

ETHNIC IDENTITY AND DIET IN THE CENTRAL ILLINOIS RIVER VALLEY

By

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ABSTRACT

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This dissertation investigates how ethnic identity is formed and manipulated following a migration. To reach this end, food choice is examined as a deliberate cultural symbol used to negotiate ethnic identity. This research utilizes a case study which explores food choice following the pre-Columbian migration of an Oneota group into west-central Illinois. Following a migration, social identity is often renegotiated and a new ethnic identity may be formed. Diet serves as an effective vehicle for manipulating individual and group identity; therefore, examining changes in food choice following a migration presents information regarding migrant population's physical and cultural interactions with their new environment (Fishkin 2005).

The migration of Oneota people to west-central Illinois (ca. A.D. 1300) presents a unique opportunity to assess Oneota subsistence, and by proxy ethnic identity, in an area that is optimal for maize agriculture (Conrad and Esarey n.d.; King 1993; Santure et al. 1990). Archaeological investigations have revealed evidence for conflict, cohabitation, and cooperation between the migrant Oneota group and local, maize-reliant Middle Mississippian people. This project seeks to reveal if and how the Oneota altered their traditionally diverse diet to manipulate their ethnic identity as they interacted with their new neighbors. Two broad research questions were generated which focused on diet: was the Oneota diet in the central Illinois River valley different from the Middle Mississippian diet in the area, and did ethnic identity, among social categories, have the strongest impact on the west-central Oneota diet?

To explore these questions, Morton Village (IAS 11F1), a Bold Counselor Oneota habitation site, and the associated mortuary site, Norris Farms 36, were chosen as the Oneota

sample. Orendorf (IAS 11F107), a nearby Mississippian habitation and mortuary site, was chosen to represent local Middle Mississippians. Analysis of stable isotopes from seventy-five human bone samples from each of these two sites allowed for the comparison of consumed diet at Morton Village and Orendorf. The $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of the samples were examined as part of an intersite analysis and the isotope values from Norris Farms 36 remains were further explored as part of an intrasite analysis.

The intersite analysis demonstrated differences between diets at the two sites, with significantly lower $\delta^{13}\text{C}$ values and generally higher $\delta^{15}\text{N}$ values at Norris Farms 36. This indicates that there were deliberate differences in food choice between the two sites which may have been used by the inhabitants at Morton Village to signal their ethnic identity to local populations. The intrasite analysis revealed a relatively large amount of variation. The lack of homogeneity at Norris Farms 36, even within groups based on sex and age, indicates that there was not a homogenous ethnic identity at Morton Village that was prioritized over other available social identities.

In addition to shedding light on Oneota subsistence, this study demonstrates how the investigation of diet can reveal valuable information about ethnic identity and social interactions. In light of the evidence for positive and negative interactions in the area, the results of this study suggest that the inhabitants at Morton Village used food choice in a deliberate manner, likely using diet to invoke specific identities on a situational basis.

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To My Family-
those given to me by blood or by fortune

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TABLE OF CONTENTS

LIST OF TABLES	v
LIST OF FIGURES	viii
Chapter 1: Introduction	1
Section 1.1 Brief Introduction and Statement of Goals of the Study.....	1
Section 1.2 Overview of the Investigation of Ethnic Identity in Archaeology.....	1
Section 1.3 Statement of the Problem and Importance of Project	3
Section 1.4 Scope of the Project	5
Section 1.5 Research Goals.....	7
Section 1.6 Limitations of the Study.....	8
Section 1.7 Organization of the Dissertation	10
Chapter 2: Theoretical Framework	12
Section 2.1 Relevance of Project to Anthropology.....	12
Section 2.2 History of Migration Research in Archaeology.....	12
Section 2.3 How Migration Impacts Social Interactions	17
Section 2.4 Investigations of Ethnic Identity	18
Section 2.5 An “Interaction Plus” Framework for the Investigation of Ethnic Identity.....	22
Section 2.6 Modern Investigations of Ethnic Identity in Archaeology	26
Section 2.7 Food as a Cultural Symbol.....	28
Section 2.8 Overview of This Case Study	31
Section 2.8.1 Definition of Key Terms	31
Section 2.8.2 Theoretical Framework of the Case Study.....	33
Section 2.8.3 Migration and Ethnic Identity in the Central Illinois River Valley	34
Section 2.8.4 Overview of the Case Study	34
Section 2.9 Summary and Contributions of this Project.....	38
Chapter 3: Archaeological Background.....	39
Section 3.1 Brief Overview of the Oneota Tradition.....	39
Section 3.2 The Central Illinois River Valley.....	40
Section 3.3 Bold Counselor Oneota.....	42
Section 3.4 Early Investigations of Morton Village and Norris Farms 36 (IAS 11F1) ..	44
Section 3.4.1 Overview of the Morton Village site	44
Section 3.4.2 Norris Farms 36 Mortuary Complex.....	45
Section 3.4.3 Norris Farms 36 Skeletal Analysis	48
Section 3.4.4 Morton Village Subsistence Information.....	48
Section 3.4.5 Morton Village/Norris Farms 36 Social Interaction	51
Section 3.5 Recent Investigations at Morton Village	56

Section 3.6 Overview of the Middle Mississippian Tradition in Central Illinois	58
Section 3.6.1 The Archaeological Context of the Orendorf Site	59
Section 3.6.2 The Mortuary Complex.....	61
Section 3.6.3 Skeletal Analyses of Orendorf Remains	62
Section 3.6.4 The Nature of External Relationships at Orendorf	63
Section 3.6.5 Orendorf Subsistence Information.....	65
Section 3.7 Summary	66
Chapter 4: Research Questions, Materials, and Methods	68
Section 4.1 Research Questions.....	68
Section 4.2 Rationale Affecting the Use of Stable Isotope Analysis for this Project	71
Section 4.2.1 Rationale for Isotopic Analysis of Human Remains.....	71
Section 4.2.2 Rationale for Isotopic Analysis of Faunal Remains	72
Section 4.2.3 Rationale for Analyzing Collagen	73
Section 4.3 Criteria for Selecting Samples and Sample Collection Methods.....	76
Section 4.3.1 Sampling Criteria for Human Remains.....	76
Section 4.3.2 Sampling Methods for Human Remains.....	78
Section 4.3.3 Sampling Criteria for Faunal Remains	80
Section 4.3.4 Sampling Methods for Faunal Remains.....	81
Section 4.4 Isotopic Analysis Procedures	81
Section 4.4.1 Cleaning of the Samples	82
Section 4.4.2 Demineralization of the Samples	83
Section 4.4.3 Analysis of the Bone Samples in the Mass Spectrometer.....	86
Section 4.5 Validation of Usable Specimens	89
Section 4.6 Adjustment of Burial Categories	91
Section 4.6.1 Adjustment of Demographic Categories.....	92
Section 4.6.2 Determination of Warfare Category	94
Section 4.6.3 Determination of Disease Category	95
Section 4.6.4 Grave Good Category Development.....	96
Section 4.6.5 Other Notes about Burial Category Decision	96
Section 4.6.6 Selection of Norris Farm Burials for Osteobiographical Analysis.....	97
Section 4.7 Statistical Analysis of the Isotope Values.....	97
Section 4.7.1 Statistical Analysis Using SPSS	98
Section 4.7.2 Statistical Analysis Using ArcGIS.....	98
Section 4.7.3 Summary of Materials and Methods.....	100
Chapter 5: Floral and Faunal Analysis.....	101
Section 5.1 Morton Village/Norris Farms 36 Subsistence Information	101
Section 5.2 Orendorf Subsistence Information	103
Section 5.3 Isotope Analysis of Morton Village/Norris Farms 36 Faunal Remains	104
Section 5.3.1 Results of the Isotope Analysis of Morton Village Fauna.....	105

Section 5.3.2 Comparisons with Other Archaeological Investigations of Faunal Isotopes	105
Section 5.3.2.1 Fish.....	108
Section 5.3.2.2 Birds.....	109
Section 5.3.2.3 Mammals.....	109
Section 5.3.2.3.1 Deer.....	110
Section 5.3.2.3.2 Dogs	110
Section 5.3.2.4 Turtles	111
Section 5.3.2.5 Freshwater Mollusks.....	111
Section 5.3.3 Stable Isotopes of Floral Remains	112
Section 5.3.4 Interpretation of Stable Isotope Results.....	113
Section 5.4 Summary	116
Chapter 6: Comparative Results	117
Section 6.1 Overview of Sites and Brief Demographic Overview	118
Section 6.2 Statistical Analysis.....	119
Section 6.2.1 Intersite Analysis of Subadults	119
Section 6.2.2 Intersite Analysis of Adults	123
Section 6.2.3 Intersite Comparisons Between Sites for Different Sexes	125
Section 6.2.4 Intersite Comparisons Between Sites for Evidence of Warfare	130
Section 6.2.5 Intersite Comparisons Between Sites for Different Interment Types	136
Section 6.3 Orendorf Isotope Values in Context	142
Section 6.4 Norris Farms 36 Isotope Values in Context.....	143
Section 6.5 Summary of Intersite Differences.....	144
Chapter 7: Results of Norris Farms 36 Intrasite Analysis	148
Section 7.1 Brief Overview of the Norris Farms 36 Sample	148
Section 7.2 Intrasite Statistical Analysis.....	150
Section 7.2.1 Effects of Demographic Groups on Isotope Values	151
Section 7.2.2 Variation in Isotope Values Related to Warfare and Trauma Status.....	158
Section 7.2.3 Variation in Isotope Values Related to Interment Type	160
Section 7.2.4 Disease-Related Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ values at Norris Farms 36	164
Section 7.2.5 Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ values Associated With Grave Goods	165
Section 7.2.6 Spatial Variation at Norris Farms 36	170
Section 7.3 Osteobiographical Analysis of Select Norris Farms 36 Individuals.....	178
Section 7.3.1 Summary of Information Obtained Through Osteobiographical Analysis	206
Section 7.4 Summary of Norris Farms 36 Intrasite Analysis	207

Chapter 8: Discussion and Conclusion	210
Section 8.1 Introduction.....	210
Section 8.2 Intersite Comparison.....	212
Section 8.2.1 Comparison of Mississippian and Oneota Carbon Isotope Ratios Between the Two Sites	213
Section 8.2.2 Comparison of Oneota and Mississippian Nitrogen Isotope Ratios Between the Two Sites	217
Section 8.2.3 Summary and Implications of Intersite Differences	219
Section 8.3 Intrasite Analysis of Norris Farms 36.....	222
Section 8.4 Summary of Intersite and Intrasite Analyses	225
Section 8.5 Contributions of This Study.....	227
Section 8.6 Future Research	229
Section 8.7 Conclusions.....	230
APPENDICES	
Appendix A: Published Values for Faunal Stable Isotopes from Collagen.....	234
Appendix B: Full List of Usable Human Samples from Norris Farms 36 and Orendorf	241
Appendix C: Published Values for Human Stable Isotopes from Collagen	246
Appendix D: Grave Good Associated Variation in Adult $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values...	254
Appendix E: Grave Good Associated Variation in Adult Female $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values	258
Appendix F: Grave Good Associated Variation in Adult Male $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values	262
Appendix G: Grave Good Associated Variation in Subadult $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values	266
Appendix H Spatial Analysis of Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values at Norris Farms 36	270
Appendix I: Copyright Permission Letter.....	273
WORKS CITED	275

LIST OF TABLES

Table 3.1 Cultural Chronology of Morton Village and the Orendorf Site.....	60
Table 4.1 Number of Individuals Sampled in Each Age Category.....	78
Table 4.2 Summary of Collagen Yields.....	84
Table 4.3 Results from Testing of Collagen Yields.....	85
Table 4.4 Number of Usable Samples Each Age Category	90
Table 4.5 Number of Usable Faunal Samples	91
Table 4.6 Number of Usable Samples by Specific Demographic Group	93
Table 5.1 Stable Isotope Ratios of Faunal Remains from Morton Village.....	106
Table 5.2 Published Isotope Values for Floral Remains.....	113
Table 5.3 Protein Amounts for Different Food Resources	115
Table 6.1 Comparison of $\delta^{13}\text{C}$ (‰) Values from Subadult Groups at Both Sites	121
Table 6.2 Comparison of $\delta^{15}\text{N}$ (‰) Values from Subadult Group at Both Sites.....	121
Table 6.3 Comparison of $\delta^{13}\text{C}$ (‰) Values from Broad Demographic Groups at Both Sites	124
Table 6.4 Comparison of $\delta^{15}\text{N}$ (‰) Values from Broad Demographic Groups at Both Sites	125
Table 6.5 Comparison of $\delta^{13}\text{C}$ (‰) Values from Broad Demographic Groups at Both Sites	126
Table 6.6 Comparison of $\delta^{15}\text{N}$ (‰) Values from Broad Demographic Groups at Both Sites	127
Table 6.7 Comparison of $\delta^{13}\text{C}$ (‰) Values from Broad Demographic Groups at Both Sites	131

Table 6.8 Comparison of $\delta^{15}\text{N}$ (‰) Values from Broad Demographic Groups at Both Sites	132
Table 6.9 Demographic Breakdown of Interment Types.....	136
Table 6.10 Intersite Comparison of $\delta^{13}\text{C}$ (‰) Values of Single Interments by Age Group.....	137
Table 6.11 Intersite Comparison of $\delta^{15}\text{N}$ (‰) Values of Multiple Interments by Age Group.....	138
Table 6.12 Intersite Comparison of $\delta^{13}\text{C}$ (‰) Values of “Typical” and “Atypical” Interments	140
Table 6.13 Intersite Comparison of $\delta^{15}\text{N}$ (‰) Values of “Typical” and “Atypical” Interments	141
Table 7.1 Sex-Related Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36	151
Table 7.2 Age-Related Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36	155
Table 7.3 Age-Related Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36 in Individuals Over 5 years of Age	158
Table 7.4 Adult Trauma Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36.....	159
Table 7.5 Single/Multiple Burial Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36	160
Table 7.6 Skeletal Position of Adult Norris Farms 36 Sample.....	163
Table 7.7 Adult Skeletal Position Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36	163
Table 7.8 Disease-Related Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36	165
Table 7.9 Grave Good Associated Variation in Adult $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) Values	167

Table 7.10 Grave Good Associated Variation in Adult Female $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) Values	168
Table 7.11 Grave Good Associated Variation in Adult Male $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) Values.....	168
Table 7.12 Grave Good Associated Variation in Subadult $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) Values	169
Table 7.13 Spatial Analysis of Mortuary Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) Values	170
Table A.1 Published Values for Faunal Stable Isotopes from Collagen	234
Table B.1 Full List of Usable Human Samples from Norris Farms 36 and Orendorf.....	240
Table C.1 Published Values for Human Stable Isotopes from Collagen.....	246
Table D.1 Grave Good Associated Variation in Adult $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values	254
Table E.1 Grave Good Associated Variation in Adult Female $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values	258
Table F.1 Grave Good Associated Variation in Adult Male $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values.....	262
Table G.1 Grave Good Associated Variation in Subadult $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values	266
Table H.1 High/Low Clusters of Mortuary Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values.....	270
Table H.2 Spatial Autocorrelation of Mortuary Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values	271

LIST OF FIGURES

Figure 3.1 Map of Central Illinois River Valley	41
Figure 3.2 Locations of Norris Farms 36 and Orendorf	61
Figure 4.1 Example Photograph of Norris Farms 36, Burial 11 Pre-sampling.....	79
Figure 4.2 Example Photograph of Norris Farms 36, Burial 11 Post-sampling.....	80
Figure 5.1 Isotope Ratios of All Usable Human and Faunal Samples.....	107
Figure 5.2 Isotope Ratios in Modern New World Food Groups.....	107
Figure 6.1 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Values for All Subadults Between Sites	120
Figure 6.2 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Neonate at Both Sites	122
Figure 6.3 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Values for All Adults Between Sites	124
Figure 6.4 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Young Adult Females at Both Sites.....	127
Figure 6.5 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Middle Age Adult Females at Both Sites	128
Figure 6.6 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Older Adult Females at Both Sites.....	128
Figure 6.7 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Young Adult Males at Both Sites	129
Figure 6.8 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Middle Age Adult Males at Both Sites	129
Figure 6.9 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Older Adult Males at Both Sites	130
Figure 6.10 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Adults with Evidence of Warfare.....	132
Figure 6.11 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Adults Without Evidence of Warfare.....	133

Figure 6.12 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Females with Evidence of Warfare	133
Figure 6.13 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Females without Evidence of Warfare	134
Figure 6.14 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Males with Evidence of Warfare	134
Figure 6.15. Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Males Without Evidence of Warfare	135
Figure 6.16 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Norris Farm 36 Adults with evidence of warfare, compared to Orendorf adults without evidence of warfare	135
Figure 6.17. Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Norris Farm 36 Adults without evidence of warfare, compared to Orendorf adults with evidence of warfare	136
Figure 6.18 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Single Adult Burials at Both Sites	138
Figure 6.19 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Single Subadult Burials.....	139
Figure 6.20 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Multiple Adult Burials at Both Sites.....	139
Figure 6.21 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Adult Single Norris Farms 36 Burials and Adult Multiple Orendorf Burials.....	141
Figure 6.22 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Adult Multiple Norris Farms 36 Burials and Adult Single Orendorf Burials	142
Figure 7.1 Spatial Distribution of Age Groups at Norris Farms 36.....	149
Figure 7.2. Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ for All Individuals Between Sites	152
Figure 7.3 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Values for Females and Males at Norris Farms 36.....	153
Figure 7.4. Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Values for Females and Males at Norris Farms 36.....	154
Figure 7.5 Age-Related Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ values at Norris Farms 36.....	156
Figure 7.6 Age-Related Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ values at Norris Farms 36.....	157

Figure 7.8 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Single and Multiple Burials	161
Figure 7.9 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Adult Single and Adult Multiple Burials	162
Figure 7.10 Spatial Distribution of Adult $\delta^{13}\text{C}$ Values at Norris Farms 36.....	171
Figure 7.11 Spatial Distribution of Beads at Norris Farms 36	174
Figure 7.12 Spatial Distribution of Projectile Points at Norris Farms 36.....	175
Figure 7.13 Spatial Distribution of Perimortem Trauma at Norris Farms 36.....	177

Chapter 1: Introduction

Section 1.1 Brief Introduction and Statement of Goals of the Study

This project investigates how ethnic identity is formed and manipulated following a migration. To reach this end, food choice is examined as a deliberate cultural symbol used to negotiate ethnic identity. This research utilizes a case study which explores food choice following the pre-Columbian migration of a Native American group into west-central Illinois. Following a migration, social identity is often renegotiated and a new ethnic identity may be formed. One mechanism for manipulating individual and group identity is diet; a key component of this is the development of “cultural taste” (Forero and Smith 2011). In diasporic communities, for example, the consumption of “authentic” “traditional” foods serves an important role in negotiating social identity (Fishkin 2005). As such, the examination of food choice following a migration has a particularly strong potential to reveal valuable information about ethnic identity.

