	Sucker sp.		**Yellow Perch**		**Lepomid Sunfish**		**Northern Pike**		**Brown Bullhead**	
	NISP	**%**	**NISP**	**%**	**NISP**	**%**	**NISP**	**%**	**NISP**	**%**
Anterior Cranial & Oral Group (maxilla, premaxilla, palatine, mesethmoid, vomer, lateral ethmoid dentary, angular)	7	15.2	17	27.9	4	4.9	25	28.7	53	20.5
Central Cranial Group (hyomandibular, quadrate, entopterygoid, metapterygoid, pterygoid, operculum, preoperculum, interoperculum, suboperculum, frontal, parasphenoid, prootic, sphenotic, pterotic)	23	50.0	27	44.3	43	52.4	33	37.9	107	41.5
Hyoid/Branchial Arch (ceratohyal, epihyal, urohyal)	0	0.0	6	9.8	4	4.9	15	17.2	30	11.6
Posterior Cranial Group: (cleithrum, posttemporal, postcleithrum, scapula, coracoid, supraoccipital, exoccipital, basioccipital)	16	34.8	11	18.0	31	37.8	14	16.1	68	26.4
TOTALS	46	100.0	61	100.0	82	100.0	87	99.9	258	100.0
Elements not included in tabulation	pharn. arch 4 weberian 3 orbitosphenoid 1 tripus 1		lacrimal 2		basipterygium 1		basipterygium 1		hypohyal 1 orbitosphenoid 7 alisphenoid 1 pect. spine 5 weberian 17 pterygiophore 2	

bluegill, etc.), and yellow perch. Although the brown bullhead also falls into the small end of the Moatfield size spectrum, the robust processes of its trunk vertebrae should result in good recovery in six millimetre mesh.

A low ratio of salmonid cranial to vertebral bone may also have been due to differential preservation. In a bone density study of chinook salmon, Butler and Chatters (1994:417) found that vertebrae are at least twice as dense as all but a few cranial bones. The relative durability of vertebrae over cranial bones has been demonstrated for lake whitefish as well (Lubinski 1996). The consequent preservation bias against salmonid cranial bones has been demonstrated under laboratory conditions (Lubinski 1996:178-179) and documented in archaeological assemblages (Butler and Chatters 1994:417-422).

Table 2.9. Vertebral counts for selected fish species. Taxa are listed in order of vertebral counts.

Species	**Vertebral Count**[1]
American Eel	103-111
Lake Trout	61-69
Atlantic Salmon	58-61
Northern Pike	57-64
Lake Whitefish	55-64
White Sucker	41-44
Brown Bullhead	34-39
Yellow Perch	38-41
Large- and Smallmouth Bass	30-32
Pumpkinseed	29

[1] Vertebral counts are taken from Scott and Crossman (1979). For suckers and catfish the first four trunk vertebrae comprising the weberian apparatus are excluded. This is a large specialized structure that might be included with cranial bones when differentiating the head from the fillet areas.

A low ratio of salmonid cranial to vertebral bone might also result from differential deposition, especially on inland sites. Ethno-archaeologists Stewart and Gifford-Gonzalez (1994:242, 244) observed that at remote fish processing camps where fish are prepared for long distance transport to a central, inland location, fish heads are removed and the vertebral columns tend to be transported to the village as part of the dried fish fillets. This pattern was also noted for Northwest Coast sites by Butler and Chatters (1994:413). Cleaning, de-heading and drying, which can be done by smoking, not only preserves the fish meat, but removes considerable bulk and weight. In an ethno-archaeological study of a Northwest Coast Salmonid fishery, O'Leary (1996:19) found that processing and drying reduced the weight of the final product to about one-quarter of the live weight. When spawning, lacustrine salmonids are harvested at a remote lakeshore site, such as the one described by Sagard (1968:185 ff.); remote processing would vastly reduce the amount of effort devoted to transporting fish to the village.

In summary, in addition to a preservation bias against salmonid cranial bone, if salmonids are harvested at remote sites of the type Sagard described for the post-contact Huron, there is also a depositional bias—little or none will be transported to the village site. Indeed, the presence of lacustrine salmonid species in an archaeological assemblage could go unrecognized unless fish vertebrae are analyzed (Thomas 1996c). These points are critical in evaluating the importance of salmonids relative to other fish resources. Also important is the fact that most salmonids are richer in calories than other fish species because their meat has a higher fat content (Table 2.10). This, and the timing of their spawning seasons, makes salmonids an especially desirable resource to procure in preparation for winter (Cleland 1982:768). The same can be said for eels, which are even richer in calories.

According to Heidenreich (1971:210-211, Fig. 12), the most important fish resources for the post-contact Huron were the salmonids: lake whitefish, lake trout, and cisco (*Coregonus artedii*). These primarily lacustrine species spawn over rocky or hard bottomed shallows in the fall (Scott and Crossman 1979:222, 239, 271). Lake whitefish and lake trout, but not cisco, occur at Moatfield in the Feature 1 assemblage. In lieu of cisco, the least calorie-rich salmonid listed in Table 2.10, we find a trace of Atlantic salmon remains. The presence of Atlantic salmon together with American eel provide a riverine dimension to the autumn fish harvest.

The presence of lake whitefish, lake trout, Atlantic salmon, and American eel remains in the same feature strongly indicates a deposition event or events reflecting autumn subsistence activities (Scott and Crossman 1979:194, 222, 271, 625). Moreover,

Table 2.10. Nutritional value[1] for selected fish species.

Species	**Calories[2]**	**Fat (g)[2]**
Atlantic Salmon	217	13.4
Lake Trout	241	10.0
Lake Herring (Cisco)	96	2.3
Lake Whitefish	155	8.2
American Eel	233	18.3
White Sucker and Sucker sp.	104	1.8
Northern Pike	88	1.1
Large- and Smallmouth Bass	104	2.6
Yellow Perch	91	0.9

[1] Nutritional data from Watt and Merrill (1964: Table 1) apply to raw fish.

[2] per 100g

the presence of lake whitefish and lake trout cranial bones indicate that at least some fresh fish from Lake Ontario, or at least, that incompletely processed whole fish, were brought to the site.

The salmonid-eel group accounts for only one percent of the specimens in the fish cranial bone assemblage; approximately nine percent of the MNI from the cranial bone assemblage; and 22% of the vertebral assemblage. These figures indicate that this group was a moderately significant component of the fish diet. While it is possible, even likely, that the salmonid-eel group comprised an important stored cold season resource, the presence of fragile salmonid cranial bones likely indicates primary deposition, and suggests that the salmonid remains reflect food-related activities carried out when or just before the feature was filled.

Locally Procured Fish Group

The second group in the fish assemblage consists of species that could be caught in the Don River, although some species might be more common in the lake shallows near the mouth of the river, from Ashbridges Bay to the Toronto Islands.

In contrast with the salmonid-eel group, the second group has a very high cranial to vertebral bone ratio (Table 2.7). While one species from the first group was identified solely on the basis of vertebrae (Atlantic salmon), two taxa from the second group were identified solely on the basis of cranial bones (bowfin and black or white crappy). As explained above, some of this difference may be due to differential preservation in the salmonid skeleton and the fact that taxa in the salmonid-eel group tend to have more vertebrae than the taxa in the locally procured fish group.

It is also possible that part of this vertebral deficit is due to differential recovery. The average size of most species in the second group is much smaller than that of species in the salmonid-eel group. With a decrease in body size, and hence a decrease in size of individual vertebrae, one might expect a decline in recovery rate. On the other hand, species with vertebrae of comparable size to the salmonid-eel group (e.g., northern pike) still exhibit the reversed ratio in cranial bone to vertebra.

Also, recovery bias alone does not explain the cranial bone to vertebra ratio for the brown bullhead, the dominant species in the second group, and, indeed, in the whole fish assemblage. Given that mature brown bullhead are smaller than the mature fish in the salmonid-eel group, and that their vertebral bodies are proportionally smaller, one might normally expect a recovery bias against bullhead vertebrae. However, the transverse and spinous processes of bullhead trunk vertebrae are robust and firmly rooted. The corresponding structures in salmonids and pike have weak, socketed connections reminiscent of unfused epiphyses, and the archaeologically recovered vertebral bodies almost invariably have no processes at all—only empty sockets survive. The stout projecting spikes on bullhead vertebrae tend to snag in six millimetre screens, increasing their recovery rate.

When harvest-level quantities of fish are caught by people based in fishing camps located far from the village site, transportation costs can be reduced by processing and drying fish in the fishing camps. However, there would be far less reason for off-site processing of fish opportunistically procured in relatively small numbers and relatively near the site—particularly smaller species of fish such as brown bullhead, pumpkinseed, and sucker. It is suggested that these tended to be brought into the village in whole, unbutchered condition. Also, the fat content of the meat is lower, and they are probably less suitable for long term preservation than species of the salmonid-eel group. Perhaps therefore, the observed vertebral deficit can be explained in terms of *intra*-site processing. The species of the second group may have been brought to the site as whole fish, where processing debris and consumption waste might well have been discarded in different places.