Section 1.2 Overview of the Investigation of Ethnic Identity in Archaeology

Over the past 20 years, archaeologists have shown an interest in understanding migration and the resultant effect on ethnic identity as aspects of cultural behavior. Archaeologists have begun to move beyond proving that past migrations have occurred and are investigating how migration impacted social interaction. There is growing appreciation for the complex and highly variable nature of relationships between ethnic groups (Stone 2003:31). Closely associated with this focus on social interaction is the problem of ethnic identity (Snow 1995).

Anthropologists recognize that ethnic identity is both socially constructed and highly mutable, seeing ethnicity as an instrument for social power that has a dependent reality (Gardner

2007; Knudson and Stojanowski 2009). Ethnic identity is an effective tool used to mediate social relations and negotiate access to resources (Jones 1997:72). This study contributes to the understanding of how groups manipulate their ethnic identity following a migration through an examination of the relationship between social interaction and identity markers from a bioarchaeological perspective.

The theoretical framework of this dissertation draws from both interaction and practice theories of ethnic identity. Specifically, this framework is informed by the recognition that the active negotiation of ethnic identities through social interaction takes place within the context of specific cultural practices and historical experiences through which the perceptions of similarities and difference are formed (*habitus*). Although individuals and groups may not have a perfect knowledge of their *habitus*, they are aware of the material and social constraints which affect them, such as status, gender, and kin relations, and actively negotiate their position in society within these constraints (Stone 2003:41). By appreciating the variability of the constraints within which individuals work, this framework acknowledges the importance of the historical and structural context on individual perception without accepting the assumptions regarding homeostasis inherent in practice theory (Stone 2003:42). This framework, which denies the passivity of individual actors about the structure in which they operate, allows archaeologists to appreciate the variability of responses to the arrival of a new migrant group.

Based on this theoretical foundation, investigating ways in which ethnic identity was either emphasized or deemphasized has the potential to yield valuable information about social interactions between prehistoric groups following a migration. To reach this potential, archaeologists must examine how and when groups emphasized or deemphasized their ethnic identity. Ethnic identity is reified through the use of case-specific identity markers. Changes in

the way these symbols are produced, reproduced, and/or transformed over time can shed light on how ethnic identity has been manipulated in the past (Baumann 2004:14). By focusing on intentional and/or symbolic aspects of the archaeological assemblage, archaeologists can begin to appreciate how ethnic identity is reified through active and intentional manipulation of identity and its public display.

As such, it is important for archaeologists to investigate the utility of individual markers of ethnic identity as tools for the investigation of past social interactions. This is particularly true for bioarchaeologists, who are uniquely suited to explore how individuals used their physical bodies in the construction of social identity (Knudson and Stojanowski 2009:1). This project will contribute to bioarchaeology as a whole by exploring the utility of examining consumed diets as a vehicle of ethnic identity reification.

Section 1.3 Statement of the Problem and Importance of Project

Food is a powerful cultural symbol which can be used to manipulate ethnic identity. Given the central role food plays in ethnogenesis, “the informative power of food is as yet only partially tapped” (Twiss 2012:38). To help address this void, this project examines food choice as a deliberate cultural symbol used to manipulate ethnic identity following a prehistoric migration.

As anthropologists seek to better understand the late prehistoric period in eastern North America, the understanding of food choice plays a central role. In particular, the relationship between maize and Mississippianization is often emphasized. Anthropologists recognize that the practice of selecting and consuming food serves as a vehicle for cultural concepts. Food can be used to recreate or reaffirm social identity and by extension, studies which focus on food choice

can reveal valuable information into past cultural dynamics (Bell 2003; Fischler 1988; Hastorf and Johannessen 1994).

The migration of Oneota people to west-central Illinois (ca. A.D. 1300) presents a unique opportunity to assess Oneota subsistence, and by proxy ethnic identity, in an area that is optimal for maize agriculture (Conrad and Esarey n.d.; King 1993; Santure et al. 1990). As migrants to the area, the Oneota people at Morton Village (IAS 11F1) had access to rich agricultural lands capable of supporting intensive maize agriculture. In addition, they were in regular contact with maize-reliant Middle Mississippians, with recent excavations at Morton Village focusing on evaluating the social context of Oneota and Middle Mississippian interaction within the village, including the possibility of cohabitation. This dissertation seeks to reveal how the Oneota migrants maintained or altered their traditionally diverse diet as a result of this interaction.

The Oneota Tradition appeared around A.D. 1000 and existed as a recognizable archaeological tradition in eastern North America until around A.D. 1750 (Brown and Sasso 2001). Morton Village and the associated Norris Farms 36 cemetery (IAS 11F1) are archaeological sites believed to be the result of a migration of a group of Oneota people to the central Illinois River valley, most likely from the north or west. Morton Village, the focus of this project, is a large, multicomponent site in Fulton County, Illinois (King 1990). The associated Norris Farms 36 cemetery is situated on a bluff edge overlooking the Illinois River valley in close proximity to Morton Village. The Norris Farms 36 cemetery contained 264 burials which makes it the largest Oneota burial sample available for study.

A great number of individuals at Norris Farms 36 exhibited trauma, with approximately thirty-four percent of adults meeting a violent death (Milner 1999). As a result of these studies, early interpretations of the late prehistoric period in west-central Illinois focused on evidence for

conflict and warfare (see Milner, Anderson and Smith 1991; Milner, Smith, and Anderson 1991; and Milner 1999). Despite this focus on conflict, early research also noted conspicuous Middle Mississippian cultural influences on the Oneota inhabitants at Morton Village (Esarey and Santure 1990:164) and non-specific interaction in the region. Recent investigations at Morton Village have yielded additional evidence for positive interactions between Oneota and Middle Mississippian people. Archaeological evidence suggests that, at least for part of the occupation, both groups lived at Morton Village simultaneously. At this time, there is little evidence within the site that indicates a spatial segregation of Oneota and Middle Mississippian people. Instead, a picture of regular and cooperative interaction appears. It is not uncommon, for example, to find Oneota ceramics in a Middle Mississippian house and vice versa.

In light of these recent excavations, it is clear that focusing on the Oneota as an intrusive group holding tightly to their cultural identity and plagued by regular raiding by Middle Mississippian parties (e.g. Milner, Anderson, and Smith 1991), obscures the complexity of intergroup relationships in west-central Illinois during the late prehistoric. Further investigation into ethnic identity is needed to help anthropologists develop a clearer picture of cultural interactions during this period. This dissertation will contribute not only to the specific understanding of Oneota diet but will also serve as a demonstration of how food choice can lend insight into ethnic identity and the social interactions of past populations.

Section 1.4 Scope of the Project

This research contributes to such an understanding by assessing Oneota subsistence, and by proxy ethnic identity, in an area otherwise inhabited by maize-focused Middle Mississippian people. Studies of food choice following migration typically center on a comparison of the

immigrants to the local population (i.e. Phinney et al. 2001). Following this precedent, this dissertation will interpret Oneota diet at Morton Village in comparison to the neighboring Middle Mississippian diet in the central Illinois River valley, as represented by the Orendorf site. To this end, analysis of stable isotopes will be performed on skeletal remains from Norris Farms 36 and compared to remains from the Middle Mississippian habitation and mortuary site, Orendorf. Stable isotope analysis of bone is the most commonly used method of analyzing consumed diet. Analysis of $\delta^{13}\text{C}$ values can provide valuable information regarding the contribution of C4 plants (in eastern North American, maize is the most commonly used C4 plant) to the diet (Bumsted 1981; Schwartz and Schoeninger 1991). In addition, in areas where most faunal resources are believed to be terrestrial in nature, changes in $\delta^{15}\text{N}$ values can generally be assumed to reflect changes in terrestrial animal protein intake, with a decrease in values reflecting a decrease in meat consumption and/or a decrease in the trophic levels of animal protein consumed (White et al. 2001a).

The Orendorf site (IAS 11F107) is a Middle Mississippian temple town in the central Illinois River (Conrad 1991). It is located roughly 20 kilometers upriver of the Morton Village site on a bluff overlooking the Illinois River and Rice Lake. (Esarey and Conrad 1981; Google 2011; Wilson 2010). Though the accepted chronology (see Table 3.1) places the Orendorf phase in an earlier period than the Bold Counselor Oneota occupation of Morton Village, some radiocarbon dates indicate that the occupation at Orendorf extended longer, with eleven calibrated radiocarbon dates for Orendorf yielding a summed 2-sigma probability for the occupation extending from A.D. 1149 to 1320 (Wilson 2010:66). In addition, when these radiocarbon dates are interpreted in conjunction with the multiple rebuilding events at Orendorf, it is possible that the Orendorf site was occupied longer than the originally estimated 80 to 100

years (Wilson 2010:67). In addition to the potential that Orendorf and Morton Village were at least somewhat coeval, there are other reasons why Orendorf is an ideal site to use in a comparison with Morton Village. As a large Middle Mississippian site in the central Illinois River valley, Orendorf provides information on social interactions in the area, including information regarding local and nonlocal trade (Conrad 1991). Orendorf also has a large skeletal population which is comparable to Norris Farms 36.

Section 1.5 Research Goals

As migrants to the Central Illinois River Valley, the Oneota people at Morton Village were in contact with Middle Mississippians. This project explores what effect this contact had on ethnic identity. Following a migration, groups have a variety of potential options, ranging from assimilation to the drawing of ethnic boundaries. Food choice has the potential to present some valuable information about how the groups interacted.

There are two main research goals of this project. The first is to examine the utility of consumed diet as a tool for investigating ethnic identity. The second main research goal of this project is to learn more about Oneota food choice in the central Illinois River valley. In an attempt to address the latter question of how the migrant Oneota population interacted with their Middle Mississippian neighbors, I have generated two broad research questions focusing on diet: Was the Upper Mississippian diet at Morton Village/Norris Farms 36 different from the Middle Mississippian diet at the Orendorf site; and was the diet at Morton Village/Norris Farms 36 homogenous? These questions are presented in more detail in Chapter Four.

With an appreciation that different types of identities may cross-cut each other in various ways, the populations at Morton Village/Norris Farms 36 and Orendorf will be broken down

along common identity categories, such as age and gender, in order to limit any confounding effect on ethnic identity. Additional criteria that I attempt to control for include evidence of warfare, disease, and mortuary treatment.

If the Oneota in the central Illinois River valley represented a diasporic group with a longing and reverence for their “homeland”, it would be expected that their food choice would focus on maintaining their original diet as much as possible (Bell 2003). This strategy would result in a diet significantly different than Middle Mississippians in the area. In addition, continually reifying a traditional ethnic identity would likely involve routine consumption of traditional food, likely prioritizing the ethnic identity over other social categories, resulting in a homogenous diet within the site.

Section 1.6 Limitations of the Study

There are several limitations to this study, including the question of the appropriateness of Orendorf as a comparison site, difficulty in interpreting stable isotopes, the possibility of sampling bias, and differences in data collection and reporting.

The archaeological site of Orendorf was chosen as the Middle Mississippian comparison site. Though the Oneota occupation at Norris Farms 36 is not believed to be strictly contemporaneous with the Middle Mississippian site of Orendorf, it serves as a proxy for Middle Mississippian for several reasons, as outlined earlier. Though not exactly contemporaneous, the occupations at the two sites had the possibility of being at least somewhat coeval. In addition, Orendorf is a large Middle Mississippian site located only about 20 km upriver from Norris Farms 36 and the inhabitants at both are believed to have had potential access to a similar array of floral and faunal resources. Orendorf is a “typical” Middle Mississippian temple town and has

yielded valuable information regarding social interactions in the central Illinois River Valley (Conrad 1991; Steadman 2008a). Finally, Orendorf is associated with a large, fairly well-preserved skeletal population that was appropriate for isotope analysis.

For this project, stable isotope values from the Norris Farms 36 population are presumed to be representative of the Bold Counselor Oneota diet in the central Illinois River valley. Isotope values from the Orendorf population are presumed to be representative of the Middle Mississippian diet in the central Illinois River valley. It is outside the scope of this project to assess the appropriateness of each site as a representative for its relative archaeological tradition beyond a simple comparison of the results from this project with published stable isotope values from other archaeological samples.

Stable isotope analysis of human bone reveals relative information about consumed diet only. It does not yield specific measurements of the amount of maize or other resources that were consumed nor does it provide a snapshot of a moment in time. Instead, isotope values provide information about the composite diet of individuals, so information about culturally important dietary events, such as feasts, is not easily accessible. Because multiple factors influence a given individual's isotopic signature, the difficulty in interpreting isotope values is a limitation in this study. However, stable isotope analysis does have the potential to give a broad overview of diet and the large sample sizes from the two populations also help offset this limitation.

In order to draw meaningful conclusions from isotope ratio results, it is critical that the investigator has an understanding of locally available food resources and their isotope signatures. In order to gain such an appreciation for the local isotopic variation, forty faunal samples were taken from the Morton Village assemblage associated with the Norris Farms 36 population. Finally, stable isotope analysis of bone does not reveal information about the relationship of food

choice to barriers to food acquisition, be it environmental or social, so when interpreting isotope values as reflective of dietary choice, it must be kept in mind that multiple factors influence food choice.

Due to the size of the skeletal collection of both sites, a sampling strategy was used and is described in Chapter Four. Fifty bone samples were taken from Oneota adults interred at Norris Farms 36 and from twenty-five subadults. Fifty adult and twenty-five subadult bone samples were also taken from Orendorf burials. This sample is designed to represent an equal number of males, females, and subadults from the two sites. However, it is possible that this sample does not accurately represent the total population living at the two sites. For both Norris Farms 36 and Orendorf, it is unknown whether additional cemeteries served the two sites.

In order to attempt to control for other social identities which could have affected diet, skeletal populations from both sites were reduced into several smaller subgroups for various analyses. For example, a complete reassessment of age, sex, and pathology of the skeletal remains was impossible. Such divisions rely upon secondary data gathered and generously shared by previous researchers. As a result, the categories used in this project are based on information presented by other researchers. Likewise, categories based upon mortuary treatment have been developed from information available in print (in the case of Norris Farms 36) or made available to me (in the case of Orendorf). I took every possible precaution in ensuring my information was as complete and accurate as possible.

Section 1.7 Organization of the Dissertation

The next chapter builds the theoretical framework of this dissertation. The history of migration and ethnicity research in archaeology is presented in order to situate the current study.

An outline of the case study and its goals is also included in Chapter Two.

Chapter Three provides background information about the Oneota and Middle Mississippian traditions. The relevant archaeology and physiographic characteristics of the central Illinois River valley are discussed. Site descriptions of Morton Village/Norris Farms 36 and Orendorf are included in order to put this research into the appropriate context.

Chapter Four outlines the materials and specific methods used in this study. Justifications are made for the methods chosen for this project. Great care is taken to be explicit about each decision made in order to ensure this study could be replicated.

Chapter Five presents information regarding floral and faunal resources, including the results of stable isotope analysis of a sample of faunal remains from Morton Village/Norris Farms 36. The results of the intersite comparison are included in Chapter Six. The intrasite analysis of Norris Farms 36 is found in Chapter Seven.

Chapter Eight contains the discussion and conclusions. Interpretation of both intersite and intrasite analyses is provided and placed into a broader archaeological context. Chapter Eight also notes the contributions of the study, makes suggestions for future research, and summarizes the key findings of this dissertation.

Chapter 2: Theoretical Framework

Section 2.1 Relevance of Project to Anthropology

This project investigates how ethnic identity is formed and manipulated following a migration. To reach this end, food choice is examined as a deliberate cultural symbol used to manipulate ethnic identity. The problem of migration is a topic of interest to many fields, including history, sociology, geography, and, of course, anthropology. The matters of who moves, when they move, why they move, and what happens after they move are all addressed in various ways and within various scales by these different disciplines (Brettell 2003:1). Anthropology as a discipline is interested in human diversity across time and space, including cultural differences between social institutions, cultural beliefs, and communication styles. Such differences are brought into relief by the process of migration when two disparate groups come into contact for the first time.

Section 2.2 History of Migration Research in Archaeology

The history of migration research in archaeology is complicated. The popularity of migration as a research topic was heavily influenced by broader theoretical shifts that impacted the discipline as a whole. The following sections will focus on the impact of these theoretical trends on migration research in archaeology.

The late nineteenth century brought a developing understanding of variability in the archaeological record, leading many to question the models of cultural development intrinsic to cultural-evolutionism. In addition, the concept of the hierarchical categorization of groups presented by culture-evolutionary theorists began to fall out of favor. The development of

culture-historical archaeology appears to have been a response to the decline of culture-evolutionary archaeology and the coincident promotion, by anthropologists such as Franz Boas, of the understanding of cultures as geographically and temporally distinct entities, each with their own unique historical development of traits and resultant material culture (Cameron 1995; Trigger 2007). Culture-historical archaeology often focused on ethnicity, including a nationalist political agenda, particularly in Europe. Many culture-historical archaeologists focused on trying to identify direct cultural and/or ethnic links from prehistoric group peoples to modern groups.

Culture-historical archaeologists also focused on creating typologies and classifying sites based on identifiable traits in the material record. Archaeologists from this school of thought postulated that culture changes could be predominantly explained either by diffusion or migration (Cameron 1995). Diffusion referred to the spread of ideas from one culture into another via trade or emulation. Migration referred to the physical movement of people into a new area. Migration, the focus of this project, was viewed by archaeologists from the culture-historical school as a viable explanation for the colonization of a new area or the replacement, in a particular geographic location, of an indigenous population with a new population. As a result, many archaeologists in the late nineteenth and early twentieth century would explain changes in material culture by postulating that a migration had occurred (Cameron 1995:106).

The 1960s and 1970s brought radical changes to the field of archaeology with the rise of processual archaeology. Processual archaeology grew, in part, out of a perception that culture-historical archaeologists did not investigate the human experience. Under the culture-historical framework, archaeologists did not perceive the archaeological record as a direct view into cultural processes of the past; culture-historical archaeologists were most focused on collecting, categorizing, and seriating artifacts, explaining variability using diffusion or migration.

This widespread and uncritical use of migration by culture-historical archaeologists led to the abandonment of migration as a viable explanation for culture change by processual archaeologists (Cameron 1995). Migration as a theory was viewed as an inadequate explanation for specific cases, not compatible with the systemic or nomothetic explanations which characterized processual archaeology (Cobb 2005:565).

The end result of this retreat from migration as an explanatory mechanism during the processual era is that migration was excluded from the majority of archaeological studies. According to Snow (1995:62), this rejection of migration by processual archaeologists led them to focus the burden of proof on migration hypotheses, leaving presumed immobility as the default hypothesis.

Despite the marked rejection of migration as a research topic in archaeology during the 1960s, 1970s and 1980s, other disciplines such as geography, demography, history, and genetics were advancing investigations into migration. During this period, for example, multiple journals were developed in other disciplines dedicated to the subject of migration (Burmeister 2000:539).

During the 1990s, after three decades of disregarding migration as an explanatory force, archaeologists began to show a renewed interest in migration. This new enthusiasm for migration research is likely due to many factors, including the recognition of the limitations of in situ development theories (see Snow 1995), increasing focus on interregional interaction, the application of world systems theory, and an intensified focus on ethnicity (Cameron 1995). This modern research argues that migration, the reconstitution of place, and the manipulation of social boundaries were commonplace prehistorically. Despite the tentative, renewed interest in migration, the antimigration bias of the processual era has not been completely eradicated, particularly the viewpoint that migration is a “simple” explanation (e.g. Clark 1994). This

insidious notion persists despite both archaeological and ethnohistoric research demonstrating the importance of population movement prehistorically (e.g. Anthony 1990; Burmeister 2000; Cameron 1995; Cobb 2005). Perhaps this belief that migration is a simple explanation is obscuring a more gloomy fact – migration is, in reality, an extremely difficult process to investigate. According to Snow (1995:72), migration is a complicated process intricately woven with various other complicated problems such as site age, site duration, ethnicity, etc., all of which introduces a great deal of variability into archaeological investigations. Despite the messiness of migration, this process is worth investigating as it has great potential to elucidate how the production of place and identity are manipulated. For example, both Cobb (2005) and Pauketat (2003) outline specific examples of migration in North America during the late prehistoric period, with a general acceptance that movement of prehistoric groups played a major role in the “Mississippianization” of Woodland societies (Cobb 2005:567).

As archaeologists once again began studying migration, they began attempting to tackle some of the variability that complicates the analysis of migration. A major challenge is determining the correct scale of analysis. Another major question facing archaeologists investigating migration is fundamental: how can migration be identified in the archaeological record? Migrations rarely involve large groups moving into unoccupied areas or the total replacement of one group with another. Instead, migrations tend to be gradual demographic processes (Hill et al. 2004).

Over the last couple decades, archaeologists developed models to investigate migration on multiple scales, the appropriateness of which is determined based on the specific research question being investigated (Hill et al. 2004). Anthony (1990) suggested that it was important to identify general structural conditions, such as push and pull factors, which favor the occurrence

of migration. He talked about the difference between short-distance and long-distance migration and noted that long-distance migrations involve a movement across a cultural boundary which can appear to “leapfrog” geographic regions. Long-distance migrations would rarely include the entire homeland population and may involve a few “apex families”, two influences which have the potential to introduce demographic and stylistic biases. Long-distance migrations also often have a counterstream of migration running antiparallel to the migration stream from the circumscribed “homeland” to a specified destination (Anthony 1990:903). However, Cameron (1995:113) notes that if a migration causes the “homeland” to be abandoned, the idea of migration stream and counterstream would be less relevant. Likewise, Cameron (1995:112) notes that concepts such as “migration stream” and “return migration” are terms borrowed from modern studies where the individual or family are important social units; prehistorically, there was likely a stronger focus on the group, which would render the models of migration streams or counterstreams inapplicable. Though presumably rare, long-distance migrations offer the opportunity to investigate the effects of contact between two or more distinct social groups.

Providing archaeological proof that migration occurred is critical, although at this time, there is no straightforward procedure that can reliably identify a specific migration and its origin (Burmeister 2000:553). As noted by several archaeologists (Burmeister 2000; Cameron 1995; Hill et al. 2004), it is likely that the presence of migrants can be determined by analyzing technological, as opposed to stylistic, choices. The theoretical foundation for this approach is the “low message potential” of technological choices. These choices are isochrestic, the result of enculturation in social groups, and therefore used unconsciously (Sackett 1982). Isochrestic style, as defined by Sackett (1982), is contrasted against iconological style choices which are consciously and actively chosen to send intentional messages about social identity. Immigrants

would be less likely to alter their isochrestic style (aspects of production which are unconscious and of low message potential) as a result of influences from other groups than they would be to alter iconological style choice, which have a high communication potential.

Another major problem facing archaeologists investigating migration is the need to expand the theoretical understanding of migration as an element of cultural behavior (Burmeister 2000:540). Closely associated with the examination of migration as human behavior is the problem of ethnicity (Snow 1995). With the increased recognition of migration in the archaeological record comes the acknowledgement that the interaction between ethnic groups is a complex and highly variable phenomenon (Stone 2003:31).

Section 2.3 How Migration Impacts Social Interactions

Though some prehistoric migrating groups may have encountered no earlier inhabitants of their new chosen territory, for most groups migration brought them into contact with an indigenous group. There is a range of potential outcomes when two groups come into contact. The indigenous group may meet them with fierce resistance or with open arms. More than likely they will experience something between these two extremes and both groups will actively manipulate social boundaries. In addition, the goals of the migrants are important in determining the nature of social interaction.

Migrants can be interested in full assimilation into the local culture. Historically, this is associated with individuals of a low status or individuals who have been persecuted (Hornsey and Hogg 2000). To them, their migration is an opportunity to seek success and/or freedom and the host community is seen as their salvation.

Other migrants are interested in maintaining strong ties to their homeland. Their migration may be a temporary situation even if the “outpost” is permanent. For example, it is not unusual historically for young individuals to migrate in an attempt to establish wealth and then return home when they have achieved their goals, a situation which would result in a permanent settlement of impermanent migrants.

It is also possible for individuals to maintain strong ties to their homeland but be unable to return, such as in an involuntary migration or a diaspora as a result of environmental loss or violence. In a diaspora, migrants typically retain fantasies of returning “home” and lack full assimilation into the local culture at their new location.

Thus, the end result of a migration may be complete assimilation of the migrant group into the local culture or strict maintenance of the original culture. More than likely, the reality will be somewhere in between these two extremes. It is important to recognize that migrants rarely fully retain their traditional identity or instantly assimilate into the host community. Instead, migrants have a unique identity as migrants: neither us nor them. Indeed, the relationship of cultural identity to the process of migration is rarely black and white, instead this relationship operates on a spectrum. In order to fully understand the interaction of migrant and local populations, it is necessary to explore the nature of ethnic identity in general as well as the role various vehicles play in the formation, negotiation, and/or reification of ethnic identity in particular (Stone 2003:31).

Section 2.4 Investigations of Ethnic Identity

Ethnic identity has been generally accepted as a worthwhile subject of archaeological investigation for the past 20 years or so. Emberling (1997:296) states that understanding

ethnicity is essential to developing an adequate understanding of the past. Dissatisfaction with simple and static concepts such as “tribe” fueled the interest in ethnicity. As noted by Jones (1997:52), investigation into “ethnic groups” became an acceptable substitute on a taxonomical level but such investigations were, for the most part, rooted in a more theoretical approach designed to accommodate the complicated social phenomena being studied. However, there is no single definition of ethnic identity or a single framework within which to study it (Baumann 2004). Like all archaeological research, it has been influenced by various schools of thought.

Early anthropologists viewed ethnic identity as something immutable and rooted in human nature (e.g. Geertz 1963). Those who stressed the primordial nature of ethnic identity argue that the bonds between individuals resulting from genetic, linguistic, religious, and cultural relationships are more essential and “real” than other identities. Such relationships are involuntary and more powerful than situational alliances and disputes (Geertz 1963; Isaacs 1974). Primordialists also stress the psychological basis of ethnic identity, arguing that humans are predisposed to be loyal to a defined group and hostile to members of other groups, and the biological basis of ethnic identity, arguing that ethnicity represents a form of kin selection (Geertz 1963; Shils 1975).

Major critiques of the primordialist approach to ethnic identity have focused on the static viewpoint, noting that it fails to take into account the dynamic and situational nature of ethnic boundaries (Baumann 2004; Jones 1997). Anthropologists, as a whole, shifted away from the primordial framework to an instrumental view of ethnic identity. This shift in viewpoint owes much to the work of Fredrik Barth and the influential work of the Manchester School in the 1960s and 1970s, with instrumentalistic ideas becoming increasingly important in the 1980s in archaeology (Gardner 2007; Knudson and Stojanowski 2009). Instrumentalists emphasize the

highly mutable character of ethnicity, seeing it as a tool for social power that has a dependent reality (Gardner 2007; Knudson and Stojanowski 2009). As such, instrumentalists are concerned with how ethnicity is used to mediate social relations and negotiate access to resources (Jones 1997:72).

Instrumental archaeological investigation typically falls into two theoretical camps: ethnicity as viewed by interaction theorists and ethnicity as viewed by practice theorists. The first focuses on the situational nature of ethnicity by examining the processes of social categorization and interaction and is an outgrowth of the works of Fredrik Barth (1969) and Abner Cohen (1978) in ethnography (Stone 2003). The latter focuses on the socio-structural and cultural dimensions of ethnicity and adopts a more objectivist approach (Jones 1997:75.)

Barth (1969) saw ethnic groups as situational and dynamic social categories formed primarily through boundary maintenance and social interaction. Barth focused on social boundaries between ethnic groups, which Cohen (1974:389) noted only exist in the presence of interethnic relations. However, such ethnic boundaries are not impermeable and cultural traits, ideas, and individuals can cross through them (Baumann 2004; Ellemers 1988). Such boundaries can be reified through the use of symbolic markers and followers of Barth believe that the actors involved in any interaction are highly conscious of symbol use and manipulation whether by themselves or others. The symbols of ethnicity used to mark these boundaries change over time but must be recognized and agreed upon both within and outside the group (Stone 2003:35). Ethnic groups also change over time, with ethnogenesis creating new groups in opposition to other groups and with some ethnic groups ceasing to be relevant and fading away.

Ethnic identities create we/they distinctions that influence social interactions. Individuals and groups can invoke or deemphasize ethnic identities and move from one ethnic identity to

another as needed to advance personal interests through processes of interaction, exclusion, or inclusion (Cohen 1978). Anthropologists adhering to this interactionist perspective generally believe that the actors involved in these interactions demonstrate a high level of self-reflexivity in how they utilize ethnic group membership. An individual cannot simply claim group membership (Stone 2003). In order to claim an ethnic identity, the individual, members of the ethnic group, and nonmembers of the ethnic group must all recognize the membership of an individual. As noted by Stone (2003:35), membership in an ethnic group is the source of potential disagreement within the community. As such, ethnic identity must be consistently negotiated and reified.

The interactionist view of ethnicity has been criticized for focusing on differences between ethnic groups instead of the makeup and similarity within a single group (Bentley 1987). Important questions, such as how individuals recognize others within their ethnic group and how individuals make the decision to come together to form an ethnic group were largely ignored by interactionists (Stone 2003). Jones (1997) states that the cultural and social context in which interactions of different ethnic groups occur must be incorporated into ethnic studies. As a response to this weakness of the interactionist view, others moved to concentrate on the cultural content within the ethnic groups, using Bourdieu's concept of *habitus*, rather than the interaction between them (Stone 2003).

Practice theory has been incorporated into studies of ethnicity to explore how people come to embrace a shared social identity (Knudson and Stojanowski 2009:4). Bentley (1987) drew on Bourdieu's concepts of *habitus* and practice to understand how ethnicity is constructed and ethnic identity is maintained. Bentley and other practice theorists believe that individual

actors are generally unaware of the structure in which they live and the factors restraining the choices available to them (Bentley 1987; Bourdieu 1977).

In practice theory, *habitus* comprises the underlying set of rules of society that individuals are largely unconscious of, within which practices are regular, unconscious, and goal directed. *Habitus* conditions individuals to perceive the world in a certain way and influences how all new interactions are structured (Stone 2003). Ethnic group membership constitutes similarities based on shared *habitus* and symbolic differentiations (Bentley 1987). Thus, in order to properly account for the formation of an ethnic identity, we must not focus on social interaction but instead identify the dimensions of *habitus* that dictate how ethnic identities interact with conceptions of personal and group identity (Bentley 1987: 47). Because individuals are rarely seen as self-reflexive, and are seen instead as unaware of the manipulation of symbols by themselves and others, change is only expected when something challenges the *habitus* from outside the system, such as encountering a new group following a migration. Practice theory, then, assumes culture exists in a homeostatic state (Stone 2003:34). Criticisms of this perspective are based on the practice theorists' focus on determinism, homeostasis, and assumed isolation of populations and instead assert that there is little evidence for homeostasis of ethnic identity or isolation of populations historically or prehistorically (Stone 2003:39).

Section 2.5 An “Interaction Plus” Framework for the Investigation of Ethnic Identity

Several modern studies of ethnicity (e.g. Stone 2003; White et al. 2009) have combined aspects of interaction and practice-based takes on ethnic identity theory to form a theoretical framework which can be thought of as “interaction plus”. This framework recognizes that the active negotiation of ethnic identities through social interaction takes place within the context of

habitus (specific cultural practices and historical experiences through which the perceptions of similarities and difference are formed). By considering both the reflexive actions of individuals and the structural constraints within which they act, the investigation of ethnic identity can be imbued with meaning (Stone 2003).

Using ethnicity in this way gives archaeologists the ability to examine intergroup relations following a migration in a meaningful way. Given the variation inherent in relations between indigenous and immigrant populations, there is no single model that can be applied to all situations. Instead, ethnic identity following a migration must be examined on a case-specific basis using as many meaningful aspects of the archaeological assemblage as possible.

Because ethnic identity is reified by symbolic representations of a group, changes in how these symbols are produced, reproduced, and/or transformed over time can shed light on how ethnic identity has been manipulated in the past (Baumann 2004:14). The challenge comes in identifying aspects of the archaeological assemblage which shed light on ethnic identity. While technological and isochrestic style may identify the presence of a migrant population, as discussed earlier, they reveal little about the active negotiation of ethnic identity (Stone 2003). Stone argues that, because ethnic identity is reified through active and intentional manipulation of identity and its public display, archaeologists need to focus on intentional, symbolic aspects of the archaeological assemblage when investigating ethnicity.

Stone acknowledges that determining whether an aspect of the archaeological assemblage was used to signal ethnicity- as opposed to other social roles- is complex, especially given the situational nature of ethnic expression (Stone 2003:43). Gardner (2007) points out that different types of identities and different kinds of practice may cross-cut each other in various ways. This means that markers chosen for certain ethnic boundaries may overlap markers used in the

negotiation of intragroup identities, such as age and gender categories. In order for the signal to be interpreted correctly as a symbol of ethnic identity, both the sender and the receiver must recognize and understand the meaning of the symbol. In addition, to properly interpret a cultural symbol, particularly from a prehistoric assemblage, an understanding of the context of communication within which the symbol is displayed is critical.

Ethnographic research has demonstrated that ethnic identity can be situationally symbolized through numerous aspects of material culture that are infused with communicative style (Stone 2003:45). For example, exterior architecture can serve as a public and permanent identity marker, whereas internal architecture is permanent but more private (Burmeister 2000). Such permanent markers are always “on”, which limits the actors’ ability to use the ethnic identity situationally, though it can be presumed that the actors have some control over their audience. Items which can be intentionally displayed or intentionally hidden, such as portable items like lithics and ceramics, can be situationally displayed. This is also true of styles of dress, personal adornment, and food consumption – these are highly mutable and can be altered relatively quickly as needed. Stone (2003:44) points out that the ability to display ethnic identity on command – and hide it when socially detrimental – is important for channeling interaction to influence economic and political power.

Both ritual and routine are important for signaling ethnic identity (Gardner 2007; Stone 2003). Participation and associated non-participation in ritual is viewed as an important locus of social negotiation between members of different ethnic groups (Stone 2003:44). However, certain aspects of ethnic identity may require active and regular signaling to others and/or oneself in order for the ethnic identity to form a significant element of an individual’s self-identity (Gardner 2007). Also, because ethnic groups typically have a sense of shared history, aspects of

the past and existing cultural repertoire are likely to be used as ethnic identity markers (Stone 2003).

Because ethnic identity can be invoked publicly, privately, permanently, temporarily, ritually and/or routinely, there is not a one-to-one ratio of artifact class and identity marker in a given archaeological assemblage. Ideally, multiple lines of evidence would be used when interpreting ethnic interaction prehistorically, though this project is based on the principle that examining highly communicative artifacts in conjunction with the archaeological context as a whole, allows archaeologists to gather information about how individuals identified ethnically in the past.

This principle holds that if ethnic identity was an important identity to a given group in the past, it must have then been manipulated and/or reified frequently in order to maintain its meaning. In addition, it would be expected that multiple vehicles would be used to communicate this identity to its members and nonmembers. Variability and/or changes in the amount of ethnic identity signaling would be directly related to the importance of ethnicity as a role to the members of the community; for example, when two groups change from long-distance trade partners to physical neighbors, ethnic identity and its associated identity markers will change (Stone 2003). Therefore, by examining the nature of ethnic identity markers in prehistoric groups, archaeologists can gather information regarding the impact of migration on ethnic identity.