The assemblage presents a complex picture in terms of when and how species were procured. As mentioned above, because of habitat preferences and spawning behaviour, the species in the salmonid-eel group are more likely to have been procured in harvest-level amounts in the fall. The lake whitefish and lake trout are most probably taken from lake waters, and their remains are indicative of an organized lacustrine gill net fishery (Cleland 1982:774, 780). On the other hand, spawning behaviour of northern pike, yellow perch, and suckers present an opportunity to catch them in large numbers in the spring (Scott and Crossman 1979:359-360, 532-533, 540, 757). They would still be available throughout the remainder of the fishing season, albeit in significantly smaller quantities, and could be taken on a more opportunistic basis. Some or all of the major taxa in the second group would be available in the Don River less than 500 metres downstream from the site.

Body Portion Representation Analysis

A study of body portion representation was undertaken (Table 2.8) since this sort of analysis may sometimes cast light on whether a resource was procured near to a site or at some distance, and potentially whether or not mass processing techniques were used. Data were tabulated for the five most common taxa in the assemblage, all of which were from the locally exploited group. In compiling values for this table, specimens consisting of two or more articulated bones were counted as multiple elements. Thus, a specimen comprised of a ceratohyal articulated with an epihyal was counted as two items. Also, minimum numbers of element (MNE) values were not estimated. While such estimates may have provided a somewhat more accurate picture, the reported figures still provide a reasonably effective idea of how well various parts of the skeleton are represented in the assemblage.

The central cranial group has the highest specimen count for each taxa. This is expected because it also includes more countable bones than other groups. Beyond this, the values in this table appear to be influenced by the dietary adaptations of the different species. For example, the northern pike has the largest frequency of anterior cranial and oral bones. This is what might be expected for the largest and most specialized predator species in the second group, and, indeed, this high frequency is largely attributable to the abundance of mandibular arch elements. The yellow perch, which also has a major piscivorous diet, scores very similarly in this area. On the other hand, the diet of the white sucker and bullhead, both bottom feeders, is comprised primarily of softer items. The white sucker has the lowest frequency for anterior cranial and oral bones. Its diet consists largely of chironomid (midge) larvae and pupae, cladocerans (water fleas), and molluscs (Scott and Crossman 1979:542). The brown bullhead scores higher than the white sucker in this area. It has a broader diet including items with more hard parts including, among other things, offal, molluscs, mature insects, crayfish, plants, and other fish (Scott and Crossman 1979:602).

During the analysis, a few significant element deficits were noted that are not readily attributable to dietary adaptation. Foremost among these, and clearly visible in Table 2.8, is a lack of sucker hyoid/branchial arch elements. These bones—the urohyal, ceratohyals, epihyals, and dorsal and ventral hypohyals—form the bony framework for the gill structures. (Because in most species, hypohyals are generally small enough to pass through a six millimetre screen, they have not been counted in Table 2.8.) The gill structures would probably have been removed in one of the initial butchering operations, on or off-site.

The dearth of bones in the sucker hyoid/branchial arch group contrasts with the abundance noted for northern pike. Since removal of the gills is probably one of initial steps in butchering a fish, the strong presence of pike hyoid/branchial arch bones is a good indication that pike tended to be brought back to the site whole, or at least in relatively intact condition.

The level of resolution used in Table 2.8 masks the significant absence of a few key skeletal parts. These include elements which are readily recognizable and which seem to be sufficiently robust to persist in most archaeological contexts. Most should be large enough to be recovered in six millimetre mesh with reasonable consistency, and those which are small enough to elude consistent recovery with such mesh should still be caught intermittently—especially considering that over 600 fish scales were recovered. The interpretations regarding these deficits are predicated upon the inference, made above, that most of the locally exploited fish debris in Feature 1 was derived from processing fish carcasses prior to cooking rather than from dietary refuse itself.

Perhaps the most significant of these element deficits involves the white sucker. Although the bones of the sucker oral area are not as massive as those of the northern pike, they are still recognizable and identifiable. Not one sucker maxilla or angular was identified, although five dentaries were recovered. If selective recovery is ruled out, the absence of these elements must be attributed to differential deposition. It is conceivable that the musculature and soft parts of the flexible sucker oral region were removed from the carcass and eaten, and the bones discarded elsewhere on the site.

A total absence of sucker hyomandibular bones was also noted. This absence is puzzling because the hyomandibular is large, eminently recognizable, and from its central location on each side of the skull articulates with major bones of the auditory capsule, the ear-shaped gill flap, the cheek, and (through the symplectic and interhyal) the mandibular and hyoid arches. Five bones which articulate with the hyomandibular were identified (two opercula, one sphenotic, and two mesethmoids). Of these, the latter two are smaller and arguably less readily recognizable. Also, no northern pike opercula were identified. The operculum is the largest bone of the gill flap (opercular series). The posterior edge of this bone is relatively fragile and attrition is common in archaeological specimens. Given that the northern pike is the second best represented species in the assemblage, one would have expected to find some opercular specimens, particularly the thicker anterior margin and the robust glenoid-like hyomandibular facet. Of the bones which articulate with the operculum, six preopercula and six hyomandibulars were identified. No explanations are offered for these apparent absences.

Of the five most common taxa in our assemblage, the pumpkinseed and related species (such as bluegill, *L. macrochirus*, green sunfish, *L. cyanellus*, and longear sunfish, *L. megalotis*) are the smallest and most fine-boned. It is possible that differential preservation, differential recovery, or both could have affected their element representation. Therefore, while there are element over- and under-representations for this taxon, they were not further explored.

Most Commonly Recovered Fish: Exploitation and Processing Patterns

Brown Bullhead

Foremost among the group of locally available species is the brown bullhead. Two hundred eighty-two brown bullhead specimens were identified, comprising almost 46% of the cranial bone assemblage. At least 13 individuals are represented. The brown bullhead also dominated the fish assemblage at the Over site (Thomas 1996b:13). These data seem surprising given that, in a summary of census studies from 1949 to 1984, Martin (1985:37-42, 93-98) found the brown bullhead to be uncommon in the Don system while it is known to be "very tolerant" of high temperatures, low oxygen levels, high carbon dioxide levels, and pollutants (Scott and Crossman 1979:602), and is extremely well distributed throughout almost all of southern Ontario (Mandrak and Crossman 1992:88). Therefore, one would expect that, better than most other fish species, Don River bullhead populations would have withstood the warming and pollution caused by deforestation and industrialization, and would still be present in some numbers. This apparent paradox may be resolved by the fact that two major fish sampling methods used in census studies, which Martin reviewed, tended to systematically under-represent bullheads. They are not often caught in seine nets, for example, because they tend to slip out from beneath the net, and when stunned by electrofishing, they sink and tend to remain unnoticed on the bottom (Ian Buchanan, Ontario Ministry of Natural Resources, personal communication 1999).

The average relative size estimate for the bullhead elements from Feature 1 is 87.54% of FA985-2, the reference skeleton used for comparison. This figure was derived from 167 specimens identified as brown bullhead and probable brown bullhead (*Ameiurus* cf. *nebulosus*), and which were at least three-fourths complete. The range is 55 to 120%; 57% of these specimens fall within ±10% of the average; the median is 85%. The key reference skeleton is tentatively estimated to be 305 mm in total length based on an osteometric comparison with a series of brown bullhead skeletons at the Royal Ontario Museum Vertebrate Paleobiology collection.

The average length (total length or TL) of bullheads in Feature 1 is estimated at 270 mm. The average length for brown bullheads in Canada ranges from 203 to 356 mm (Scott and Crossman 1979:602). The Moatfield mean bullhead length is close to the arithmetic mean for the Canadian range—280 mm. However, this Canadian average includes specimens from an immense area, and the climate in the Toronto region is relatively mild compared to the rest of Canada. No average size data are available for the Lake Ontario basin or for southern Ontario. Bearing in mind that a milder climate generally favours size, and that the average length of bullheads in nearby New York State is 356-406 mm (Werner 1980:131), the Feature 1 specimens may actually be somewhat small in relation to the Lake Ontario basin in general.

In addition to ponds and lake margins, bullheads inhabit slow moving parts of larger watercourses where vegetation is abundant and the bottom is sand or mud (Scott and Crossman 1979:602). While the shallows around the mouth of the Don River and nearby Toronto Islands probably included prime bullhead habitat, they may have been available closer to Moatfield. The lower ten kilometres of the Don River has a gentle drop of one metre per kilometre, and was bordered by marshland before the channel was straightened in the late nineteenth century (Martin 1985:5, 9). This part of the river would therefore have provided excellent bullhead habitat. Further up the Don River, natural ponding in intermittent level stretches may well have provided additional but limited habitat even closer to the site.

Bullheads are not particularly suitable targets for mass procurement techniques during spawning season. Their spawning behaviour lacks strong schooling and migration components (Scott and Crossman 1979:593, 597, 601). It appears that some form of fish trap—a basket trap positioned on the bottom or some variation of a pound net built into the bottom—would be the most productive method. Active capture techniques by means of nets would probably not be as effective for bullheads since they tend to slip out from beneath a seine net, and because a seine net can not be deployed effectively in the vegetated habitat favoured by bullheads (Ian Buchanan, personal communication, 1999). As a bottom dwelling night feeder (Scott and Crossman 1979:602) and a fish of modest size, the brown bullhead is also a poor target for spear fishing. Since they readily take bait (Scott and Crossman 1979:603), angling might be a possibility. Indeed, it is possible to angle for bullheads without a hook using an attended angling technique (Macins 1979:33). Yet angling, even using unattended multiple hook lines, is less efficient than fishing with basket traps. A moderately sized basket trap takes approximately one day to manufacture and can last for several years (Lindstrom 1996:142, 146-147).

There would have been a tradeoff between the higher productivity habitat in the lower Don River and the greater transportation costs to exploit that zone from the Moatfield village. Fishing in the slowly moving waters of pond habitats (which likely existed in scattered locations upstream in the Don system) would have produced fish at a slower rate than one could realize in the wetland habitat of the lower Don, but transportation costs from nearby pond habitats would have been lower. Given the minimal labour effort involved in passive, unattended fishing techniques, the limited bullhead productivity posited for upstream locations could have been less of an issue than transportation costs.

In any case, the presence of hyoid arch bones, which support the gill structures, indicates that bullheads were brought to Moatfield as whole fish and processed there. The relatively small number of vertebrae in the feature, however, indicate that bullhead processing was undertaken in a number of site locations, and/or that meal related refuse tended to be deposited elsewhere.

Wherever it occurred, it is a possibility that processing of brown bullheads tended to result in asymmetric fragmentation rates in the cleithrum and the coracoid. Of 11 left cleithrum specimens that included at least part of the angle, only two had transverse breaks at the angle. Five specimens were entire or almost so. Of ten right cleithrum specimens that included at least part of the angle, five had transverse breaks at the angle. Two specimens were almost entire. The pattern seems to be echoed by a higher breakage rate in the right coracoids. The coracoid is joined down its entire length with the ventral process of the cleithrum in a symphysis-like articulation creating a single structure. A breakage pattern which affects the ventral process of the cleithrum should, therefore, affect the coracoid. Of 11 left coracoids, all were reasonably intact. Of the eight right coracoids, only five were complete or nearly complete. A similar asymmetrical breakage pattern was observed in the bullhead assemblage at the Dunsmore site, a fifteenth century settlement in Barrie, Ontario.

In most important fish species, the angle region of the cleithrum is relatively robust and well buttressed. In the brown bullhead and other members of the catfish family, the angle and dorsal process of the cleithrum are unusually thick and well ossified. It would be relatively difficult to induce a major transverse fracture in the angle and dorsal process area except by express intent. What appears to be intentional breakage of the cleithrum is described below for some other fish species in this assemblage. Elsewhere, at the Peace Bridge site (AfGr-9), it was suggested that a similar pattern of apparently intentional breakage was caused by breaking off the anterior part of the fish skull prior to cooking (Thomas 1997:487).

Northern Pike

The northern pike is the second best represented species among the locally available species. Eighty-seven northern pike specimens were identified, and one specimen identified only as a large esocid (northern pike or muskellunge). These account for approximately 14% of the fish cranial bone assemblage. At least seven individuals are represented.

The key reference skeleton upon which relative size estimates are based, FA967-5, had a total length of 618 mm while the average length of northern pike in Canada is 457 to 762 mm (Scott and Crossman 1979:356). The average relative size estimate for 66 specimens securely identified as northern pike is 74.89% of key reference skeleton FA967-5. For 38 specimens which were at least three-quarters complete, the average relative size estimate is 74.66%. For both groups the range is 55 to 120%, and the median falls at 75%. The Moatfield average falls somewhere between 400 to 460 mm.

Pike show a correlation between body size and water depth. Younger, smaller pike prefer shallower water with more dense vegetation including emergent, floating and submergent plant species. Older, larger pike seek deeper water with sparser submergent vegetation. Younger pike seek water depths equating to 10 cm for every 12 mm of body length (Casselman 1996:18-19, 23). If the above held true for the Moatfield pike, most individuals in the pike assemblage could have been taken from water between mid-calf to mid-thigh deep.

The northern pike has a habitat preference similar in certain ways to the brown bullhead, but, in terms of the Don system, pike show an even stronger downstream tendency. Northern pike prefer warm waters of heavily vegetated slow flowing rivers and weedy bays of lakes (Scott and Crossman 1979:360). Smaller pike are more tolerant of low oxygen concentrations than large pike (Casselman 1996:20), but generally pike are not as tolerant as bullheads. Thus, pike might not thrive well in isolated oxbow ponds in the marshland of the lower Don as would bullheads. While pike were not reported in the 1949 or 1985 Don River census studies, they were plentiful in the mid-nineteenth century (Martin 1985:8, 37-42, 93-98), and they still can be found in Lake Ontario around the mouth of the Don (Buchanan 1989:68, 80). Suitable habitat for pike would probably have existed in at least the lower ten kilometres of the Don which has a low gradient, a relatively gentle current, and which once included wetland habitat (Martin 1985:9).

Sagard mentioned that the Huron caught pike incidentally during the fall lacustrine salmonid fishery (Sagard 1968:230). The lacustrine salmonid component of the Feature 1 faunal assemblage indicates that the Moatfield people mounted similar fishing expeditions at which they may have caught pike. According to Sagard, pike were caught in gill nets set in lake waters at depths which seem greater than the average for pike. While pike have a decided preference for shallow vegetated habitat, a few pike are known to spread out from these areas into water over nine metres deep. These are usually larger pike, sometimes reaching nine kilograms (MacCrimmon and Skobe 1970:92).

Mature pike move into vegetated river floodplains and marshes to spawn immediately after the ice melts in the spring. Under the right conditions, mass movement of mature pike into spawning grounds can be described as a migration or a run. At least as late as the mid-nineteenth century, nets were set near the mouth of the Don to catch spawning pike. Spawning takes place in the day in water as shallow as 18 cm. Groups of spawning pike, composed of a female followed by several males, are relatively unwary. The commotion raised by spawning pike splashing in the shallows will draw the attention of anyone nearby (MacCrimmon and Skobe 1970:92; Martin 1985:9; Scott and Crossman 1979:357-361; Werner 1980:93). The recovery of seven individuals from Feature 1 might therefore suggest spring deposition.

On the other hand, the pike spawning in the lower Don would likely have included a sizable number of larger pike from the Lake Ontario population, including fish over half a metre in length. While the size range in Feature 1 might well be typical of a resident population in the lower Don, the size range in a sample of pike caught spawning in the lower Don should be wider than a sample of resident pike caught after the spawning period in the same habitat (John Casselman, personal communication, 1999). The pike in this assemblage appear to have been relatively small—all but one were probably less than 50 centimetres in length. On this basis, the best interpretation seems to be a pattern of opportunistic exploitation of pike resident in the wetlands of the lower Don.

Fish traps can effectively catch large fish (Lindstrom 1996:146). Whether or not traps were constructed and sited specifically for pike, traps effective in catching other shallow water species would perhaps also catch a few pike. Seining has been shown, in fish census studies, to be a comparatively ineffective means to capture pike (Buchanan 1989:68, 80). Alternatively, spear fishing is one of the most effective ways of taking pike, being between five and seven times more efficient in terms of catch per unit effort than angling with modern equipment (Sztramko and Paine 1984:7, 18, 36). Given the depth range inferred from the estimated size of the Feature 1 pike, spear fishing has potential as the possible procurement method.

Northern pike, like brown bullhead, has a relatively even cranial bone distribution pattern (Table 2.8). The hyoid arch series is particularly well represented, and the data show that gill structures from at least five individual pike were removed and discarded in Feature 1. This indicates that pike tended to be brought to the site in whole condition in spite of the distance between Moatfield and the lower Don.

It appears that Feature 1 contains processing refuse for northern pike rather than dietary refuse. The postcranial data show a marked deficit in pike vertebrae. The average vertebral count for pike is 57 to 65 (Scott and Crossman 1979:365). Feature 1 yielded only 31, or less than ten percent of the approximately 427 vertebrae expected from seven individuals. Assuming a good recovery rate for pike vertebrae, there seems to have been a tendency for the fillet portion to be deposited elsewhere, separately from the head portion.

Possible intentional perimortem fractures were noted on four cleithra (1423 through 1426). In each case the cleithrum was broken at the base of the ventral process by a transverse break.

Lepomid Sunfish

Fish of the genus *Lepomis*, or lepomid sunfish, comprise the third best represented taxon among the locally exploited fish. On the north shore of Lake Ontario, the principal species of this group include: the pumpkinseed (*Lepomis gibbosus*) and the bluegill (*L. macrochirus*); and, occurring less frequently, the green sunfish (*L. cyanellus*) and the longear sunfish (*L. megalotis*) (Mandrak and Crossman 1992:135-140).