To summarize, studies which investigate ethnic identity within an “interaction plus” framework are based on the concepts that individuals are aware of the structures in which they live their everyday lives, that they actively negotiate their positions in these structures, and that these interactions occur within specific cultural contexts. Specifically, actors utilize identity

markers to negotiate their individual ethnic identity to influence interactions between themselves and members both within and outside the group. By understanding ethnic interaction in general, archaeologists can begin to understand the nature of interaction between indigenous groups and migrant populations in specific cases (Stone 2003). Because ethnic identity is situational, the interaction between local and migrant populations will vary considerably depending on the sociopolitical structure of the two groups and the history of past interaction between the two groups (though not necessarily the individuals). The end result of such interaction between two groups can range from the development and maintenance of a strong, cohesive ethnic identity as migrants to the complete assimilation and loss of ethnic identity as a social category (Stone 2003:61). According to Burmeister (2000:546), an immigrant group that continues the tradition of the old homeland while being influenced by an indigenous population will create an ethnic identity that is distinct from that of its homeland and that of the indigenous population.

Applying this framework to an archaeological problem is complex but offers the opportunity to move from the goal of assigning a site to one ethnic category or another to the goal of understanding the relationship of individuals at a site with an appreciation of ethnic identity as fluid, dynamic, and context-specific.

Section 2.6 Modern Investigations of Ethnic Identity in Archaeology

Many studies in the last fifteen years have contributed to the understanding of how ethnic identity can be accessed through the archaeological record. These include studies of house construction (Burmeister 2000; Gardner 2007; Pauketat 2003; Stone 2003), ceramics (Gronenborn and Magnavita 2000; Pearce 1999; Stone 2003), and faunal assemblages (Barrett et

al. 2001; Crabtree 1990; Hesse 1990; Reitz 1985). More recently, bioarchaeological research has begun to focus on the study of ethnic identity.

As emphasized by Knudson and Stojanowski (2009:1), bioarchaeology is uniquely suited to investigate ethnic identity due to its direct engagement of the physical body in the construction of social identity. Some of the first applications of bioarchaeology to ethnicity research were focused on identifying migrant groups. Information on oxygen and/or strontium isotopes (Buzon et al. 2007; Conlee et al. 2009; White et al. 2004a; White et al. 2004b), differential mortuary treatment (Conlee et al. 2009), dental modification (Cox and Sealy 1997), and cranial modification (Hoshowers et al. 1995; Torres-Rouff 2002) were used to identify different ethnic groups. A review of bioarchaeological literature demonstrates that with a few exceptions (e.g. White et al. 2004b), the majority of early investigations into ethnicity following a migration focused on identifying migrants archaeologically (e.g. Blom et al 1998; Steadman 1998). Current trends in bioarchaeology include utilizing evidence for discrete ethnic group to draw conclusions regarding social interaction (e.g. Cook and Shurr 2009; Duncan 2009; Hakenbeck et al. 2010; Klaus and Chang 2009; Knudson and Blom 2009; Nystrom 2009; Stojanowski 2009; Sutter 2009; Torres-Rouff 2009; White et al. 2004a; White et al. 2004b; White et al. 2009).

In the last five years, bioarchaeological research has expanded from simply identifying different ethnic groups in a given skeletal population to investigating social interactions through concepts of agency, identity, and personhood (White et al. 2009). The body is used to manipulate identity; identity can be symbolically expressed via tattoos, piercings, foot binding, cranial modification, weight gain or loss, and/or food choice (Buikstra and Scott 2009; White et al. 2009). The incorporation of social identity into the biological body, or embodiment, results in the

use of the body to demonstrate ethnic identity. One central substance used in the process of embodiment is food.

Section 2.7 Food as a Cultural Symbol

During the processual era of archaeology, the majority of investigations into food choice focused on resource availability and nutritional value. Though catchment analyses of sites hold value, they miss an important fact: food is more than a means of survival, it is central to our personal and social identities. The recognition of the power of food as a cultural symbol is well-established in cultural anthropology and is growing in archaeology and bioarchaeology (Appadurai 1981; Belasco 1999; Counihan and van Esterik 1997; Farnsworth 2001; Fischler 1988; Fox 2013; Gabaccia 1998; Gumerman 1997; Hastorf and Johannessen 1994; Narayan 1995; Smith 2006; Twiss 2012; Vizcarra Bordi 2006; White et al. 2009).

As Twiss (2012:360) notes, the constant need for nutritional input means that food is cognitively prominent and physically ubiquitous, making it an ideal vehicle for marking membership of particular group. The procurement, preparation, and consumption of food needs to happen regularly, often several times a day. These activities typically involve multiple people, making all aspects of diet imbued with ideological and social meaning.

The inclusion or exclusion of people or groups from the actual food-related activities helps establish and maintain social relationships (Gumerman 1997). In addition to the cultural significance of the activities of procuring, preparing, and consuming food, the actual food is imbued with symbolic meaning. Smith (2006) argues that the act of consuming food may represent the ultimate symbol of identity, conformity, and resistance. The biological act of eating is therefore a social act: we are what we eat both biologically and socially (White et al. 2009). In addition, food taboos act as signifiers as well: we are not only what we eat, we are also what we

do not eat (Belasco 1999). It is not uncommon for a group to refer, often derogatorily, to another group by what it is imagined to eat – such as referring to the French as “frogs” (Fischler 1988:280).

Both routine and ritual use of food reinforces ethnic identity, though the use of food is not static. As noted by Barth (1969), ethnic boundaries are not impermeable and it is not unusual for food to be shared and borrowed from one region to another (Gabaccia 1998). However, it has been noted that food preferences gain strength as ethnic identity markers in the presence of other ethnic groups. An example, presented by Fox (2013:2), is how English emigrants have been known to break open tea bags to make a “proper” cup of tea. Fischler refers to Calvo, the French Sociologist, who observed that migrants have been known to retain food preferences even when their native language has been forgotten (Fischler 1988:280).

Given the central role food plays in ethnogenesis, “the informative power of food is as yet only partially tapped” (Twiss 2012:38). Investigations into food production has revealed information about the construction of identity (e.g. Barrett et al 2001; Jones and Richards 2003; O’Sullivan 2003). Zooarchaeologists have contributed to the study of ethnic identity by investigating food processing (e.g. Jackson and Scott 2003; Scott 2008; Tuma 2006). Recent studies (e.g. Cook and Schurr 2009; White et al. 2009) have also demonstrated the contribution of studies into the consumption of food to the study of ethnicity, though this needs to be expanded.

Although all food has a set of values associated with it that lends it value beyond its caloric yield, corn seems to be an especially powerful cultural vehicle, therefore having a particularly great potential for contributing to the study of ethnic identity (Hastorf 1994:396). The cultural significance of maize is seen in its inclusion in cultural mythology and mortuary

rituals (Bohrer 1994; Ford 1994; Gumerman 1994; Ortiz 1994). Richard Ford (1994:525) stated that “corn itself is a cultural artifact, and we can have no more exciting form of archaeological evidence for use in cultural interpretation.”

Some of the questions surrounding maize focus on the cultural changes that accompany the shift to a subsistence strategy that focuses on maize. Wymer (1994) suggests that maize may always have had a special significance in eastern North America. Maize appeared in the region by A.D. 200 but maintained a relatively low profile until A.D. 800-900, when the use of maize dramatically increases. She suggests that maize may have existed in a social context distinctive from other garden crops for hundreds of years before rapidly making the change to a staple crop. Hastorf and Johannessen (1994) suggest that the question of the sudden transformation of maize into a dietary staple cannot be adequately addressed in purely economic terms, as corn is not necessarily superior to the crops that compose the Eastern Agricultural Complex. Instead, they view maize as an agent of transformation in terms of ethnic identity. Indeed, the sudden amplification of the existing significance of maize in eastern North America is associated with the process of Mississippianization (Hastorf and Johannessen 1994).

Hastorf and Johannessen argue that corn became the focus of a new identity and speculate about the motivation people had to become corn-eaters. While they acknowledge we cannot know the exact meanings carried by corn in prehistoric populations, they suggest that a common theme shared among many historical and contemporary Native American groups is the personification of corn. They suggest that for many cultures corn belongs conceptually with people as opposed to other plants. They point to, as does Gumerman (1994), the fact that corn has no wild counterpart – corn needs humans to exist. In addition, maize demonstrates marked genetic flexibility and the ability to mutate, changing cob color, shape, size, and taste in a single

generation (Hastorf and Johannessen 1994). The interactive nature of corn, then, may imbue it with a special symbolic and cosmological role.

Research across the New World demonstrates the extraordinary cultural significance of maize for many diverse groups (Ford 1994; Gumerman 1994). Historical accounts demonstrate the large extent to which corn figured as a symbol in cultural life and cosmology of many Native American groups (Bohrer 1994; Hastorf and Johannessen 1994; Ortiz 1994). This evidence suggests that a symbolic network was associated with maize, with groups manipulating and reifying these symbols to effect cultural change (Hastorf 1994).

Section 2.8 Overview of this Case Study

This section presents an overview of the case study which serves as the focus of this dissertation. Key terms are defined and the theoretical framework is articulated, which situates this case study within the larger context of research on migration and ethnic identity. Finally, an overview of the specific case study is presented.

Section 2.8.1 Definition of Key Terms

As mentioned earlier in this chapter, there is no single definition of ethnic identity or a single framework within which to study it (Baumann 2004). Rather than provide an exhaustive list of various ways in which ethnic identity has been defined, I will focus on how ethnicity will be examined within the constraints of this project: the framework within which this project is situated draws heavily from the framework set forth by Tammy Stone (2003) and is informed by both interaction theory and practice theory.

For the purposes of this dissertation, ethnic groups are defined as any group of people who set themselves apart and/or are set apart by others with whom they interact or co-exist on the basis of a sense of common descent extending beyond kinship, political solidarity with regard to other groups, and common customs, language, religion, values, morality, and/or etiquette (Cohen 1978; Jones 1997:xiii). Ethnic groups are subjectively utilized modes of identification used in interactions among and between groups and can be narrowed or broadened in relation to the specific needs of an individual or group (Cohen 1978:385). Criteria for membership in an ethnic group may or may not be consistent throughout time and between individuals.

Various researchers have identified several characteristics which tend to be shared among all ethnic groups. These include a proper name to identify the group, a belief in common ancestry, shared narrative of common past, shared fundamental cultural values (such as language, religion, or customs) which results in some unity in material culture, a psychological link with a “homeland”, and a membership which identifies itself and is identifiable by others, resulting in a sense of solidarity (Barth 1969: 10-11; Emberling 1997:310; Hutchinson and Smith 1996:6-7).

Ethnic identity is defined for this dissertation as self-conceptualization by an individual of their membership in an ethnic group. Ethnic identity is situational and a product both of self and group identity that is formed in reaction to social interaction (Cohen 1978). For the purposes of this dissertation, ethnic identity will be interpreted as a self-conscious, ascribed social category structured in opposition to “others” based on abstract stereotypes (Gardner 2007:199). These stereotypes are used to create ethnic boundaries, which are reified through deliberate use of symbolic markers. However, individuals are typically able to change their affiliations; individuals may identify with multiple ethnic groups or none at all, expressing different group

identities in different contexts of interaction (Gardner 2007:199). Though self-identification is important, the process of assigning people is both subjective and objective and carried out by self and others (Cohen 1978:387). Ethnicity, when used in this dissertation, is a general term which refers to ethnic identity.

Ethnic identity differs from nationalism, or association with a particular political group, by a lack of link to a specific policy. Regional identity in areas of low population movement may share several features with ethnic identity but demonstrate marked difference in areas of migratory processes by typically lacking a common origin myth. Status and class are fundamentally hierarchical so, though they may crosscut ethnic identity, they may include members of more than one ethnic group and rarely encompass an entire ethnic group (Emberling 1997).

Section 2.8.2 Theoretical Framework of the Case Study

Despite the focus on interactions in developing the framework for this dissertation, points made by Jones (1997) and echoed by Stone (2003) are taken into consideration. Specifically, the active negotiation of ethnic identities through social interaction still takes place within the context of specific cultural practices and historical experiences through which the perceptions of similarities and difference are formed (Jones 1997). By considering both the reflexive actions of individuals and the structural constraints within which they act, the investigation of ethnic identity can be viewed in a more meaningful way (Stone 2003).

This dissertation framework is informed by Stone's assertion that, although individuals and groups may not have perfect knowledge of the total structure within which they operate, they are aware of the material and social constraints that affect their daily lives, such as status, gender,

and kin relations, and actively negotiate their position in society within these constraints (Stone 2003:41). By appreciating the variability in the constraints within which individuals work, this framework acknowledges the importance of the historical and structural context on individual perception without accepting the assumptions regarding homeostasis inherent in the practice theory framework (Stone 2003:42). This framework, which denies the passivity of individual actors about the structure in which they operate, allows archaeologists to appreciate the variability in response to the arrival of a new migrant group.

Section 2.8.3 Migration and Ethnic Identity in the Central Illinois River Valley

In this chapter I have shown the need for continued research on migration and ethnic identity. It is an accepted fact of migration that migrants must negotiate their cultural identity following a migration in a manner representative of their goals. I have also demonstrated the potential for research on food choice to yield valuable insights into the manipulation of ethnic identity. Finally, I have presented the argument that maize is a particularly powerful vehicle for the transmission of cultural knowledge and, therefore, information about ethnic identity.

This project contributes to the broader understanding of the human experience of migration by investigating how individuals use diet to manipulate or reinforce their cultural identity following a migration. Specifically, this project will demonstrate how a study of maize consumption can inform archaeologists about ethnic identity. To reach this end, I will focus on a case study of the dietary choice of a migrant population in late prehistoric west-central Illinois.

Section 2.8.4 Overview of the Case Study

This research explores food choice following the pre-Columbian migration of a Native

American group into west-central Illinois. Morton Village (IAS 11F1) and the associated Norris Farms 36 cemetery (IAS 11F1) are archaeological sites demonstrably the result of a migration of a group of Oneota people to the central Illinois River valley, most likely from the north or west. Morton Village, the focus of this project, is a large, multicomponent site in Fulton County, Illinois (Harn 1990). The associated Norris Farms 36 cemetery is situated on a bluff edge overlooking the Illinois River valley in close proximity to Morton Village.

Analysis of the remains from Norris Farms 36 revealed that a great number of individuals met a violent death as a result of interpersonal violence (Milner 1999; Milner, Anderson and Smith 1991; Milner and Smith 1990; Milner, Smith, and Anderson 1991). Early interpretations of the site were based on the understanding that Morton Village served as a “frontier occupation” (Milner, Anderson, and Smith 1991:593) of Oneota individuals in the central Illinois River valley. While early researchers did not focus on ethnic identity, their description of the group at Morton Village as culturally affiliated with limited sites in the area and threatened by intergroup violence implies the site can be viewed as an ethnic enclave (Milner Anderson and Smith 1991). Ethnic enclaves are generally understood as physical spaces with high concentrations of individuals with a nonlocal ethnic identity living separately from the surrounding community (Xie and Gough 2011).

Influenced by this view, early investigations of the Oneota occupation at Morton Village focused on evidence for conflict and warfare (see Milner 1999; Milner, Anderson and Smith 1991; Milner, Smith, and Anderson 1991). However, early researchers also noted evidence for pacific interactions between the groups, such as conspicuous Middle Mississippian cultural influences on the Oneota inhabitants at Morton Village (Esarey and Santure 1990:164).

Likewise, recent investigations at Morton Village have yielded evidence for cohabitation and cooperation between Oneota and Middle Mississippian people.

This dissertation seeks to move beyond focusing on the dichotomy between the Oneota and their Middle Mississippian neighbors to explore the complexity of intergroup relationships in west-central Illinois during the late prehistoric. This research contributes to such an understanding by assessing Oneota subsistence, and by proxy ethnic identity, in an area otherwise inhabited by more maize-reliant Middle Mississippian people (Conrad 1991; Harn 1991, Harn 1994). Oneota subsistence patterns are often described as diverse and based on a mixed economy that included hunting, gathering, and fishing, along with growing maize, beans and squash (Gallagher and Arzigian 1994; Tubbs and O’Gorman 2005). Although quite limited, previous stable isotope analysis of Oneota groups in Wisconsin has supported this understanding of “traditional” Oneota subsistence strategies (Vradsburg 1993; Vradsburg and Hollinger 1994).

If the Oneota in the central Illinois River valley worked to maintain their traditional ethnic identity, it would be expected that they would continue to exploit a diverse array of resources, with a low to moderate consumption of maize. If the Oneota at Morton Village sought to assimilate with their Middle Mississippian neighbors, it would be expected that their diet would be very similar to Mississippian groups in the region and that their maize consumption would be higher than other Oneota groups. In order to investigate Oneota diet in west-central Illinois, analysis of stable isotopes was performed on skeletal remains from Norris Farms 36 and compared to remains from the Middle Mississippian habitation and mortuary site, Orendorf.

The Orendorf site (IAS 11F107) is a Middle Mississippian temple town in the central Illinois River (Conrad 1991). It is located roughly 20 kilometers upriver of the Morton Village

site on a bluff overlooking the Illinois River and Rice Lake. (Esarey and Conrad 1981; Google 2011; Wilson 2010). Though the accepted chronology (see Table 3.1) places the Orendorf phase in an earlier period than the Bold Counselor Oneota occupation of Morton Village, Wilson (2010:66) suggests that the calibrated radiocarbon dates for Orendorf extend the occupation from 1149 to 1320. In addition, when these radiocarbon dates are interpreted in conjunction with the multiple rebuilding events at Orendorf, it is possible that the Orendorf was occupied much longer than the originally estimated 80 to 100 years (Wilson 2010:67). In addition to the potential that Orendorf and Morton Village were at least somewhat coeval, there are other reasons why Orendorf is an ideal site to use in a comparison with Morton Village. As a large Middle Mississippian site in the central Illinois River valley, Orendorf provides information on social interactions in the area, including information regarding local and nonlocal trade (Conrad 1991). Orendorf has a large skeletal population which is comparable to Norris Farms 36.

By utilizing stable isotope analysis of the remains from Norris Farms 36 and Orendorf, information about consumed diet, particularly the utilization of maize, can be gathered. Intersite analysis will reveal information about how diet at Morton Village fits into broader regional patterns. If the inhabitants at Morton Village were seeking to assimilate into the local Middle Mississippian population, it would be expected that they would adopt the Middle Mississippian focus on maize. The intrasite analysis provides more fine-grained information about the homogeneity of the diet at Morton Village. This will reveal information about the degree to which other social categories, such as age, sex, or other social identities impacted dietary choice. This is in line with White et al. 2009's call for investigating food consumption on smaller scales to help infer social identity.

Section 2.9 Summary and Contributions of this Project

It is now well-recognized in anthropology that investigating migration and its impact on ethnic identity holds great potential to help elucidate the human condition. Food has also been shown to be an effective vehicle for manipulating and reifying ethnic identity. This project applies both concepts by examining what food choice can tell us about ethnic identity following a migration. This project utilizes a case study of consumed diet, as revealed by stable isotopes, from late prehistoric west-central Illinois to reveal how diet serves as a means of influencing social negotiations.

Chapter 3: Archaeological Background

This chapter places the case study which serves as the focus of this project into the proper context by providing background information about the Oneota and Middle Mississippian traditions in the central Illinois River Valley. Section 3.1 provides a brief overview of current knowledge about the Oneota tradition as a whole. Section 3.2 describes the relevant geographic and environmental features of the central Illinois River valley. Section 3.3 presents information about the Oneota tradition in Illinois. Section 3.4 provides information about the early investigations and interpretations of the Morton Village and Norris Farms 36, and section 3.5 explains how recent investigations at Morton Village have enhanced the understanding of the Bold Counselor Oneota. Section 3.6 describes the Middle Mississippian occupation at the Orendorf site and section 3.7 summarizes the information presented in this chapter.

Section 3.1 Brief Overview of the Oneota Tradition

The Oneota tradition, often referred to as Upper Mississippian per its designation in the Midwest Taxonomic System, represents a late prehistoric cultural complex primarily located on the Prairie Peninsula (Brown and Sasso 2001; Cleland 1966; Gibbon 1972; Hall 1962; Henning 1970, Henning 1998; Overstreet 1978, Overstreet 1997; Staeck 1995; Stoltman 1983). The Oneota tradition appeared around A.D. 1000; the following horizons serve to identify broad tradition-wide trends: Emergent A.D. 1000-1150; Developmental A.D. 1150-1400; Developmental/Classic A.D. 1400-1500; Early Classic A.D. 1500-1600 and Late Classic 1600-1750 (Brown and Sasso 2001). The case study used for this dissertation falls within the Developmental Horizon, which is distinguished from other horizons by an expansion of the

Oneota into new geographical regions (Hollinger 2005; O’Gorman 2010; Rodell 2000). The Oneota tradition is characterized by a broad degree of variation; however there are several major material culture traits that serve to identify sites as belonging to the Oneota tradition. In particular, Oneota ceramics are highly diagnostic of the Oneota tradition and its horizons.

Archaeological sites of the Oneota tradition tend to appear in discontinuous clusters from southwestern Michigan and northwestern Indiana to southern Minnesota and eastern Nebraska (Hollinger and Benn 1998; Stoltman 1983). Sites tend to be located in areas with access to diverse resources, such as on terraces near bodies of water (Boszhardt 1994; Gallagher and Stevenson 1982; Tubbs and O’Gorman 2005; Wilson 2010). This allowed the inhabitants to effectively exploit multiple ecozones and provided access to arable soils as well as prairie, forest, wetland and/or riverine or lacustrine resources (Benn 1989:235; Brown 1982; Brown and Sasso 2001; Wilson 2010). Oneota subsistence strategies took advantage of the diverse resources offered by these ecozones and also included growing maize, beans, and squash along with hunting and gathering (i.e. Stevenson 1985).

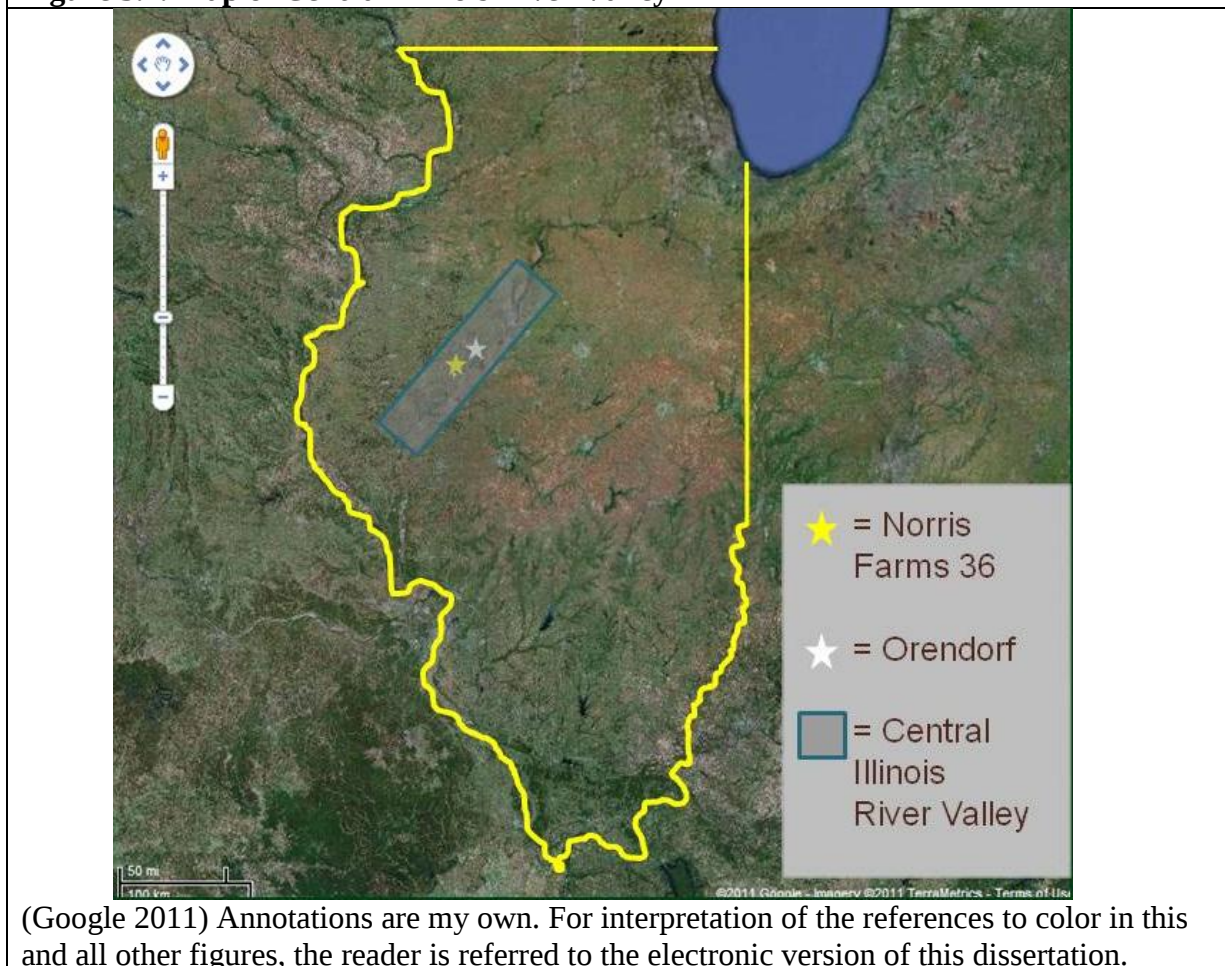
This section has provided only a brief overview of the Oneota tradition. Further aspects of the Oneota at the tradition level will be explored further in the following sections, as they relate to the case study which serves as a focus of this dissertation.

Section 3.2 The Central Illinois River Valley

Harn (1978:237) defines the central Illinois River valley (CIRV) as a 210 km valley section between the current day villages of Hennepin, Illinois, and Meredosia, Illinois. The central Illinois River valley is separated from the upper Illinois River valley and lower Illinois River valley sections on the basis of geographic location and wide differences in topography,

hydrology, flora, and fauna (see Figure 3.1). For example, the central Illinois River valley is characterized by a relatively slow current and expansive floodplain (Cheng et al. 2001; Harn 1978). Part of the Prairie Peninsula, the central Illinois River valley is bordered by the Western Forest-Prairie Division, the Grand Prairie Division, the Illinois River Sand Area Division, the Illinois River Bottomland Division Area, and the Middle Mississippi Border Division (Harn 1978:239). Climate in the central Illinois River valley during the late prehistoric period was fairly similar to the modern climate (King 1990). This means that there are a wide variety of plant and animal resources available in or near the central Illinois River valley. Ideal for human occupation, during the late prehistoric period the area was primarily inhabited by Middle

Figure 3.1. Map of Central Illinois River Valley



Mississippian populations. The settlement at Morton Village (IAS 11F1) by the Bold Counselor phase Oneota, as defined by Esarey and Conrad (1998), represents a unique migration to the area.

Section 3.3 Bold Counselor Oneota

The Bold Counselor Oneota phase has been identified at five major villages in the central Illinois River valley. All were in Fulton County, Illinois, within 33 km of the western bluff of the Illinois River (Esarey and Conrad 1998:38). Radiocarbon dates for Oneota sites in the central Illinois River valley indicate that Oneota people were present in the region as early as A.D. 1200 and certainly by A.D. 1300 (Esarey and Conrad 1998; Santure et al. 1990). The cause of this migration into the central Illinois River valley is unknown but has been variably attributed to changes in environment (King 1993) and increasing levels of social conflict both inside and outside of the region (Hollinger 2005; Wilson 2010).

As ceramics are the most diagnostic artifact of the Oneota tradition as a whole, it is appropriate that the ceramic assemblages in the central Illinois River valley are the definitive evidence for the attribution of the Bold Counselor phase to the Oneota tradition. According to Esarey and Conrad (1998:40), the characteristics of Bold Counselor Oneota include:

- 1) A high frequency of jars with horizontal trailing, 2) a very low incidence of lip stamping on jars, 3) a proliferation of bowls, many of which have lip stamping, 4) the presence of a broad, shallow bowl form with flared, concave flanges or handles decorated in Oneota fashion (this vessels form has not been documented in any other phase), and 5) the presence of Mississippian style deep rimmed plates some of which are decorated with Oneota motifs. [Esarey and Conrad 1998:40]

These characteristics can be contrasted with Middle Mississippian ceramics from the central Illinois River valley, which are typically “cordmarked jars, plain and cordmarked large coarse bowls, plain small bowls, plain and cordmarked large, wide-mouthed water bottles, plain, painted, and negative painted long neck water bottles, effigy bowls, and highly decorated plates with very wide rims” (Esarey and Conrad 1998:40).

This mix of Mississippian and Oneota ceramic styles within the central Illinois River valley suggests, at minimum, some degree of influence on the Oneota by the Middle Mississippian people in the region. This is characteristic of the Bold Counselor phase of the Oneota tradition. In fact, Esarey and Conrad (1998) note that the Bold Counselor phase cannot be defined without reference to the neighboring Middle Mississippian groups. The C.W. Cooper site is a “pure” Oneota site, providing the archetypical Bold Counselor Oneota ceramic type. According to Esarey and Conrad, the Cooper site has almost no evidence of any Middle Mississippian presence or influence, though the presence of Mississippian vessel forms with Oneota decorations does indicate some Mississippian influence (Santure et al. 1990). Otter Creek is known only from surface collections and social interactions at this site are not well understood. The Sleeth site is also only known from surface collections but these surface collections yielded a comparable number of Oneota and Middle Mississippian ceramics. The Crable site is an otherwise standard Middle Mississippian temple mound center which also had a small number of Bold Counselor Oneota ceramics, suggesting some degree of social admixture between Oneota people and Mississippians at the household level (Esarey and Conrad 1998). Prior excavations at Morton Village provided some evidence for cohabitation of both Middle Mississippians and Oneota people (Esarey and Conrad 1998; Esarey and Santure 1990; Sank 1993), and the nature of this occupation and interaction is the focus of more recent work at the site (e.g. Conner et al.

2010; O’Gorman et al. 2012). Norris Farms 36 (IAS 11F1), the mortuary component associated with Morton Village, is the best documented of all Bold Counselor sites and is primarily Oneota in nature, though ceramics from the mortuary context at Norris Farms 36 suggest the hybridization of Oneota and Mississippian styles (Esarey and Conrad 1998; Santure et al. 1990).

Section 3.4 Early Investigations of Morton Village and Norris Farms 36 (IAS 11F1)

The Morton site is a large, multicomponent site in Fulton County, Illinois, designated as IAS 11F1. It is composed of prehistoric habitation areas and mortuary areas on the western bluff line of the Illinois River valley. There is evidence at the Morton site complex of Late Archaic, Early Woodland, Middle Woodland, Late Woodland, Spoon River Mississippian, and Oneota habitations. The Oneota habitation, assigned to the Bold Counselor phase through ceramic analysis (Santure 1990a), and the associated Norris Farms 36 cemetery serve as a focus of this dissertation.

Section 3.4.1 Overview of the Morton Village site

In the 1980s, archaeologists from Dickson Mounds Museum excavated the southern end of Morton Village and Norris Farms 36 as part of salvage and mitigation projects (Harn and Klobuchar 2000; Sank 1993; Santure et al. 1990). Initial investigations at the site revealed ten structure basins and 105 pit features (both shallow and deep basins and cylindrical facilities), and two shallow basin hearths (Harn and Klobuchar 2000; Santure et al. 1990). Structures were classified as either Mississippian or Oneota based on construction type: single-post houses were identified as Oneota and wall-trench houses were classified as Mississippian. The majority of pit-features were identified as Oneota based on diagnostic ceramics. Artifacts recovered also

included various cutting and scraping tools, tool manufacturing implements, discoidals, pigment-stained tools, and a copper fragment (Santure 1990a).

These early investigations identified a pre-Oneota Mississippian occupation and a later Oneota occupation. Specifically, the Bold Counselor Phase Oneota habitation component at Morton Village was identified as a four-hectare section of the southeastern portion of the site that dates from the mid-thirteenth century to the early to mid-fifteenth century (Esarey and Santure 1990; Santure 1990a:47). The Bold Counselor Oneota occupation at Morton Village was believed to represent a migration of Oneota peoples from the north or west (Esarey and Santure 1990; Milner, Anderson, and Smith 1991; Milner and Smith 1990), in which Oneota people replaced Middle Mississippian people in the CIRV, and specifically at Morton Village. This was supported by a biological distance study by Steadman (1998) showing large biological distances between Oneota and Mississippian groups in the central Illinois River valley.

Section 3.4.2 Norris Farms 36 Mortuary Complex

In addition to the excavation of a Bold Counselor Oneota habitation component at Morton Village, excavations were undertaken on the Norris Farms 36 cemetery during the 1980s. According to Santure (1990a:56), the proximity of the village to the cemetery and the similarity of pottery design elements at both the habitation and mortuary areas suggests that the individuals interred at Norris Farms 36 resided at the Morton Village site. The Norris Farms 36 cemetery represents the largest Oneota burial sample available. Analysis of the cemetery in conjunction with analysis of the habitation site allows unique insight into settlement and subsistence practices, social organization, warfare, diet, health, and mortality, and, critically for this research, ethnic identity of a Bold Counselor Oneota population (Harn 1990).

The Norris Farms 36 cemetery is situated on a bluff edge of the Illinois River valley in close proximity to Morton Village. A single mounded structure capped the cemetery, which contained 264 burials assigned to the Bold Counselor Oneota phase. Nine hearths were found *in situ* in the mound and are believed to be associated with the cemetery; the hearths possibly served a mortuary function (Santure 1990b: 69). The majority of the burials were single, extended, and elliptical in shape, as is typical of Oneota mortuary treatment (Foley-Winkler 2011; Kriesa 1993; O’Gorman 1996). Typically, it appears that graves were avoided during subsequent inhumations and there is some evidence for grave markers for ten of the graves (Santure 1990b: 69). There is evidence that most individuals were interred in open graves, several of which apparently were covered by a pole roof prior to being filled (Santure 1990b:72).

Topography of the bluff-top, as opposed to solar phenomenon, appears to have had the most influence on grave orientation (Santure 1990b:69). Graves appear to have been arranged radiating out from a center, with infants and children more likely to be buried near the center and adults buried near the periphery (Santure 1990b). In interments where the head was directed south (as opposed to the majority of burials with heads directed north), there were typically several nearby graves with heads also directed south. Santure (1990b:71) notes that this pattern may be a function of social persona, cause of death, or the timing of the interments.

Though the majority of interments were single, ten percent of the interments were multiple graves. Five graves held two individuals, which may represent a familial relationship (Santure 1990b:72). Seven graves on the periphery of the cemetery held a total of 19 individuals with evidence of trauma. There were several instances of post-interment additions, some of which may have been a response to episodes of violence (Santure 1990b:73-74).

Forty-four percent of the population was interred with non-perishable grave goods and a wide variety of grave artifacts were recovered (Santure and Esarey 1990:105). The majority of utilitarian artifacts (weapons, lithic reduction tools, fabricating and processing tools, and raw materials) were found interred with adult males, which Santure and Esarey (1990:110) suggest indicated that males were important members of Bold Counselor phase society.

This pattern of association of utilitarian artifacts and adults males is also found in Middle Mississippian mortuary sites in the area (such as Dickson Mounds and Morton Mound F^o14). However, the wide distribution of age groups found with weapons, particularly arrowpoints, is distinct from nearby Middle Mississippian sites (Santure and Esarey 1990). This distribution likely is representative of the egalitarian, tribal-level social structure associated with the Oneota tradition and Santure and Esarey suggest, “(t)he high frequency of arrowpoints combined with the wide age range of individuals may be a graphic measure of social stress. Perhaps weapons constitute the equipment most needed to ensure day-to-day group survival.” (Santure and Esarey 1990:110).

In addition to being distinct from Middle Mississippian mortuary sites in terms of weapon distribution, there are many other characteristics which set Norris Farms 36 apart from nearby Middle Mississippian mortuary sites. These include the roofed graves, artifact styles, evidence for social stress, and non-celestial orientation of graves (Santure and Esarey 1990:110). However, artifacts between Norris Farms 36 and nearby Middle Mississippian sites indicate some similarity. Likewise, a positive correlation of age and artifact density is similar between Norris Farms 36 and nearby Middle Mississippian sites (Santure and Esarey 1990).