While identification to species level was complicated by an absence of comparative samples in the primary reference collection, the identification process was rendered even more difficult by the fact that the pumpkinseed hybridizes with other lepomid species, sometimes extensively, creating fertile offspring (Scott and Crossman 1979:717). However, the lack of taxonomic precision is mitigated by the fact that the pumpkinseed is by far the most common lepomid in the Toronto region, at least in recent times. Pumpkinseed accounted for 97.1% of all lepomid sunfish found near the mouth of the Don in a 1989 survey (Buchanan 1989:68:80). In a 1992 census of the Humber River, pumpkinseed accounted for 98.1% of all lepomids (RSMI 1992:Tables 1 and 2). If this were true for pre-contact times, pumpkinseed may have accounted for all but a minor fraction of the lepomid sunfish population in the Toronto region. The problem posed by the lack of taxonomic precision is ameliorated by the fact that the pumpkinseed and bluegill are very close in size and are similar in behaviour, habitat preference, diet, and spawning season (Scott and Crossman 1979:716-717; 720-723; Werner 1980:161-163). Hence, for purposes of reconstructing past human subsistence behaviour, the lepomid sunfish of the Feature 1 assemblage might be regarded as a single group and treated as a composite class (Grayson 1984:93).

The lack of taxonomic precision is apparent in the identifications: only 50 specimens are securely identified as pumpkinseed; 44 are probable pumpkinseed; an additional 33 are identified as *Lepomis* sp. or cf. *Lepomis* sp. Considering only the 50 secure and probable pumpkinseed identification, at least six individuals are represented. If we take into account the additional 33 *Lepomis* sp. and cf. *Lepomis* sp. identifications, the MNI rises to ten.

Pumpkinseed have been found in various parts of the Don system and far into the upper reaches of the Don, near Major MacKenzie Drive. They have been found in respectable numbers near Lawrence Avenue, midway between Moatfield and the lower Don (Martin 1985:37-42, 98-98).

It appears that the lepomid specimens in the Moatfield assemblage tend to be somewhat small. In Canada, the species averages between 178 to 229 mm. No average length statistics were located for Ontario. The key pumpkinseed reference skeleton, FA1008-1, had a total length of 190 mm. This is slightly less than 203.5 mm, the midpoint in the Canadian average range. The average relative size estimate for 45 specimens identified as *Lepomis gibbosus* or *L.* cf. *gibbosus* is 89.84% of the key reference skeleton. The range is 66 to 110% and the median is 90%. The statistics are identical for 59 specimens identified as *L. gibbosus*, *L.* cf. *gibbosus*, or *Lepomis* sp., except that the average relative size estimate is 90.14%. Osteometric data for only two specimens were obtainable.

The pumpkinseed is a warm water species preferring quiet stretches of watercourses with submerged vegetation for cover, as well as small lakes and ponds, and the shallow vegetated bays of large lakes. In some small bodies of warm water they comprise the majority species. Bluegill habitat includes slow flowing, heavily vegetated portions of some rivers and large creeks as well as the weedy, shallow, warm water of lakes and ponds (Scott and Crossman 1979:717, 722). The habitat preferences of both major lepomid species in Ontario are, therefore, similar. Their habitat preferences are also similar to those of bullhead and younger, smaller northern pike. The diet of both the pumpkinseed and bluegill is mostly composed of insects and, secondarily, other invertebrates. Both feed throughout the water mass (Scott and Crossman 1979:717, 722).

The pumpkinseed and bluegill are probably not much easier to catch during their spawning period than during the rest of the fishing season. Their spawning behaviour involves neither mass migration nor large scale aggregation and both spawn intermittently for a protracted period of time from late spring until early or mid-summer. Spawning takes place in submerged vegetation in waters of lakes, ponds, or slow flowing streams. Nests for spawning are formed in a variety of bottom materials including sand, clay, and mud. In both species, the nests can be numerous and closely packed. Both spawn in shallow water but while the pumpkinseed prefers a nesting depth of roughly 15 to 31 cm, the bluegill prefers a slightly deeper water—roughly 81 cm (Scott and Crossman 1979:716, 721).

While nesting might concentrate fish and temporarily fix them in a relatively circumscribed area during spawning episodes, the location of these nests, in submerged vegetation, would probably make them difficult to exploit with hauled seine nets. Lepomids are too small to spear, and their size would seem to preclude effective angling. Given Late Iroquoian fishing technology, some form of fish trap may well have been the most effective way to catch lepomid sunfish. Indeed, pumpkinseed are fished commercially in parts of Ontario and Quebec, usually with hoop nets set in shallow water (Scott and Crossman 1979:718). Wing nets, fence traps, and basket traps might also have been effective.

The lepomid sunfish assemblage has the most uneven cranial bone representation profile of the five major fish taxa found in Feature 1 (Table 2.8). The anterior cranial group, which includes bones of the oral region, are poorly represented. Also, relatively few bones of the hyoid-branchial arch group were identified. Differential preservation might have contributed to this pattern. Even though the pumpkinseed and bluegill length ranges strongly overlap with that of the yellow perch, most of their bones are noticeably less robust. Indeed, lepomid bones in archaeological assemblages tend to be less complete than yellow perch bones, and for this reason, it is usually more difficult to accumulate osteometric data for them. Differential recovery might also be a factor affecting the lepomid cranial bone representation profile; lepomids are the smallest of the major taxa in Feature 1. While either of these factors could have contributed to the unusual cranial bone profile, they do not fully explain it—especially since over 600 delicate fish scales were also recovered from Feature 1. The lepomid cranial bone representation data deserve further investigation, but only in light of additional comparative work with samples derived by flotation and screening from various types of soil matrix.

Given that the pumpkinseed is so widely distributed in Ontario (Scott and Crossman 1979:717; Mandrak and Crossman 1992:136) and that it can still be found in most parts of the Don system (Martin 1985:37-42, 93-98), it most likely was procured very close to the Moatfield village. Together with their diminutive size, there would be little reason to process them at a remote site.

Only six lepomid sunfish vertebrae were identified in the Feature 1 assemblage. Pumpkinseed usually have 29 vertebrae, and bluegill 28 to 29 (Scott and Crossman 1979:714, 720). The *Lepomis* sp. assemblage yielded an MNI value of

10. Lepomid vertebrae are obviously underrepresented, but the picture may be clouded by the potential problems with differential preservation and recovery.

Yellow Perch

The yellow perch is the fourth best represented taxon among the locally exploited fish . It is found in Lake Ontario waters around the mouth of the Don River (Buchanan 1989:68, 70, 80, 82) and was reported in one sampling location in the Don River system as late as 1985 (Martin 1985:37, 98). Sixty-four yellow perch specimens were identified accounting for 10.4% of the fish cranial bone assemblage. At least seven individuals are represented.

The key reference skeleton used as the basis for relative size estimates, FA1021-2, has a total length measurement of 218 mm. In Canada, yellow perch average 203 to 305 mm long (Scott and Crossman 1979:759). In New York State, adults reach 254-279 mm (Werner 1980:168). The arbitrary size threshold for reproductively mature perch used in fish population studies in the Toronto waterfront area is 130 mm (Buchanan 1989:15). Thus, our key reference skeleton is smaller than the Canadian arithmetic average and the range for older adults in New York, but is well into the adult size range.

Relative size estimate data indicate that most sized perch bones came from larger fish than the key reference skeleton. The average relative size estimate for 55 sized and positively identified yellow perch specimens is 124.36%. This is very close to the average relative size estimate of 122.95% for the 44 specimens that are at least three quarters complete. The median value for both is 125% and the range is 70 to 160%.

Several osteological measurements were recorded, but the specimen count for most was too small to produce meaningful results. The operculum provided the most osteometric data. The length of the dorsal spine (LDS) was taken for six opercula (four lefts and two rights). The average LDS is 19.02 mm, and the range is 12.8 to 22.6 mm. The key reference skeleton yielded an LDS of 17.2 mm. The next best set of measurements came from five preopercula (three lefts and two rights). The average height of the caudal border (HCB) is 26.52 mm with a range of 16.2 to 20.0 mm. The average length of the ventral border (LVB) is 17.74 mm with a range of 16.2 to 20.0 mm. The average relative size estimates for the two sets of archaeological specimens is 109.17% and 123.0%, respectively.

Perch populations in upstream locations may not have achieved the maximum growth realized by populations in the lower Don or in Lake Ontario. When considering the relationship between size and reproductive maturity, yellow perch populations vary in average length and weight depending on environmental conditions. Perch populations in limited habitats tend to be stunted. Indeed, taking age into account, there are measurable size differences between perch populations in Lake Ontario and Lake Erie (Scott 1967:102; Scott and Crossman 1979:758).

Yellow perch can be found in habitats ranging from large lakes to ponds to quiet stretches of rivers. They prefer open, clear water where there is moderate vegetation.

A shallow water species, they can live in both warm and cooler water (Scott and Crossman 1979:759). The habitat preference of the yellow perch, particularly mature ones, places more emphasis on open water parts of the habitat favoured by the brown bullhead and younger pike, and also by the lepomids except that, with respect to lepomids, stronger emphasis is placed on lacustrine and downstream territory.

The yellow perch was one of the first species to be exploited by the nineteenth century Great Lakes seine fishery (Scot and Crossman 1979:759). In pre-contact times, yellow perch would have been available in the nearshore lake waters around the mouth of the Don. The marsh-lined, slow-flowing lower Don must also have provided good yellow perch habitat. Indeed, perch fishing was known to have been good in the Don at least until the mid-nineteenth century (Martin 1985:8). Although recent census data indicate that perch lived in at least a few intermittent slow flowing stretches further upstream in the Don system, far greater concentrations would have been available in the lower Don and in the littoral zone of Lake Ontario.