Mortuary treatment has long been recognized to hold potential as a marker of ethnic identity (see Goldstein 2006). The initial mortuary analyses have revealed both similarities and

differences between Norris Farms 36 and nearby Middle Mississippian sites; the differences suggest the maintenance of a distinct ethnic identity at Morton Village, while the similarities reflect some level of permeability of the ethnic boundaries. These similarities and differences will be taken into account when interpreting the results of this project.

Section 3.4.3 Norris Farms 36 Skeletal Analysis

There were 264 individuals recovered from Norris Farms 36 attributed to the Oneota component, providing the largest documented well-preserved Oneota skeletal collection available for research (Milner, Anderson, and Smith 1991; Milner and Smith 1990). Milner and Smith (1990) analyzed the human remains to gather information regarding demography, disease load, and human behavior. As part of a basic inventory, postcranial measurements were taken and stature was determined. The skeletal analysis also involved examining skeletons for evidence of culturally prescribed modifications and skeletal and dental anomalies (Milner and Smith 1990).

Section 3.4.4 Morton Village Subsistence Information

Archaeological sites of the Oneota tradition tend to be positioned to effectively exploit multiple ecozones that typically include wetland, riverine or lacustrine resources (Brown 1982; Brown and Sasso 2001; Tubbs and O’Gorman 2005). Oneota subsistence patterns are generally characterized as diverse and based on a mixed economy that included growing maize, beans and squash along with hunting and gathering (i.e. Stevenson 1985). Early interpretations of Oneota subsistence viewed the Oneota diet as less intensive and less successful than the Middle Mississippian diet. The more northern environment associated with the Oneota tradition was

seen by these early studies as impoverished; limiting factors such as the length of the growing season, poor soil composition, and deficiencies of the Oneota wood and bone hoes as compared to Mississippian stone hoes were used to explain the mixed economy (Baerreis and Bryson 1965; Cleland 1966; Gibbon 1972; Griffin 1960; Michalki 1982). Research by Brown (1982) showed that maize was highly productive even in the northern Midwest and additional studies would reveal evidence of intensive Oneota agriculture in the upper Mississippi River valley using ridged fields with locally productive strains of maize (Benn 1989; Gallagher 1992; Gallagher et al. 1985). This research was instrumental in dispelling the view of the Oneota subsistence pattern as the result of a marginal environment.

During the 1980s and 1990s studies on Oneota subsistence began to emphasize the advantages of the Oneota economy as the importance of diversity and flexibility in the Oneota diet became clearer (Brown 1982; Gallagher and Arzigian 1994; Hart 1990; Overstreet 1995; Scarry 1993). Gallagher and Arzigian (1994) have suggested that a flexible pattern of intensification with diversification improved the success of the Oneota subsistence strategy. Hunting and gathering practices varied by region based on resource availability over time and across space. Though the specific practices varied, there are some commonalities to the Oneota subsistence pattern. Both local cultigens (cultivants of the Eastern Agricultural Complex) and nonlocal cultigens (maize, beans, and squash) were grown. Non-domesticated plants, such as wild rice, fruits and seeds were gathered. Hunting of woodland animals was part of localized Oneota economies (Brown 1982; Gallagher and Arzigian 1994; Hart 1990; Overstreet 1995; Scarry 1993). Aquatic resources were also important and included fishing, hunting aquatic and semi-aquatic mammals and reptiles, gathering aquatic tubers, and gathering freshwater mussels (Brown 1982; Cremin 1999; Gibbon 1986; Overstreet 1997). The large number of storage pits

typically seen at Oneota sites suggests the importance of storing resources to be used throughout the year.

Fitting into the pattern of site location and resource availability, Morton Village afforded access to a variety of biotic zones. The potential existed for inhabitants of Morton Village to have access to aquatic, semiaquatic, prairie, and woodland habitats. This would have allowed access to a variety of fish, mussel, reptile, amphibian, bird, and mammal species. Potentially available species include (but are not limited to) sunfish, bass, crappie, pike, buffalo, redhorse, drum, bowfin, gar, numerous mussel species, turtles, frogs, muskrat, beaver, white-tailed deer, squirrels, raccoon, turkey, passenger pigeon, cottontail, woodchuck, bobwhite, striped skunk, prairie chicken, elk, and various species of aquatic birds (King 1990). In addition, there would have been a variety of seasonally available wild plant species in the area. These species would include (but would not have been limited to) arrowheads, cattails, pond lilies, American lotus, hickory, black walnut, butternut, pecans, acorns, paw paw, crabapple, mulberry, gooseberry, blackberry, grapes, sugar maple, shagbark hickory, hazelnut, plum, black cherry, raspberry, dewberry, and elderberry (King 1990; King 1993).

Oneota subsistence is typically believed to be based on a broad spectrum of wild and cultivated resources, (Brown 1982; Gallagher and Arzigian 1994; Gallagher and Stevenson 1982); and as Gallagher and Arzigian have suggested an “intensification with diversification” (Gallagher and Arzigian 1994:184). Despite the diversity of available resources, preliminary investigations suggested that the Oneota in the central Illinois River valley had relatively circumscribed diets. Stable isotope analysis on Upper Mississippian remains from the upper Illinois River valley suggests a level of maize dependence comparable to Middle Mississippians (Emerson et al. 2005). An archaeobotanical analysis of Oneota features at Morton Village

showed a noticeable lack of goosefoot, wild barley, and knotweed (Schroeder 2000). The preliminary data also suggested an emphasis on maize cultivation (Styles and King 1990a:64).

In addition to limited diversity of floral remains, preliminary analyses of faunal data from the 1980s excavations at Morton also suggested that the population was not taking full advantage of available resources and it is possible that there was limited consumption of red meat (Styles and King 1990a). The faunal assemblage recovered from pits at the Norris Farms 36 cemetery, however, painted a broader picture of subsistence than the Morton Village habitation site (Styles and King 1990b). Styles and King (1990b:153) suggested that the more diverse faunal assemblage at Norris Farms 36 could represent a year-round subsistence (groups returning to the mortuary site year round; whereas Morton Village could represent a summer settlement only) or that the fauna included as grave goods could reflect a broader subsistence regime prior to arrival at Morton Village/Norris Farms 36. It was also suggested that sociopolitical stress prevented Morton peoples from accessing the broad spectrum of resources available in the Central Illinois River Valley, forcing them to increase their reliance on corn and acorns (King 1993; Milner and Smith 1990).

Section 3.4.5 Morton Village/Norris Farms 36 Social Interaction

The nature of the internal relationships within the Oneota Tradition has been the focus of several interesting studies (e.g. Berres 2001; Gibbon 1972; O’Gorman 1996; O’Gorman 2010; Staeck 1999). The Oneota have been described as tribal-scale, sedentary groups with villages that functioned relatively independently of neighboring settlements (Milner, Anderson, and Smith 1991; Berres 2001; Schroeder 2004). The Oneota are believed to have had a less hierarchical social organization than Middle Mississippian groups, with the household being the

largest scale at which evidence of production was found (Benn 1989; Berres 2001). For example, there is no evidence for craft specialization in the Oneota (Benn 1989). Conversely, there does seem to be some variation in the treatment of the dead throughout the Oneota tradition and within some particular localities, hinting at some degree of differential status, possibly by household (O’Gorman 1996; Tubbs and O’Gorman 2005). Despite this ambiguity, the Oneota are generally seen as having relatively simple socio-political organization, with the decentralized authority and decision-making practices typical of tribal-level societies (Benn 1989; Berres 2001; Gibbon 1995; Schroeder 2004).

The social relationships between Oneota and Middle Mississippian peoples in general are poorly understood (Brown and Sasso 2001). There is ample evidence that the Oneota were recipients of exotic materials that moved through inter-regional exchange patterns: trade goods included chert hoes, marine and freshwater shell, copper, catlinite, and perishables like salt, meat, skins and feathers (Benn 1989; Henning 1995; Santure et al. 1990). Some of these exotic materials were incorporated into the mortuary treatment of those interred at Norris Farms 36. Perhaps most intriguingly, Oneota assemblages reveal shared iconography affiliated with the Southeastern Ceremonial Complex (SECC); suggesting similarities between the belief systems of the Oneota and Middle Mississippian societies (Benn 1989: 235; Berres 2001; Santure et al. 1990).

Early analyses, such as those by Esarey and Santure (1990:164), identified conspicuous Middle Mississippian cultural influences on the Oneota inhabitants within the central Illinois River valley. For example, the hybridization of ceramic styles suggests regular and positive interaction between the Oneota and Middle Mississippian groups (Milner, Anderson, and Smith 1991). Likewise, artifacts between Norris Farms 36 and nearby Middle Mississippian sites

indicate some similarity in technological, subsistence, social, and ceremonial practices. Esarey and Santure (1990) suggest that Morton Village Oneota people were to some degree politically and economically affiliated with the Middle Mississippians of the central Illinois River valley. However, the degree and nature of social interaction between the Oneota people at Morton Village and nearby Middle Mississippian is not clear.

Mitochondrial DNA analysis of the human remains from Norris Farms 36 demonstrated a high degree of genetic diversity in the population (Stone and Stoneking 1998). Further comparison with mtDNA analysis of a sample of human remains from the Middle Mississippian site of Orendorf (IAS 11F107) failed to reveal evidence that the Orendorf and Norris Farms 36 populations represent biologically separate groups (Shook and Smith 2008). However, whether the groups were intermarrying or simply share a common ancestry is unclear (Shook and Smith 2008). Biodistance studies by Dawnie Steadman yielded little evidence of biological interaction between the inhabitants of Morton Village and Mississippians in the area (Steadman 1998; Steadman 2001). At this time, the amount of biological relatedness between Bold Counselor Oneota and neighboring Middle Mississippian groups is not clear. As technology improves, analysis of nuclear DNA from the two populations may shed more light on the degree of biological interaction between the two populations.

Despite the evidence of positive social interactions between the Oneota and Middle Mississippian groups and ambiguous evidence of biological relationships, the Oneota at Morton Village also interacted negatively with other groups. Intergroup conflict during the late prehistoric period, particularly in west-central Illinois, has been the subject of several studies (Hollinger 2005; Milner 1999; Milner, Anderson, and Smith 1991; Milner, Smith, and Anderson 1991; Steadman 2005; Steadman 2008a; Tallman 2004).

Based on the skeletal evidence of trauma, Santure (1990c:154) identified “compelling evidence for extreme social conflict during the Bold Counselor phase”. A great number of individuals at Norris Farms 36 exhibited trauma, including antemortem, perimortem, and postmortem trauma (Santure 1990c). More significantly, the nature of the trauma indicates a relatively high rate of interpersonal violence, versus accidental trauma, which has stimulated articles regarding interpersonal violence in west-central Illinois during the late prehistoric (for example: Milner 1999; Milner, Anderson, and Smith 1991; Milner, Smith, and Anderson 1991; Steadman 2008a). Nineteen percent of the total population, and around thirty-three percent of adults, interred at Norris Farms 36 were victims of violent death (Milner, Anderson, and Smith 1991; Santure 1990c). Perimortem alterations to the bone include unhealed injuries (including definitive examples of lethal trauma where projectiles remained lodged in the body), signs of decapitation, and signs of scalping (Milner, Anderson, and Smith 1991: 583; Santure 1990c). It is important to note that the skeletal analysis likely underrepresents the number of victims of violence since the designation is reserved for those individuals with clear perimortem trauma and individuals may have died at the hands of another without any skeletal evidence.

Milner and colleagues (Milner 1999; Milner, Anderson, and Smith 1991; Milner, Smith, and Anderson 1991) proposed that the victim profile at Norris Farms 36 points to ambushes of small work groups. For example, adults were more likely than juveniles to die a violent death, as were people suffering from disabilities (Milner, Anderson, and Smith 1991). The nearly equal number of male and female victims suggests attacks on single-sex task groups venturing from Morton Village. Furthermore, several multiple interment graves were found to include only one sex, suggesting multiple victims of the same sex dying in the same incident. The relatively high number of female victims is atypical for small-scale society warfare and Milner et al. suggests

that attackers may have found it difficult to take females hostage for logistical reasons (Milner, Anderson, and Smith 1991:594).

Milner and colleagues (Milner 1999; Milner, Anderson, and Smith 1991; Milner and Smith 1990) attributed the violence to intergroup warfare as opposed to intragroup violence or accidents. Evidence for the small-scale warfare include the sheer number of victims of violent death (a level unsustainable within a community), multiple victims presumably from the same event, the presence of juvenile victims, and corpse mutilation (Milner 1999; Milner, Anderson, and Smith 1991; Santure 1990c). Milner and Smith (1990) speculated that the social conflict experienced by the Oneota population at Morton Village would have contributed to the overall stress load and therefore could have had a deleterious effect on overall health. Taken in context with the limited data regarding floral and faunal assemblages recovered during archaeological investigations of Morton Village in the 1980s, Milner and colleagues suggested that the threat of violence may have influenced the success of food-procurement activities, possibly limiting the inhabitants of Morton Village to a circumscribed territory and therefore a circumscribed diet (Milner, Anderson, and Smith 1991; Milner and Smith 1990).

The pattern of violence seen in the Norris Farms 36 cemetery was striking and had a profound influence on the understanding of cultural dynamics in eastern North America during the late prehistoric period (see Milner 1999; Milner, Anderson, and Smith 1991 and Steadman 2008a). Violence and conflict was seen as a broader phenomenon in the region and was the focus of additional investigations in the Illinois River valley. Other late prehistoric skeletons from the region exhibit evidence of violence, including projectile points embedded in bones, blunt force trauma, and evidence of scalping (Conrad 1991; Neumann 1940; Steadman 2008a). However, as discussed earlier, there is also evidence for positive interactions between the Oneota at Morton

Village/Norris Farms 36 and their neighbors. This includes the conspicuous Middle Mississippian cultural influences on the Oneota inhabitants at Morton Village as demonstrated by the hybridization of ceramic styles and the presence of burial goods that resemble materials from distant regions (Santure and Esarey 1990). Milner, Anderson, and Smith (1991:592) suggest that “(i)t is not surprising that evidence for both cooperative and antagonistic intergroup relationships occurs in the same archaeological context because these contradictory forms of behavior coexist among the inhabitants of hostile social environments.”

Section 3.5 Recent Investigations at Morton Village

Recent investigations at Morton Village have shifted the focus away from the more striking topic of violence and towards a more nuanced appreciation for the evidence for social interaction, including cooperation and peace building (e.g. Conner et al. 2010; O’Gorman et al. 2012). In 2008, Jodie O’Gorman from Michigan State University and Michael Conner from Illinois State Museum-Dickson Mounds began a project to further investigate Morton Village with the broad goals of accurately delineating site boundaries and site structure, and of developing an understanding of the relationship between Oneota and Middle Mississippians at the site and in the region.

These investigations have yielded evidence for cohabitation and cooperation between Oneota and Middle Mississippian people. Archaeological evidence suggests that both groups were occupying Morton Village simultaneously and also suggests that some wall-trenched houses could be associated with Bold Counselor Oneota as well as Middle Mississippians. At this time, there is no evidence within the site that indicates a spatial segregation of Oneota and Middle Mississippian people. Instead, a picture of regular and cooperative interaction appears. It

is not uncommon, for example, to find Oneota ceramics in a Middle Mississippian house and vice versa (Conner et al. 2010).

Likewise, the recent investigations at Morton Village have not supported the hypothesis that the Bold Counselor Oneota inhabitants were impacted by circumscribed territory or limited access to subsistence resources. Instead, recent preliminary analyses have suggested a diverse assemblage of both floral and faunal resources.

While it has been clearly demonstrated that an Oneota migration into the central Illinois River valley occurred and that the population faced ongoing violence, evidence from Norris Farms 36 and Morton Village also indicates alliance building and possibly shifting community compositions among Middle Mississippian and Oneota groups. The combination of Middle Mississippian and Oneota ceramic styles, for example, suggests an active manipulation of markers of identity.

Further investigation into ethnic identity is needed to help anthropologists develop a clearer picture of social interactions during the late prehistoric period. Stable isotope analysis of consumed diet will shed light onto one aspect of ethnic identity by exploring how food was used as a vehicle for the negotiation of ethnic identity during the late prehistoric period in the central Illinois River valley. Comparison of the stable isotope measurements from Norris Farms 36 with stable isotope measurements from the Orendorf site, a nearby Middle Mississippian site, will address one of the two broad research questions which serve as a focus of this dissertation: Was food used to emphasize ethnic boundaries between the Oneota and Middle Mississippians within the central Illinois River valley? Assessing the homogeneity within the Norris Farms skeletal population will resolve my second research question: Was ethnic identity the primary influence on dietary choice at Morton Village or did other social identities exert more influence on dietary

choice? These research questions, and the methods used to address them, are explained in Chapter Four.

Section 3.6 Overview of the Middle Mississippian Tradition in Central Illinois

Around 1000 A.D., groups in the midcontinent began to focus more intensively on maize agriculture. The associated changes in culture that followed by the 12th century are the basis of the Middle Mississippian tradition. During the Middle Mississippian period, people became more sedentary and began living year-round in fortified villages (Schroeder 2004). These villages frequently had earthwork mounds associated with them and the number and nature of earthworks are often used to classify Middle Mississippian villages into regional hierarchies (Green 1997). In addition to the appearance of settlement hierarchies during the Middle Mississippian, social organization becomes more complex and Middle Mississippian societies are often labeled chiefdoms (Peebles and Kus 1977). Institutionalized social inequality has been demonstrated in analyses of the Middle Mississippian mortuary record, analyses of public architecture and analyses of health (Brown 1971; Fowler 1991; Hatch and Geidel 1985; Larsen 2002; Powell 1995; Schurr and Schoeninger 1995). Shell-tempered ceramics are common in the Middle Mississippian and there is evidence for widespread trade networks.

The Mississippian period is well represented in the central Illinois River valley by Mississippian style artifacts, construction styles, and burial styles beginning sometime during the 11th century (Conrad 1991; Harn 1994). Conrad (1991) divides the Middle Mississippian sites in the central Illinois River valley into two geographic regions: Spoon River Mississippian (primarily in Fulton County, though it extends into Schuyler and Peoria counties) and the La Moine River Mississippian in the lower central Illinois River valley. Conrad (1991) divides the

Spoon River Mississippian into the Eveland Phase (ca. A.D. 1050-1150), the Orendorf Phase (ca. A.D. 1150-1250), the Larson Phase (ca. A.D. 1250-1300) and the Marbletown Complex (ca. A.D. 1300-1400?). This project utilizes the type site for the Spoon River Orendorf Phase as part of the case study.

Section 3.6.1 The Archaeological Context of the Orendorf Site

The Orendorf site (IAS 11F107) is an Orendorf Phase temple town in the central Illinois River valley attributed to the Spoon River Mississippian culture (Conrad 1991). It has been dated to approximately A.D. 1150-1250, though some controversy exists over these dates (Bender et al. 1973; Bender et. al 1975; Esarey and Conrad 1998; Wilson 2010). This makes it one of the earliest large towns in the central Illinois River valley and it is presumed to have played a critical role in model formulation of how towns interacted (Conrad 1991).

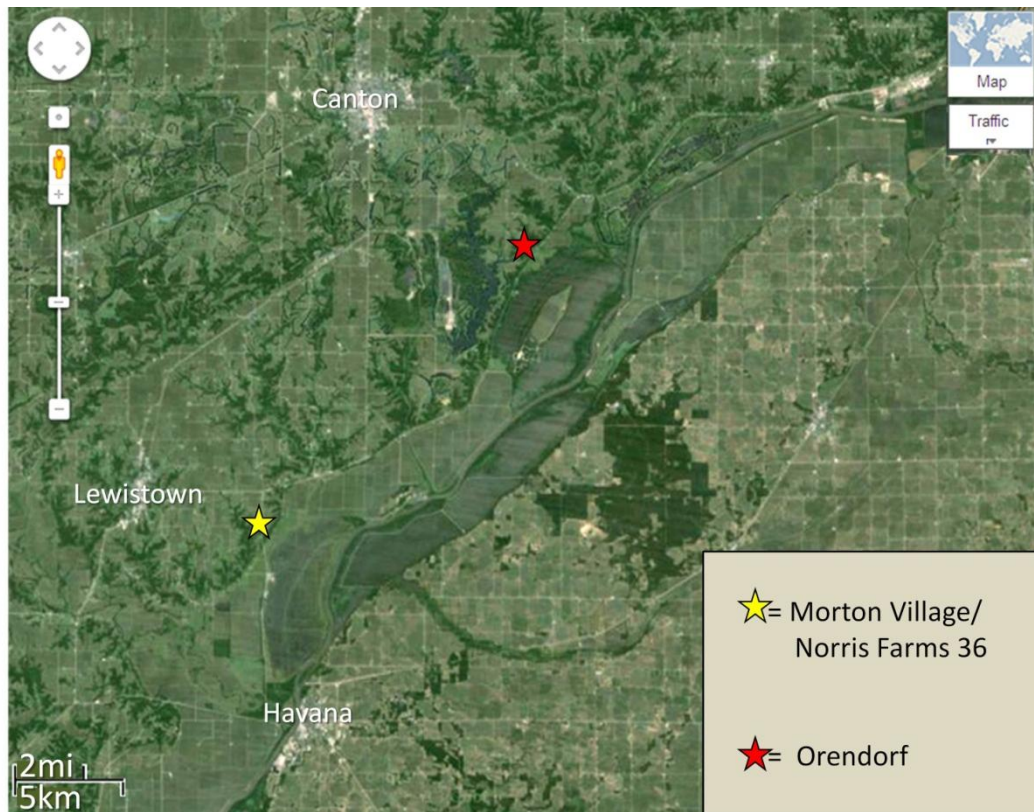
The Orendorf site is located roughly 20 kilometers upriver of the Morton site on a naturally defensible portion of a bluff overlooking the Illinois River and Rice Lake, as shown in Figure 3.2. (Esarey and Conrad 1981; Google Maps 2011; Wilson 2010). Five sequentially built main settlements, Settlements A-E, appear to have been constructed during the occupation history of Orendorf (Santure 1981). Settlements C and D have been the most extensively studied. Excavations of C and D have revealed evidence of year-round occupation of between 400 and 500 people, as well as fortification at both settlements (Santure 1981; Wilson 2010:66). The site has evidence of clear community planning, including plazas and public buildings (Conrad 1991).

The accepted chronology of the central Illinois River valley (see Table 3.1) places Orendorf in an earlier period than the Bold Counselor Oneota occupation of Morton Village. However, summed 2-sigma probability for eleven radiocarbon dates from Orendorf yield a range

from A.D. 1149 to 1320 (Wilson 2010:66). In addition, when these radiocarbon dates are interpreted in conjunction with the multiple rebuilding events at Orendorf, it is possible that Orendorf was occupied much longer than the originally estimated 80 to 100 years (Wilson 2010:67). In addition to the potential that Orendorf and Morton Village were at least somewhat coeval, there are other reasons why Orendorf is an ideal site to use in a comparison with Morton Village. These include the fact that Orendorf is a large Middle Mississippian site which provides information on social interactions in the Central Illinois River Valley, including information regarding local and nonlocal trade, and the fact that Orendorf is associated with a large skeletal population. Such data are comparable to those produced by investigations of Morton Village and Norris Farms 36 and enables the comparison of the two sites.

Table 3.1. Cultural Chronology of Morton Village and the Orendorf Site				
Site	Cultural Affiliation	Midpoint Calendar Dates	Dating Source	Lab No.
Morton Village	Late Woodland	A.D. 620	Charcoal (Santure et al. 1990)	ISGS-1390 ISGS-1350
	Spoon River Mississippian, Larson Phase	A.D. 1250-1300	Ceramic chronology (Santure et al. 1990; Conrad and Harn 1972)	
	Spoon River Mississippian	A.D. 1118	Charcoal (Santure et al. 1990; Wilson 2010)	ISGS-1391
	Bold Counselor Phase Oneota	A.D. 1230-1560	Charcoal (Santure et al. 1990)	ISGS-1348 ISGS-1349 ISGS-1377 ISGS-1415 ISGS-1416
Orendorf	Spoon River Mississippian, Orendorf Phase	A.D. 1150-1300	Charcoal, plant remains (Bender, Bryson, and Baerreis 1973; Bender, Bryson, and Baerreis 1975)	WIS-603 WIS-604 WIS-605 WIS-606 WIS-607 WIS-608 WIS-649 WIS-683 WIS-692 WIS-693 WIS-695

Figure 3.2. Locations of Norris Farms 36 and Orendorf



(Google 2011) Annotations are my own.

Section 3.6.2 The Mortuary Complex

The Orendorf phase burial complex is defined by cemeteries or burial mounds on or near the Illinois River bluff (Conrad 1991). Similar to Norris Farms 36, the mounds associated with Orendorf were built in definite stages, as opposed to accretional additions over time. Graves were then dug into these stages and graves were often superimposed over earlier burials.

According to Steadman (2008a:53), who is performing ongoing work on the mortuary context at Orendorf, the majority (69%) of burials were multiple interments. This contradicts Conrad (1991), who suggested that single, supine graves were the most common burial treatment. Despite the prevalence of individuals exhibiting perimortem trauma (see discussion in

Section 3.4.6), there does not seem to be a relationship between violent deaths and these mass graves (Steadman 2008a). Therefore these multiple interments must be considered part of the “normal” mortuary treatment, keeping in mind that violent death is often underrepresented in the archaeological record.

Ceramics were the most common category of grave furniture (Conrad 1991). Other grave goods included shell spoons, *Busycon* pendants, marine shell beads, cougar teeth, bone pins, arrowpoints, single celts or battle axes of polished limonite, Mill Creek chert, fishhooks, tool kits, galena, quartz crystals, and a possible medicine bag (Conrad 1991). Unlike other Orendorf phase sites, it does not appear that artifact class (i.e. shell versus ceramics) was mutually exclusive (Conrad 1991). In nearby Orendorf phase sites, partially disarticulated burials of adult males lacked skulls. The disproportional number of skull fragments in comparison to other human bone fragments at Orendorf supports the theory that the missing skulls were most likely curated (Conrad 1991). Orendorf mortuary practice is representative of Middle Mississippian in the central Illinois River valley due to its similarity to other regional Middle Mississippian mortuary sites in terms of the arrangement of burials and the nature of grave goods.

Section 3.6.3 Skeletal Analyses of Orendorf Remains

At this time, the total minimum number of individuals recovered from the Orendorf cemetery as reported by Jeremy Wilson (2010) is 275. According to Steadman’s 2008 publication, when the collection stood at 268, the population includes both adults and subadults of both sexes. Of the 268 individuals, 58% are adults over the age of fifteen (Steadman 2008a:52). For adult individuals for whom sex was determined, there was an equal number (54) of males and females, though selective mortality was indicated by high young adult female

mortality (Steadman 2008a; Wilson and Steadman 2008). Steadman (2008a) has completed a skeletal inventory on the Orendorf sample and a number of her students at Binghamton University have analyzed the remains for their master's research.

Analysis on the collection has revealed enamel hypoplasias (Wilson 2004), porotic hyperstosis (Bauder 2002; Bauder 2009), tuberculosis and treponematosi (Hanson 2000a; Hanson 2000b; Strange 2006). Theses and dissertations written about Orendorf have also focused on limb biomechanics and behavior (Worne 2005), the effect of skeletal pathology on isotopic data (Strange 2006), paleodemography and paleoepidemiology (Wilson 2010) and on the evidence of interpersonal violence in the population (Tallman 2004).

Section 3.6.4 The Nature of External Relationships at Orendorf

Though debated in the literature, there is evidence that Orendorf represents an in situ development of a Middle Mississippian group. Ceramic continuity in the region supports an in situ development with relatively limited influence from the American Bottom (Steadman 2001). Biological distance analysis by Steadman indicates that Orendorf peoples had relatively limited genetic interaction with nonlocal Mississippian and/or non-Mississippian groups (Steadman 1998; 2001).

Steadman notes that, though Orendorf and Larson phase Middle Mississippians were receiving more immigrants than earlier Mississippian groups, the extent of external gene flow was small (Steadman 1998:318). These data all support the conclusion that Mississippian culture change and demographic shifts in the central Illinois River valley during the late prehistoric period were likely the result of in situ processes (Steadman 2001:71).

The presence of fortifications at Orendorf indicates that some of its external relations

were not positive. This is supported by Steadman's findings that nine percent (25 individuals) of the 268 individuals included in her study were victims of violence, using the criteria of clear perimortem evidence of interpersonal trauma, inferred perimortem trauma based on archaeological context (e.x. projectile point found in ribcage, apparent decapitation), and antemortem cranial depression fractures (Steadman 2008a). The most frequent perimortem trauma included evidence of scalping and projectile wounds (Steadman 2008a: 59). Both adult males and adult females were equally likely to be victims of violence, with 20% of both males and females (11/54) exhibiting signs of interpersonal trauma (Steadman 2008a:58).

The pattern and nature of trauma at Orendorf does not support the hypothesis of intragroup or ritualized violence (Steadman 2008a). Instead, Steadman concludes that most of the trauma is the result of intergroup conflict, following the expectations laid out by Milner (1999). In general, the equal distribution of perimortem trauma between males and females, as well as evidence for interments of single or small groups of individuals suggests repeated, small-scale attacks. An interesting exception to this pattern at Orendorf is the presence of what appears to be a mass grave of at least fifteen people, twelve of whom were at least partially recovered during excavations (Steadman 2008a:54). Of the remains analyzed, three individuals exhibited evidence of interpersonal violence. Children, adult males, and adult females were all represented in the mass grave, so retainer sacrifice is unlikely (Steadman 2008a). Steadman notes that this mass grave could represent a massacre, as violent deaths do not necessarily leave a clear skeletal record, but given the limited nature of the excavation cannot make that determination (Steadman 2008a:59).

The high levels of skeletal trauma at Orendorf are some of the highest in the prehistoric Midwest, matching only Norris Farms 36. That the inhabitants at Orendorf were at high risk of

violent death is clear. What is less clear is who their enemies were. Conrad suggests that their adversaries may have been other Middle Mississippian groups in the valley, evidenced by the finding of Mississippian arrow points in a fatal context (Conrad 1991). Whether or not Orendorf adversaries were limited to other Middle Mississippian groups, the evidence of violence at Orendorf is consistent with Milner's assertion that life in west-Central Illinois was perilous in the late prehistoric time period (Milner, Anderson, and Smith 1991).

Section 3.6.5 Orendorf Subsistence Information

A number of different environmental zones were available in the vicinity of the Orendorf site; potential access was available for aquatic, semiaquatic, prairie, and woodland habitats. This would have allowed access to essentially the same varieties of faunal and floral resources available to the group at Morton Village (King 1990; King 1993; Speth 1981).

Despite the availability of a diverse assemblage of wild resources, subsistence at Orendorf is believed to have been similar to other Middle Mississippian sites: they are thought to have relied heavily on maize and white-tailed deer with only minor exploitation of other available resources (Emerson 1981:161). Indeed, a large amount of deer elements were recovered at Orendorf, suggesting an important, year-round focus on deer (Emerson 1981). In addition, evidence from the analysis of bird bones indicates that the Orendorf population extensively utilized marsh resources (Speth 1981). Bird species that would have been likely to frequent agricultural fields, such as turkey, were also commonly recovered at Orendorf (Speth 1981). Various types of fish were also recovered at Orendorf, indicating that fishing contributed to their overall subsistence (Paloumpis 1981).

Floral remains from Orendorf include corn, hickory, walnut, hazelnut, polygonum, chenopodium, pecan, sunflower, domestic bean, maygrass, squash and an unidentifiable tuber (Esarey and Conrad 1981). Maize was recovered in the majority of flotations from Orendorf (Conrad 1991). Given the ubiquity of maize at the site, as well as the frequent presence of manos and metates recovered in domestic structures, it is clear that maize was an important component of the diet at Orendorf (Perazio 1981). The reliance by Orendorf peoples on maize is supported by the limited stable isotope analysis that has been performed on Orendorf human remains, which revealed notably negative $\delta^{13}\text{C}$ values (Buikstra and Milner 1991; Buikstra, Rose, and Milner 1994; Strange 2006).

The archaeological and limited isotope evidence suggests that the people at the Orendorf site were consuming a characteristically Middle Mississippian diet. This supports the use of Orendorf as a Middle Mississippian comparison site for this analysis.

Section 3.7 Summary

This chapter situates this project within the appropriate archaeological background of the late prehistoric central Illinois River valley. Archaeological evidence supports the interpretation of the Bold Counselor Oneota as an intrusive group of migrants to the central Illinois River valley and the Middle Mississippian populations, such as Orendorf, as a local cultural development. Negative social interactions and the drawing of ethnic boundaries are suggested by the evidence for high levels of intergroup violence at both Morton Village and Orendorf and by distinct mortuary treatment at the two sites. There is, however, also evidence for positive social interactions as well, with evidence for cohabitation at Morton Village. Likewise, the hybrid ceramic styles at Morton Village hint at some level of assimilation and acculturation.

In order to fully appreciate the nature of social interactions within the late prehistoric central Illinois River valley, further investigations into ethnic identity are needed. By investigating food, a powerful cultural vehicle, this project will help clarify the nature of how groups were signaling and/or manipulating their ethnic identity. An intrasite analysis of Norris Farms 36 will shed light on how intragroup social identities influenced dietary choices and an intersite analysis of Norris Farms 36 and Orendorf will reveal how food was used to draw ethnic boundaries. The research questions this project addresses and the methods used will be explored in Chapter Four.

Chapter 4: Research Questions, Materials, and Methods

This chapter outlines the research questions, materials, and methods chosen for this study. Section 4.1 explains the two research questions which serve as the foundation of this project. Section 4.2 provides the rationale for the use of isotope analysis to address my research questions. Section 4.3 outlines the criteria for sample selection and sampling methods. Section 4.4 explains the methods used to perform stable isotope analysis. Section 4.5 discusses the validation of usable specimens. Section 4.6 explains some decisions regarding categorization of individuals based on demographic and other categories. Section 4.7 briefly outlines the statistical tests used in this project.

Section 4.1 Research Questions

In Chapter Two, I demonstrated the need for continued research on migration and ethnic identity and introduced the case study which serves as a focus of this dissertation. This section now presents the research questions serving as the foundation of this case study. In order to fully understand the interaction of migrant and local populations, it is necessary to explore the ways in which migrants negotiated and/or reified their ethnic identity (Stone 2003:31). Migrants must negotiate their ethnic identity following a migration in a manner representative of their goals and this active negotiation of ethnic identity takes place through social interaction within the context of *habitus*. By considering both the reflexive actions of individuals and the structural constraints within which they act, the investigation of ethnic identity can be viewed in a more meaningful way (Jones 1997; Stone 2003).

Based on this theoretical foundation, investigating ways in which ethnic identity was either emphasized or deemphasized has the potential to yield valuable information about social

interactions between prehistoric groups following a migration. To reach this potential, archaeologists must examine how and when groups negotiated their ethnic identity through the use of case-specific identity markers. Changes in the way these symbols were used over time can shed light on how ethnic identity has been manipulated in the past (Baumann 2004:14). In Chapter Two, I demonstrated the effectiveness of diet as a symbol of ethnic identity. Therefore, research on food choice has the potential to yield valuable insights into the manipulation of ethnic identity. In particular, maize is a uniquely powerful vehicle for the transmission of cultural knowledge and, therefore, information about ethnic identity, and is closely tied with the process of Mississippianization (Hastorf and Johannessen 1994).

This project examines food choice as a deliberate cultural symbol used to manipulate ethnic identity following the prehistoric migration of an Oneota group to west-central Illinois (ca. A.D. 1300), an area that is optimal for maize agriculture (Santure et al. 1990; Conrad and Esarey n.d.; King 1993). As migrants to the central Illinois River valley, the Oneota people at Morton Village were in regular contact with Middle Mississippians, with excavations presenting evidence for cohabitation at Morton Village of both Oneota migrants and local Middle Mississippians. This project seeks to reveal how the Oneota migrants maintained or altered their traditionally diverse diet as a result of this interaction. There are two main research questions that serve as the focus of this project.