Like the lepomid sunfish, the diet of perch includes insects, and other invertebrates, with more emphasis on fish (Scott and Crossman 1979:759).

The spawning behaviour of the yellow perch makes possible their efficient exploitation in large numbers. Mature perch migrate from lakes into tributary streams to spawn from mid-April until early May (Scott and Crossman 1979:757). Such a migration up into the Don system would have brought yellow perch closer to the Moatfield village, and they could have been caught in large numbers, along with other migratory spring spawning fish, with technology as simple as a brush fence placed in strategic locations across watercourses.

There is reason to consider a springtime subsistence event to explain the deposition of at least five yellow perch in Feature 1. If these perch did represent a spring fishery focussed on migratory spawning fish, all or most of the individuals would be mature. Relative size estimate data indicates that most, but not all, perch bones came from fish roughly as large or larger than the key reference skeleton.

Yellow perch can also be caught effectively by active inshore seining. Yellow perch are usually found in schools (Scott 1967:102; Scott and Crossman 1979:759) so a large number can be caught in a single haul. However, much skill, luck, or both are required to net a good part of a school. Of 38 seining locations, which sampled various areas along the Toronto waterfront, yellow perch were caught at five. At one of these, 23 perch were caught, probably in one or two hauls. At other seining locations, no more than two perch were caught (Buchanan 1989:26, 34, 45-46, 68, 80, 88, 96, 102, 112).

Yellow perch can also be caught effectively in various kinds of unattended fish traps: wing nets, pound nets, hoop nets, and basket traps. Presumably, a basket trap or pound net positioned to catch bullhead would also catch some perch. Since perch are best caught with the bait held just off the bottom when angling (Werner 1980:168), a fish trap in this position should also have been able to catch bottom feeding species like bullheads and suckers. Conversely, fish traps intended for bullheads and suckers might also have received a by-catch of yellow perch if properly located. Perch of average size are probably too small to spear effectively. Even if Iroquoian fishing technology produced miniature tackle effective for yellow perch, angling for fish in the perch size range would not be nearly as efficient as active seining or unattended fish trapping (Lindstrom 1996:486-489).

The cranial bone distribution profile for yellow perch somewhat resembles that for northern pike (Table 2.8). The major difference is a proportionately lower frequency of hyoid arch bones. Nevertheless, ceratohyal bones represent at least four perch, which accounts for roughly half of the (at least) seven individuals represented in the entire perch assemblage. It would appear, therefore, that many, if not most of yellow perch deposited in Feature 1, were brought to the site before preliminary processing. This may seem surprising given the fact that relative size estimate data indicate that many of the recovered individuals were of a size appropriate for the lower Don or even for Lake Ontario.

Only four yellow perch vertebrae were identified. The vertebral count for yellow perch ranges from 38 to 41 (Scott and Crossman 1979:755). Given that at least seven yellow perch are represented in the fish assemblage, there is a substantial shortfall in vertebrae. While it could be tentatively concluded that the yellow perch remains in this feature represent processing refuse rather than dietary refuse, the picture may well be distorted by a preservation and recovery bias against small bones.

Butchering marks were noted on two yellow perch cleithra. In each case a transverse cut on the lateral surface between the ventral process and the angle severed the ventral process.

White Sucker and Other Sucker Species

The genus *Catostomus* of the sucker family, the Catostomidae, is the fifth most abundant taxon among the locally exploited fish. This taxon comprises nearly nine percent of the fish cranial bone assemblage. Almost two-thirds of these specimens were identified as white sucker and probable white sucker. No other species of sucker were recognized. While it is possible that a small amount of longnose sucker (*Catostomus catostomus*) bone is present among the remaining third of the assemblage, it likely consists mostly of white sucker bones.

That sucker remains are well represented in a Moatfield fish assemblage is unsurprising. In fish census studies conducted in 1949 and 1984 at approximately 90 sampling sites throughout the Don system, including one very close to the site, white sucker was found in 45 to 65% of all sites and ranked between the second and fourth most frequently occurring species (Martin 1985:30, 36, 93-97). While sucker species were not found in the lower Don, white sucker figured prominently among the subsistence resource species tallied in a recent fish census around the mouth of the Don River (Buchanan 1989:68, 80), and suckers were reported to be plentiful in the estuary area in the early nineteenth century (Martin 1985:8). Longnose sucker was not encountered in the census studies of the Don system (Martin 1985) or of the Toronto waterfront (Buchanan 1989). This is not surprising as longnose suckers generally prefer the cold clear water of lake bottoms and tributary streams, and in southern Ontario are found only in deeper lake waters (Scott and Crossman 1979:534).

The average relative size estimate for white sucker elements (including probable white sucker) is 91.59% of key reference skeleton FA978-5. This figure was derived from 29 specimens sufficiently intact for estimates to be made. The range is 66 to 110% and the median is 85%. For 24 specimens at least three-quarters complete, the average is 92.33%. The key reference skeleton had a body length of 444 mm.

The average length for white suckers in Canada is 305-508 mm (Scott and Crossman 1979:538). In New York State, the average size for mature white suckers ranges from 457 to 508 mm (Werner 1980:125). It is estimated therefore that the size of individuals represented in the Feature 1 assemblage ranged from 330 to 450 mm, with an approximate average of between 400 and 420 mm, close to the Canadian average range.

White sucker body size can be inferentially important. There is considerable variability in growth rates between locations (Scott and Crossman 1979:541). White suckers living in the upstream and headwaters portions of the Don system are substantially smaller than those in Lake Ontario (Buchanan, personal communication, 1999). Also, as is evident with other species, there is a tendency for larger, older white suckers to live farther from shore (Scott and Crossman 1979:542). To properly evaluate the Feature 1 size data, it would have been preferable to use statistics from Lake Ontario, if not the Toronto waterfront. Unfortunately, no published size data were located for the Lake Ontario drainage. Compared to the New York State average, the white suckers in the Feature 1 assemblage are somewhat smaller.

The dentary bone furnished the most reliable osteometric data for white sucker. Five specimens could be measured: four lefts and one right representing five different individuals. The length of the dorsal border (LDB) averaged 16.26 mm. The range was from 13.6 to 18.1 mm. The LDB for reference skeleton FA978-5 is 17.5 mm. The average relative size estimate for the five measured specimens is 94%.

Preferred white sucker habitat includes tributary rivers of large lakes and the warmer, shallower waters of shallow lakes and the littoral shallows of large lakes. As bottom feeders, white suckers eat chironomid (midge) larvae and pupae, cladocerans (water fleas), and molluscs (Scott and Crossman 1979:542). While white suckers would have been available throughout much of the Don system, there would have been a population near Moatfield, although presumably they were more abundant and larger farther downstream. The marshy shallows of the lower Don would probably have supported an enormous white sucker population.

The spawning behaviour of the white sucker makes it possible to harvest them in large numbers. In the spring, approximately in early May in southern Ontario, white suckers migrate up streams, sometimes in thousands. Preferred spawning habitat includes shallow waters of streams over gravel bottoms sometimes in rapids, although a few also spawn along lake margins.

The absence of longnose sucker from a substantial assemblage of sucker remains in which white sucker has a major presence might indicate, however, that these suckers were not taken during a spring spawning run. Longnose suckers also spawn in the spring, their spawning run peaking several days prior to the white sucker run. Despite the differences in the timing of the runs, some overlapping in their exploitation would be expected. The preferred spawning habitat is gravel bottomed stretches of streams where there is a current and where the water depth is less than half a metre (Scott and Crossman 532-3). Such habitat exists in the Don system. It seems highly likely, therefore, that longnose suckers also probably migrated into the Don system to spawn.

Relative size data and, to a lesser extent, the osteometric data also suggest that the white sucker remains do not represent a spawning population. In the lower ten kilometres of the Don River, and probably for some distance upstream, Lake Ontario fish should figure prominently in a spawning population of white suckers and a sample of mature, spawning white suckers from Lake Ontario should encompass the full range of adult sizes up to the large end of the scale. Given that the key reference skeleton, FA978-5, was close to the arithmetic mean for adult Canadian white suckers and below the average for New York State, the size of the recovered fish seem overall to have been too small to represent a spawning population. Of the 31 sucker bones for which relative size estimates could be made (including bones identified to genus level), 18 (58.1%) were smaller than those in the key reference skeleton, eight were approximately the same size, and only five were larger. The undetected presence of longnose sucker remains in the assemblage would not negatively affect this assumption because the size range for longnose sucker exceeds that of the white sucker (Scott 1967:45; Scott and Crossman 1979:531). The osteometric data, although only provisional given sample size, reflect the same relative size profile. Of the five measurable dentaries, three had shorter LDB measurements than the key reference skeleton, one was close in size, and one was larger. (All measurable dentaries were identified as white sucker, although one identification was at the probable level—*Catostomus* cf. *commersoni*).

The distribution pattern for the sucker cranial bone assemblage is the most uneven of the five major taxa displayed in Table 2.8. Suckers are the only major taxon for which no hyoid arch bones were identified, although differential recovery may be partly responsible. In most taxa, the largest and most robust hyoid arch bone is the ceratohyal. A ceratohyal from an average sized adult white sucker is actually smaller than a ceratohyal from an averaged adult sized yellow perch, although the sucker is decidedly longer and weighs more. A bone this size could certainly slip through the six millimetre mesh in the archaeological screens although their complete absence, if they had been present, seems inconsistent with the fact that numerous fish scales were recovered.

Nevertheless, the frequency of hyoid arch bones has been used to help determine the stages of processing that were undertaken at Moatfield. Regardless of differential recovery, the complete absence of hyoid arch bones within a substantial assemblage of sucker bones would seem to indicate that preliminary processing was carried out away from the feature and perhaps off site, presumably near where the fish were caught. The biomass of this species in the immediate vicinity of the Moatfield village probably exceeded that of the brown bullhead or any other fish species in the Feature 1 assemblage (Buchanan, personal communication 1999). Because of its relatively small size, it is likely that this species would have been processed at Moatfield—unless a deliberate choice had been made to procure this fish at some remote location. The relative size of the Moatfield specimens would seem to suggest that this was not the case.

Also, no bones of the upper jaw were recovered, while the lower jaw is represented by the five dentaries, representing five separate individuals. The most recognizable bone in the upper dental arch of the sucker, the premaxilla, is at least as large and as solidly ossified as the dentary, and is easily recognized. Their absence, combined with the lack of sucker vomers, suggests that the upper lip and nose area was intentionally removed and deposited elsewhere.

On the other hand, other body portion representation data suggest that Feature 1 contains processing refuse as well as dietary refuse. Indeed, despite the absence of certain elements, Feature 1 contained primarily head bones, and the bones representing the fillet portion appear to have been deposited elsewhere. There is a significant deficit in sucker vertebrae. Excluding the highly modified anterior trunk vertebrae composing the Weberian apparatus, the average vertebral count for white sucker is between 41 and 44 (Scott and Crossman 1979:539). Assuming full recovery, approximately 215 vertebrae would have been found, based on an MNI of five. Only nine sucker vertebrae were identified, less than enough to account for one complete individual.

Several cleithra bore traces of possible disarticulation cuts and breaks. Two specimens with cut marks were noted (1265 and 1271). In both cases it appeared that a light transverse cut had been incised into the lateral surface at the angle, presumably to start a fracture at that point Five other cleithrum specimens had possible intentional perimortem fractures at the angle (1263, 1264, 1266, 1267, and 1968). The appearance of perimortem fracturing of fish bone is usually ambiguous, at least compared to the more readily recognizable appearance of fresh bone fracturing of mammalian long bone. However, the angle of the sucker cleithrum is not a weak point where fractures would naturally develop. It has an almost "T" shaped cross section, and is reinforced by a layer of thick-walled cellular structures similar to mammalian cancellous bone but with coarser structure. This breakage pattern is not dissimilar to that noted for walleye at the Peace Bridge site (Thomas 1997:487).

Summary

In light of the analysis of fish remains from Feature 1, it would seem that the feature contains one group of taxa which were probably procured during autumn spawning runs near the estuary of the Don (Atlantic salmon, lake trout, lake whitefish) and another group that would have been available throughout the Don River system, either nearby or further downstream in the low gradient, slow-flowing portion. The former group is represented primarily by vertebrae, which is most likely the result of transport of fillets back to the site from the lakeshore where they were initially processed, while the second group appears to represent processing debris rather than subsistence remains. The presence of both subsistence and processing refuse within the same feature suggests the contribution of multiple depositional episodes to the ashy, bone-filled lens in the feature.

Reptiles

Painted Turtle

Thirteen turtle specimens were identified, all attributable to painted turtle, *Chrysemys picta*. These included parts of the top and bottom shell (carapace and plastron) as well as some pelvic girdle bones. At least two individuals were represented, based on both duplication of elements and on developmental differences between the specimens. Neither cut marks nor evidence of bone working were observed on any of the specimens.

It appears likely that processing of the turtles began away from Feature 1, given the lack of major long bones of the pectoral or pelvic limbs. Aside from the bones of the pelvic girdle, which are anchored to the carapace by sacral ribs, no appendicular bones were identified. Moreover, the cranium, mandible, and some of the eight cervical vertebrae should have been recovered if the entire turtle had been processed in the feature.

Specimen 1651 consists of seven bones, widely distributed throughout the feature, which, when fit together, formed the major portion of a plastron.

Painted turtles prefer the quiet, warm, vegetated waters of marshes, all sizes of watercourse, and riverine ponds, backwaters and bays (Pope 1939:186), a habitat preference similar to young pike, sunfish, and especially bullhead. Indeed, this common species could be captured in fish traps positioned to catch bullheads.

The presence of unworked painted turtle bone in the feature points to a season of deposition during warm or relatively warm weather. The painted turtle is not readily captured while hibernating (from late October until late March or early April).

Birds

The Feature 1 bird assemblage is presented in Table 2.11. Only ten identifiable specimens were encountered, and half of these were on the probable level. This uncertainty reflects the fragmented condition of some of the specimens.

Except for the passenger pigeon, all of the identified birds are diving, fish-eating species, including the common loon, canvasback, greater scaup, and probably the redhead. Because of dietary and habitat preferences for these species, their recovery is probably indicative of exploitation of lacustrine habitat, and the deep-water riverine habitat found in much of the lower Don. These species are unlikely to reflect exploitation of marsh and riparian habitat, or of the upstream, upland habitat in which the Moatfield site is situated.

Table 2.11. Feature 1 bird assemblage.

Common Name	Taxon	NISP	% NISP	MNI
Common Loon	*Gavia immer*	1	10.0	1
Canvasback	*Aythya valisineria*	1	10.0	1
Diving Duck, prob. Canvasback	*Aythya cf. valisineria*	1	10.0	–
Diving Duck, prob. Redhead	*Aythya* cf. *americana*	1	10.0	1
Greater Scaup	*Aythya marila*	1	10.0	1
Diving Duck, prob. Greater Scaup	cf. *Aythya marila*	2	20.0	–
Passenger Pigeon	*Ectopistes migratorius*	2	20.0	1
Probable Passenger Pigeon	cf. *Ectopistes migratorius*	1	10.0	–
TOTAL		10	100.0	5

Seasonality information for most of the avian assemblage is presented in Table 2.12. All aquatic bird species would be present from around April 16 until the May 14, and from approximately October 21 until November 11.

All species listed in Table 2.12 either regularly overwinter in the Toronto area (greater scaup), or occasionally winter (common loon, canvasback, and redhead). Theoretically, it would be possible for all four species to be procured at some time during a single winter. It is, however, highly unlikely. To properly interpret the seasonality information, it is essential to understand how the terms "occasionally winters" and "winters" compare. In a series of annual, one-day bird counts conducted in late December in the Toronto area over a period of twenty-one consecutive years, the common loon was noted in four. No more than one individual was seen per year. Canvasback ducks were noted in three counts, and the most seen in any one year was three. The redhead duck, a third species which "occasionally winters", was spotted during three counts, and no more than two were seen per year. The greater scaup duck is, in contrast, a "wintering" species. It was reported in eighteen of the twenty-one counts, although in one year only one individual was seen. For the other 17 years the number spotted ranged from 100 to 4,723, and averaged 1,444. Diving ducks must have access to open water in order to feed. In at least one of the years when no greater scaups were seen, Lake Ontario was covered with ice out to the limit of visibility (Saunders 1947:Appendix B).

The diving, fish-eating bird species identified in the assemblage may not represent a significant food resource, but rather accidental catches during the deploy-

Table 2.12. Seasonality[1] of the Feature 1 bird assemblage.

	Common Loon	Canvasback	Redhead	Greater Scaup
Spring Migration				
Avg. Arrival	Apr. 15	Apr. 16	Apr. 9	Winters
Avg. Departure	May 29	May 14	Summers	May 18
Latest Spring Date	Occasionally Summers	May 13	Summers	Occasionally Summers
Fall Migration				
Avg. Arrival	Aug. 31	Oct. 21	Summers	Oct. 21
Avg. Departure	Nov. 18	Dec. 26	Nov. 11	Winters
Latest Fall Date	Occasionally Winters	Occasionally Winters	Occasionally Winters	Winters

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[1] Bird migration data presented here was compiled by Saunders (1947:359-361) from two separate surveys in the Toronto area. Where these surveys differed on timing, the earliest dates for the average spring and fall arrivals were selected, as were the latest dates for the average spring and fall departure dates.

ment of gill nets to catch fish in habitats in which these birds feed—the open water of Lake Ontario or the lower Don. Ethno-archaeological work by Studer (1992) demonstrates that diving birds can be attracted to fish caught in gill nets, and when this happens they can become tangled in the nets and drown. Indeed, diving, fish-eating ducks are frequently caught in gill nets set for spawning lake whitefish. The greater scaup is foremost among the diving ducks caught in this way, and loons too are frequently caught (Casselman, personal communication 1999). The most obvious alternative, but far less efficient procurement method would be bow hunting.

Three passenger pigeon bones were identified, representing the only upland game bird resource in the assemblage. All three show markedly juvenile characteristics, and could even be from the same individual. The most complete specimen, a left femur, has an unfused distal epiphysis. Bird remains at this stage of development are unusual in archaeological contexts because birds mature quickly and perhaps because bird bones at this developmental stage are fragile. Nevertheless, the left femur is almost of adult size. Reliable size evaluations could not be made of the other specimens, a right femur and a left coracoid, because the ends of each were missing.

Birds at this developmental stage probably represent a warm weather procurement event, perhaps two or three weeks prior to fall migration. Unfortunately, since the species has been extinct in Canada for approximately one century, little data are available on the number and timing of passenger pigeon broods or the timing of the fall migration. If the fall passenger pigeon migration was timed to coincide with the drop of acorns in the fall, it would be difficult to imagine a normal passenger pigeon at this developmental stage much after the end of September.

Mammals

Table 2.13 summarizes the unworked mammal assemblage. Sixty-five identified specimens were derived from fourteen or more mammal carcasses. These figures are low in comparison to the fish assemblage, despite the preservation bias acting in favour of mammalian bone that is generally denser and more robust. The mammalian assemblage is presented in inverse order of abundance with some species grouped into composite classes (Grayson 1984:98). The composite classes used here are not mutually exclusive.

White-Tailed Deer

White-tailed deer specimens account for nearly half (49%) of the unworked mammal assemblage. Much of the unidentified larger mammal material, however, is also likely white-tailed deer. At least two individuals are represented, based on the presence of two left maxillary second molars.

The pre-contact environment in the Toronto area would have been favourable to deer. The Canada Land Inventory (1971) systematically evaluated the carrying

Table 2.13. Mammal assemblage, unworked specimens.

Common Name	Taxon	NISP	% NISP	MNI
Grey Squirrel	*Sciurus carolinensis*	3	4.6	1
American Red Squirrel	*Tamiasciurus hudsonicus*	3	4.6	1
Woodchuck	*Marmota monax*	4	6.2	1
American Beaver	*Castor canadensis*	5	7.7	1
Timber Wolf	*Canis lupus*	1	1.5	1
Domestic Dog	*Canis familiaris*	2	3.1	1
American Black Bear	*Ursus americanus*	2	3.1	1
Raccoon	*Procyon lotor*	9	13.8	2
American Marten	*Martes americana*	1	1.5	1
River Otter	*Lontra canadensis*	3	4.6	1
White-tailed Deer	*Odocoileus virginianus*	32	49.2	2
TOTAL		65	100.0	14

capacity of southern Ontario for members of the deer family. The variables employed in the analysis have probably remained stable over the past two millennia—soil type, topography, drainage, and climatic factors—such that the results can be considered reliable for the period in question. Most of the land within a 25 km wide swath bordering the northwestern shore of Lake Ontario was judged to have only "slight" to "very slight" limitations to deer productivity, and there are substantial tracts of "Class 1" land which have "no significant limitations" (Toronto sheet, 30M). While the clearing of forest for agricultural crops in the vicinity of the village may have first enhanced the carrying capacity of the immediate environs, the subsistence needs of the village would have soon reduced the nearby deer population. Over time, this resource depression zone would expand, until deer might no longer be considered "locally" available (Szuter and Bayham 1989:87-88).

The deer assemblage includes an assortment of specimens from diverse parts of the body, including some infrequently encountered elements such as costal cartilages and dew claw elements (phalanges and metapodials from phalanges two and five). The post-cranial axial skeleton is unusually well represented including bones from the rib cage and pieces of cervical, thoracic, and lumbar vertebrae (Figure 2.17).

It is possible that the pattern of element representation reflects initial disarticulation of the deer carcass. Indeed, the deer assemblage includes substantial elements from Uerpmann's (1973) three categories based on the amount of soft tissue associated with the various skeletal elements including 12 elements from Class A (vertebral column [less tail], pectoral and pelvic girdles, proximal limbs); eight elements from Class B (lower limbs, brain case, mandibles, ribs, costal cartilages, sternum); and eight elements from Class C (facial bones, tail, wrist, ankle, metapodials, phalanges).

Specimen 1801, a deer frontal bone that includes an intentionally severed antler pedicle, is indicative of a fall or early winter season of deposition. Deer antlers mature in September, and they are shed, generally after mating season, in December to midwinter (Banfield 1981:392). The presence of deer antler alone is not, however, good evidence of seasonality. Antler is a raw material useful in the production of tools and of decorative objects, and may be curated for future use. Antler tools, stored raw antler, and antler manufacturing waste could be deposited at any time of year. However, a frontal bone with a severed antler is indicative of a deer kill in the fall or early winter (Henke 1971:10). Perhaps the best times to hunt deer is during the fall, when deer are attracted to mast-producing forest in significant numbers and during rutting season, from mid-October until late December, when mature deer may be less wary and may be found in groups (Banfield 1981:393; Keene 1981:100-104).

Body Area	NISP	
Dentition	3	■■■
Cranial Bones	0	
Postcranial, Axial	13	■■■■■■■■■■■■■
Pectoral Limb	5	■■■▨▨
Pelvic Limb	8	■■■■■▨▨▨
Misc. Appendicular	3	▨▨▨
Total	32	

■ =1 Specimen ▨ =1 Distal Appendicular Specimen

Figure 2.17. Deer body portion representation (unworked specimens).

Evidence of butchering was noted on several elements. Multiple cuts were noted on an axis fragment (1802), at the base of the neural arch, parallel to the vertebral column. Several cuts were found on a central rib (1724) near the angle, and another central rib (1803) may have been intentionally broken near the tubercle. Transverse cuts were noted just proximal of the elbow joint on a humerus fragment (1808), possibly left from severing the tendon of the lateral triceps. A transverse cut sawed into the surface of a caudal tibia fragment (1812) may have been positioned to sever the flexor tendons of the foot.

The determination of the minimum number of individuals was based on the presence of two left maxillary second molars. It is sometimes difficult to differentiate second and third maxillary molars in deer, so a consideration of the element identifications is important. These two teeth are definitely either second or third maxillary molars. Ordinarily, the second molar can be distinguished from the third on the basis of wear facets which form on the mesial and distal sides of teeth as a result of contact with adjacent teeth in the tooth row. A second molar can have wear facets on both mesial and distal sides, while a third molar would lack a distal contact facet because it is the last tooth in the tooth row. In this particular case, small flat wear facets are visible on the distal (posterior) surfaces of both specimens.

Garden-Hunted Species

Agricultural land clearance, crop cultivation, and related environmental changes—including village construction, accumulation of agricultural surpluses, and large scale refuse disposal—creates habitat which can support certain mammal species in higher densities than might otherwise exist in a pristine forest environment. These species are able to survive and prosper in close proximity to a human settlement due to high reproductive rates, relatively small body size, and other adaptive abilities. Losses to crops and stores can be compensated for to some extent by hunting and trapping these animals for food. Exploitation of this resource base has been termed "garden hunting" (Linares 1976).

The species which are most likely to have been part of the garden-hunted resource base have been grouped into a composite class (Grayson 1984:98).

Garden-hunted species in southern Ontario would include the snowshoe hare (*Lepus americanus*), eastern cottontail (*Sylvilagus floridanus*), the grey squirrel, red squirrel, chipmunk (*Tamias striatus*), and woodchuck, and possibly the raccoon (Thomas 1996a:151). Excluding raccoon, ten garden-hunted mammal specimens were identified accounting for one or more grey squirrel, red squirrel, and woodchuck carcasses. These comprise 15% of the unworked mammal specimens. Nine raccoon elements were identified, accounting for at least two individuals. Including raccoon in the garden-hunted category raises the total to 19 specimens, 29% of the unworked mammal assemblage, and five or more animal carcasses.

Body portion representation for the rodent specimens includes: two head area; one post-cranial axial; six major appendicular; and one distal appendicular. If raccoon specimens are included, there are: five head area; two post-cranial axial; ten major appendicular; and two distal appendicular. The dearth of rib and vertebrae specimens in the rodent sub-assemblage could be due in part to the recovery bias; squirrel vertebrae and ribs, if preserved, would easily slip through six millimetre screen. However, because only one raccoon vertebra and no raccoon rib specimens were identified, size alone may not be the deciding factor.

The presence of woodchuck indicates a season of deposition when they are not in hibernation. In Canada, male woodchucks emerge from hibernation in March, and the females in early April. They return to hibernation in October "usually before the twenty-sixth" (Banfield 1981:108).

It is also possible to estimate the season of deposition based on the labio-lingual dimension measurement of the first incisors, taken just below the occlusal wear facet. Woodchucks bear a single litter each year. Munson found that the birthing period in three regions of the United States (Maryland, Pennsylvania, and south-central Indiana) is generally limited to twenty days. This enabled him to correlate the age of juveniles, plus or minus ten days, with incisor width measurements (Munson 1984). Moatfield specimen 1652, a left mandibular first incisor, has a labio-lingual width of 4.5 mm. After adjusting Munson's (1984:398) developmental sequence to compensate for a later Canadian birthing season (Banfield 1981:109), it appears that this particular woodchuck could have died no earlier than in its first autumn.

Fur-Bearing Mammals

Remains of beaver, brown bear, American marten, and river otter comprise 11 unworked specimens from at least four individuals. This material comprises nine percent of the unworked mammal assemblage. If raccoon were included with this group because, like other species in the fur-bearing category, it provides thick fur of commercial quality, it would raise the total of fur-bearing mammal specimens to 15—close to one quarter of the unworked mammal assemblage. Because of the specimen count, it is worth considering the possibility that fur-bearing animals were processed moderately close to the catchment area of Feature 1. The timber wolf is not included in this group for reasons given below.

The body portion representation for fur-bearers excluding the raccoon is as follows: five head (including mandibles and loose teeth), three post-cranial axial, two major appendicular (pectoral and pelvic girdles and major limb bones), and one distal appendicular (wrist and ankle bones, metapodials, and phalanges). Including raccoon specimens, the figures are eight head, four post-cranial axial, six major appendicular and two distal appendicular.

All otter and marten remains came from the axial skeleton (head, vertebral column, and rib cage) as did four of the nine raccoon specimens. The otter remains consist of three maxillary teeth. The small openings which persist in the root tips of each indicate that they came from the same individual or from individuals of roughly the same age. While distal appendicular bones from bear and raccoon were identified, none were noted for otter or marten, the smallest species in this group.

Five unworked beaver specimens were identified representing one or more individuals. Three specimens were roughly comparable or slightly more developed than analogous bones in the skeleton of a beaver which died when it was approximately four months old (FA84-13). In Canada, beaver kits are born from late April until late June (Banfield 1981:161). Taking this relatively broad birthing season into account, and assuming an age at death of 4.5 months, the season of death would have been between late August and mid-December, with a midpoint of mid- and late October.

Domestic Dog

On numerous Ontario Iroquoian sites, the domestic dog was a subsistence resource which furnished a substantial amount of meat. At the nearby Over site, dog remains comprised approximately 11% of the identified unworked mammal assemblage. This total would increase to approximately 17% if micro-faunal remains were excluded from the base total. Only two dog elements were identified in the Feature 1 assemblage—most of a rib and a hip bone section.

Timber Wolf

A canine (1863) of a wolf was identified on the basis of size. It is larger than average for *Canis lupus lycaon*, the wolf subspecies closest to the Toronto area, and in the small end of the size range for *C. lupus hudsonicus*, the subspecies living around Hudson Bay. It is extremely unlikely that this tooth was derived from a domestic dog. This specimen is of interest because wolf material is rare on Iroquoian sites.

It is unfortunate that this specimen is so badly deteriorated. The root tip was definitely not drilled and although its poor condition makes evaluation difficult, it does not appear that the root had been grooved as are some bear canines, when they are used as pendants.

The Feature 1 Faunal Assemblage: Discussion and Conclusions

It would appear that Feature 1 was a stratified semi-subterranean sweat lodge or a stratified refuse-filled depression. The feature may have been filled rapidly, perhaps after a primary use, or gradually over time, perhaps even years as is the case for some sweat lodges documented on contemporary sites (Ramsden et al. 1998). On the other hand, the fish could represent one depositional event in an otherwise large, complex feature, as most of the fish remains were found in an ashy deposit in one area of the feature. Even that material, however, may have come from a number of other fish processing, ash-filled, features, containing both meal and processing refuse. Regardless of its function, the feature is isolated in terms of context, and should not necessarily be considered representative of the site's overall fishing strategies.

Some inferences may, nevertheless, be made concerning site subsistence pursuits. The bones of fall spawning lacustrine fish were found along with the remains of spring spawning fish. The former include specimens identified as lake trout, lake whitefish, Atlantic salmon and Salmonidae cf. *Prosopium* sp. or possible round whitefish. The latter group includes northern pike and *Esox* sp.; white sucker and *Catostomus* sp.; smallmouth bass and *Micropterus* sp.; yellow perch; and walleye or sauger, or *Stizostedion* sp.

During processing for storage, before smoking or drying, larger fish—such as lake trout, lake whitefish, and American eel—would have been cleaned and decapitated. While much of the lake fish appears to have been transported back to the site in fillet form, the presence of small amounts of cranial bones from these species in the assemblage may indicate that at least some of these fish were brought to the site for consumption in a fresh, unpreserved state. There is clear evidence of fall exploitation of other animals as well (e.g., deer, beaver, woodchuck). A number of the birds, on the other hand, may have been taken in either the spring or fall or even during the winter.

The spring spawning fish group comprised such a substantial portion of the overall fish assemblage—35.8% of the fish NISP, and nearly 43% the fish MNI—that at least some of this group probably represents exploitation of spawning runs. The size representation data, however, certainly indicate that, even if this material was derived from one primary context and therefore represented one depositional event, it is unlikely that it all came from a spring harvesting event. For example, the relative size estimate profile for yellow perch might resemble that of an adult population juxtaposed with a few smaller, immature fish. A catch of spawning perch taken in the springtime would consist of adult individuals, but one could also bias the age structure of a catch to selectively procure older, larger perch by fishing in deeper waters. The relative size data for yellow perch in Feature 1 might be characteristic of a springtime procurement, but it might also represent a more long term, warm weather opportunistic fishery. Also, the pike appear to be limited to the small adult size range. The relative size estimate profile for northern pike is appropriate for mature pike resident in the lower Don. A spawning pike population in the lower Don would, however, have included fish from Lake Ontario, and these would have been present and recognizable in the assemblage by their size, which they were not.

Instead, the non-lake fish component of the fish assemblage may be more characteristic of the exploitation of fish available in the Don, especially the lower Don, on an opportunistic basis and probably through the use of passive technology. It seems likely that the primary procurement methods involved various types of fish traps. This fishing effort appears to have overlapped at least to some extent, with exploitation of fall spawning salmonid species, at least as that might be interpreted on the basis of this assemblage. Indeed, the existence of the non-salmonid component of the fish exploitation strategy does not necessarily imply that a substantial effort was diverted from the salmonid fishery. Passive, unattended fishing methods require little continuous effort and can be very productive. Prior to the fishing season, one could expect considerable foot traffic up and down the Don system in preparation for the fall fishery—setting up quarters, building sheltered drying racks, gathering fire wood, and so forth. Assuming that the fish traps were already in place for the summer, the only procurement cost for bullheads, northern pike, suckers, sunfish, yellow perch, etc. would be to stop by and remove the impounded fish. Also, the Moatfield villagers could have attended to other food resources during respites between peaks in the eel run and the various salmonid spawning episodes. In this way, the fish assemblage recovered from this feature may be entirely consistent with the results of the chemical analyses of the human bone from the site, which suggests that the lacustrine salmonid fishery was very important to the site inhabitants (van der Merwe et al., Chapter 8, this volume).

THE ARCHAEOLOGY OF THE MOATFIELD VILLAGE: CONCLUSIONS

While dating an Iroquoian village on the basis of small artifact samples—such as that collected during the surface survey and limited test excavations carried out at Moatfield—is fraught with difficulties, the predominance of Iroquois Linear, Ontario Horizontal and Ontario Oblique types in the recovered ceramic assemblage and the presence of faceted ceramic pipe stems are both consistent with the temporal placement of the site at the beginning of the Middle Iroquoian period, circa A.D. 1300 (Dodd et al. 1990).

It remains, however, despite the location of the ossuary on the periphery of the village, to assess its temporal relationship to the village. Two Ontario Horizontal vessel rims were recovered, one from the surface of the ossuary and one from five metres north of the ossuary. Within the fill, a small quantity of faunal remains was recovered along with three body sherds, two of which were ribbed paddle, one piece of chert shatter and one ceramic pipe stem fragment, all of which are entirely consistent with the artifact assemblage found within the village.

Table 2.14. AMS ^{14}C dates from the Moatfield settlement feature and ossuary and calibrated date ranges.

	TO-6945	**GX-26240 AMS**	**GX-26251 AMS**	**GX-26148 AMS**
Sample	Carbonized maize	Tooth root 492b	Tooth root 1000e	Human bone
Context	Feature 1	Ossuary	Ossuary	Ossuary
$\delta^{13}C$	N/A	-14.7 ‰	-11.6 ‰	-10.5 ‰
Radiocarbon Age (B.P.)	620±60	810±40	730±40	910±40
Calibrated Age[1] (1σ)	1295-1400 cal A.D	1210-1270 cal A.D.	1260-1300 cal A.D	1040-1205 cal. A.D
Calibrated Age[1] (2σ)	1280-1430 cal A.D.	1215-1310 cal A.D.	1160-1290 cal A.D.	1020-1220 cal A.D.

[1] Calibrated ^{14}C age ranges obtained from intercepts (Stuiver and Reimer [1993], using the program CALIB 4.0 [Stuiver et al. 1998]).

In order to refine the relative dating of the site based on material culture, a series of radiocarbon dates (AMS) was run on maize remains from the village and on human bone fragments from three separate individuals within the ossuary (Table 2.14). While the calibrated date ranges for maize from Feature 1 and for two individuals from the ossuary intersect during the last quarter of the thirteenth century, the fourth date, which is also based on a sample of human bone from the ossuary is somewhat earlier. Assuming the date obtained for this fourth sample is accurate, it may represent an elder (as noted by Merrett [Chapter 6, this volume], a large percentage of the Moatfield ossuary population consists of individuals greater than 50 years of age), or a piece of bone from an ancestor maintained as an heirloom. On the whole, however, the artifact and radiocarbon data suggest that the village and the ossuary are contemporary and date to somewhere around the turn of the thirteenth century.

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