Research Question #1: Was food used to emphasize ethnic boundaries between the Oneota and Middle Mississippians within the central Illinois River valley?

By utilizing stable isotope analysis of the remains from Norris Farms 36 and Orendorf, information about consumed diet, particularly the utilization of maize, can be gathered. Intersite analysis will reveal information about how diet at Morton Village fits into broader regional

patterns. If the Oneota at Morton Village sought to assimilate with their Middle Mississippian neighbors, it would be expected that their diet would be very similar to Middle Mississippian groups in the region and that their maize consumption would be higher than other Oneota groups. If the Oneota in the central Illinois River valley worked to maintain their traditional ethnic identity, it would be expected that they would continue to exploit a diverse array of resources, with a low to moderate consumption of maize. This strategy would result in a diet at Morton Village that was significantly different than the Middle Mississippians at Orendorf. This is particularly true if ethnic identity was the most important aspect of social identity operating at Morton Village, overruling other common identity categories, such as age and gender.

Research Question #2: Was ethnic identity the primary influence on dietary choice at Morton Village or did other social identities exert more influence on dietary choice?

Building upon the theoretical framework presented above, and explained in more detail in Chapter Two, this research question focuses on an intrasite analysis of diet at Morton Village. This intrasite analysis will utilize the stable isotope information from the Norris Farms 36 burials to provide a more fine-grained view of the diet at Morton Village.

Continually reifying a traditional ethnic identity would likely involve routine consumption of traditional food. This would prioritize ethnic identity at Morton Village over other social categories, resulting in a homogenous diet within the site. By investigating factors that introduce heterogeneity into diet, information about other social categories, such as age, sex, or other social identities, and how they impacted dietary choice will be revealed. This is in line with White and others' 2009 call for investigating food consumption on smaller scales to help infer social identity.

As mentioned above, these two research questions will be addressed using stable isotope analysis of human remains from the two sites, which will allow for the assessment of intersite and intrasite variation. The materials and methods used to perform this analysis are outlined in the following sections.

Section 4.2 Rationale Affecting the Use of Stable Isotope Analysis for this Project

In Section 4.2.1 a rationale is offered for the use of human bone for stable isotope analysis. Section 4.2.2 explains the decision to perform stable isotope analysis on a selected sample of faunal bone as well. Section 4.2.3 justifies the use of collagen for the stable isotope analysis.

Section 4.2.1 Rationale for Isotopic Analysis of Human Remains

Stable isotope analysis of bone is the most commonly used method of analyzing consumed diet. Analysis of $\delta^{13}\text{C}$ values can provide valuable information regarding the contribution of C4 plants (in eastern North American, maize is the most commonly used C4 plant) to the diet (Bumsted 1981; Schwartz and Schoeninger 1991). In addition, in areas where most faunal resources are assumed to be terrestrial in nature, changes in $\delta^{15}\text{N}$ values can be assumed to reflect changes in terrestrial animal protein intake, with a decrease in values reflecting a decrease in meat consumption and/or a decrease in the trophic levels of animal protein consumed (White et al. 2001b). In areas where aquatic resources are believed to be used, such as the central Illinois River valley, the nitrogen values are somewhat more difficult to interpret. Fish remains tend to have significantly more positive $\delta^{15}\text{N}$ values than categories of

terrestrial fauna (e.x. Schoeninger and Schurr 1998). This is presumably due to the complex food webs associated with aquatic environments and the fact that fish utilize decomposing terrestrial organic matter (Schoeninger and Schurr 1998). Therefore, the consumption of fish would result in higher $\delta^{15}\text{N}$ values.

Stable isotope analysis has been performed on some of the human remains from Norris Farms 36 and Orendorf (Buikstra and Milner 1991; Buikstra, Rose, and Milner 1994; Strange 2006). However, sample numbers in both cases have been relatively small; for example, less than four percent of the skeletal collection from Norris Farms 36 has been sampled for isotope analysis.

The stable isotope analysis of the adult human remains from Norris Farms 36 and Orendorf for this project makes important contributions to the understanding of intrasite and intersite dietary variation within the central Illinois River valley. Analysis of subadult human remains provides information regarding weaning and provides information regarding dietary changes associated with the migration that are obscured in some adults.

Section 4.2.2 Rationale for Isotopic Analysis of Faunal Remains

In order to properly interpret isotope values from human remains, it is necessary to have an understanding of regional isotope levels. For example, Strange (2006) noted that $\delta^{15}\text{N}$ values at Orendorf were difficult to interpret without knowing the values for food animals in the region. The central Illinois River valley was populated primarily by maize agriculturalists during the late prehistoric period and it is possible that fauna were consuming at least some maize from the fields in the area. For example, Speth (1981) suggested that birds were exploiting the agricultural fields associated with the nearby Orendorf site. If fauna were consuming maize, their $\delta^{13}\text{C}$

values may be somewhat more positive than expected, which may impact the values of the humans who hunted them. This is a particular concern since bone collagen preferentially forms from the protein component of the diet and faunal resources are high in protein. In an attempt to draw the most accurate conclusions about how dietary resources were affecting human isotope signals, I chose to sample a small number of fauna from the habitation area at Morton Village. While the initial goal for sampling faunal remains was to collect samples from five specimens per species of mammals, fish, birds, and reptiles from faunal material recovered from Morton Village, decision-making was influenced by availability and preservation. The sampling procedure for these faunal remains is outlined in more detail in Section 4.3.4.

Section 4.2.3 Rationale for Analyzing Collagen

Bone collagen is a fibrous protein which makes up approximately one-quarter of all proteins occurring in mammals and forms part of the organic matrix of bone. Apatite is a mineral that forms part of hydroxyapatite, or the inorganic component of bone. Part of apatite is carbonate and it is this part of apatite which is used for isotope analysis (Sullivan and Krueger 1981). Because collagen is a protein, it is formed largely, though not completely, from ingested proteins (Ambrose and Norr 1991; Jim et al. 2004; Tieszen and Fagre 1993). Apatite carbonate in bone is formed from circulating carbonate in the blood and therefore is influenced by all components of the diet (Ambrose and Norr 1993; Jim et al. 2004; Sullivan and Krueger 1981). Therefore the two substances provide slightly different information. For this analysis, it was determined that collagen is the best choice for several reasons.

Most analyses of stable isotopes performed to reconstruct diet use bone collagen as the preferred tissue. This is true in the central Illinois River valley, allowing comparisons with

existing data (i.e. Buikstra and Milner 1991; Buikstra, Milner and Rose 1994; Strange 2006; etc). Although some recent work in Illinois, such as work by Emerson et al. (2005), Hedman et al. (2002) and Hedman (2006), has used apatite, collagen has also been used. Though the comparisons of collagen values between my research and Emerson et al.'s work will have to be made carefully, there is still potential for comparison using collagen alone.

Although apatite values would provide additional comparative information, at this time the cost, in terms of time and resources, outweighs the benefits for this project. The major argument for the use of apatite is based on the concept that collagen may over-represent the dietary importance of protein that is enriched in ^{13}C (e.g., marine animals) and under-represent ^{13}C enriched plant foods that are low in protein (e.g., maize). For example, a study by Harrison and Katzenberg (2003) showed that the carbon isotopic signature of maize was detectable at an earlier date, when maize was consumed in a smaller amount, in carbonate than in collagen. However, in their test study $\delta^{13}\text{C}$ of collagen does not under-represent maize in the later fully horticultural groups, which we would expect to be the case for this study. In addition, most of the time there is a fairly consistent ratio difference between the values of collagen and carbonate apatite, particularly when the protein and non-protein components have similar $\delta^{13}\text{C}$ values. Schober (1998) ran a very large number of samples from Archaic to Middle Mississippian, and only one sample showed unusual diet/apatite spacing.

Diagenesis is also a concern when choosing methods. Collagen is an organic matrix of bone and therefore breaks down over time and can become contaminated by humic substances. Collagen contamination and degradation can be tested for using the percent collagen yield, the C:N (carbon to nitrogen) ratio and the percent of weight of carbon and nitrogen in the sample. A

C:N ratio between 2.9 and 3.6 is considered acceptable for stable isotope analysis (Katzenberg and Pfeiffer 1995). AMS dating would further test the reliability of the collagen results. At this time, AMS dating is outside the scope and resources of my project, but may be an area for future collaboration.

Apatite is also more susceptible to diagenesis, caused by the exchange of minerals and the surrounding soil. There is no truly effective way to assess whether apatite has been contaminated with carbonates from the environment. Most mineral sources of carbonate are enriched in ^{13}C , so even a small amount of mineral contamination can mimic maize consumption. A study by Koch et al. (1997) found that bone apatite values were more variable than enamel apatite values, leading to the conclusion that apatite analysis is best performed on tooth enamel.

Another complication with analyzing stable isotopes from bone carbonate results from variations in turnover time. Hedges et al. (2007) demonstrated that collagen doesn't turnover significantly once maturity is reached. As a result, bone collagen represents the diet from late adolescence. Bone exchanges minerals rapidly with the bloodstream so bone carbonate may reflect a diet at a different time. This problem can be controlled for by using enamel, which does not remodel. However, although there would be value to a study using apatite from enamel focusing on the diet from the central Illinois River valley, it is outside the scope of my dissertation in terms of both time and resources.

Dr. Mark Schurr at the University of Notre Dame generously offered the use of his lab and equipment for the analysis of collagen. For the reasons listed above, as well as the logistical issues of funding and equipment, the analysis of bone collagen is sufficient for this project. The

analysis of apatite is an area where there is potential for future collaborative research and I have retained all leftover sampling material for future research.

Section 4.3 Criteria for Selecting Samples and Sample Collection Methods

This section explains the decisions I made when collecting my samples. Section 4.3.1 explains the criteria I used when selecting human remains at both sites for sampling. Section 4.3.3 describes the physical process used to collect my samples. Section 4.3.3 outlines the factors that influence the selection of the faunal sample for this projection. Finally, section 4.3.4 describes the physical process of collection faunal samples.

Section 4.3.1 Sampling Criteria for Human Remains

In order to ensure a reliable sample size for this analysis, I sampled a total of seventy-five individuals from both the Norris Farms 36 and Orendorf collections. Fifty of these individuals were adults and twenty-five were children from both collections.

To choose my sample, I created a database in Microsoft Excel for each site which included all the available burials by number and entered information about each available burial at both sites. Burials were then grouped using the sheet feature in Microsoft Excel into six different age groups: neonates, 0-1 year olds, 1-2 year olds, 2-4 year olds, 5-15 year olds and adults (15+). Adults were then further divided based on sex.

Once the seven subgroups were created in Excel, I used the random sample tool built into the program to select six neonates, six 0-1 year olds, six 1-2 year olds, six 2-4 year olds, six 5-15 year olds, 30 adult females, and 30 adult males. This process resulted in a list of 90 individuals for both sites.

In the summer of 2008, I traveled collect samples for this project. At that time, the Orendorf skeletal collection was at SUNY-Binghamton on loan to Dr. Dawnie Steadman from UMVARF and the Norris Farms 36 skeletal collection was housed at the Pennsylvania State University, on loan to Dr. George Milner from the Illinois State Museum. At the respective collections, I preferentially chose the first five individuals from each category of subadults and the first 25 individuals from the two categories of adults.

For this project, I preferentially selected samples from the sternal end of the rib. Ribs have been chosen for this analysis several reasons. Moore et al. (1989) suggested ribs be used for stable isotope analysis. Cutting ribs is relatively easy, leading to fewer logistical problems in the field. Additionally, sampling ribs allows the preservation of articulations and can be viewed as somewhat less destructive than sampling long bones. When selected individuals did not have available rib ends, I sampled any existing bone fragments that could be confidently associated with the individual. Individuals that did not have available ribs or bone fragments were excluded from my sample and another individual was substituted using the generated random sample procedure described above.

At Binghamton, using rib ends to sample the Orendorf collection resulted in a sample of 25 subadults, 20 adult males and 22 adult females. To achieve this number of samples, it was necessary to include two “likely males” as “males” and two “likely females” as “females”. Six individuals had confidently associated long bone fragments, but two subgroups, infants and adult males, were both lacking individuals with either rib ends or long bone fragments. To complete my sample, I collected a small piece of bone at the distal end of broken long bone shafts from one infant and one adult male.

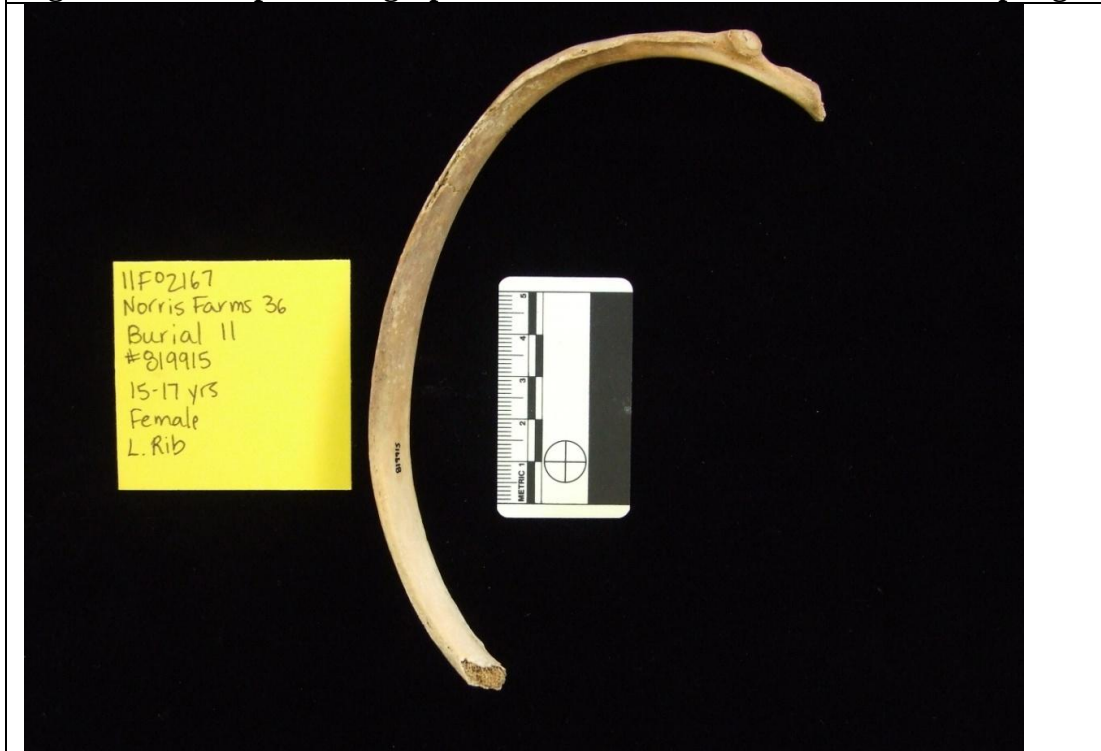
At Penn State, the Norris Farms 36 collection was much more complete. In cases where it was determined that one of the selected individuals lacked rib ends, a different individual from the same category was substituted. However, it was still necessary to include one “likely male” to complete the male sample. The neonate category of the Norris Farms 36 collection did not have 5 individuals with available rib ends or long bone fragments. A juvenile from the 5-15 year old category was substituted. The final distribution of samples is presented in Table 4.1.

Table 4.1. Number of Individuals Sampled in Each Age Category		
	Norris Farms 36	Orendorf
Neonates	4	5
Infants	5	5
1-2 years old	5	5
2-5 years old	5	5
5-15 years old	6	5
Adult Female	25	25 (2 F? included in this category)
Adult Male	25 (1 M? included in this category)	25 (2 M? included in this category)

Section 4.3.2 Sampling Methods for Human Remains

Once the burials and skeletal element to be sampled were selected, a tag recording sample and provenience information was then created on acid-free paper. Burials from Norris Farms 36 were labeled first with the letters “NF” and then with the burial number. Burials from Orendorf were labeled first with the letter “O” and then burial number. A photograph of the skeletal element was taken before sampling (for an example, see Figure 4.1).

Figure 4.1. Example Photograph of Norris Farms 36, Burial 11 Pre-sampling



I then collected approximately 0.5 gram (about the size of a fingernail) samples of bone for isotope analysis. To collect the majority of the samples, a utility knife was used to score the rib end about a thumbnail's width from the sternal end. Pliers were then used to snap the bone along the score. On denser ribs and long bones, a small handsaw was used to remove the sample. Photographs were then taken of the sample (for example, see Figure 4.2) before the sample was placed in a small bag and then placed into a larger bag that contained the acid-free tag.

Figure 4.2. Example Photograph of Norris Farms 36, Burial 11 Post-sampling



Section 4.3.3 Sampling Criteria for Faunal Remains

The initial goal for sampling faunal remains was to collect samples from five specimens per species of mammals, fish, birds, and reptiles from faunal material recovered from Morton Village. Once at the collection, housed in the Dickson Mounds Museum, a branch of the Illinois State Museum, decision-making was influenced by availability and preservation. I attempted to collect samples from as many features as possible and to collect as many species as possible. In addition, the ideal number of specimens per species was reduced to three in order to accommodate sampling from the categories of “Large Mammal” and “Medium/Large Mammal”. All of the faunal samples came from features in the Morton Village habitation site, with the exception of one dog sample, which came from Burial 56 in the Norris Farms 36 cemetery. This young male dog was found with a disabled adolescent boy (Santure 1990:93). The dog was included in sampling since grave goods suggest he may have been a food offering.

The final sample was comprised of seven fish (including bass, bowfin, buffalo fish, cat fish, gar fish, and unidentified fish), two birds (a turkey and an unidentified bird), twenty-one

mammals (including beaver, deer, dog, elk, unidentified large mammals, and unidentified medium/large mammals), and ten turtles (snapping turtle, map turtle, Blanding's turtle, softshell turtle, and unidentified turtles).

Section 4.3.4 Sampling Methods for Faunal Remains

Once the faunal samples were selected, a tag recording sample and provenience information was then created on acid-free paper. Faunal samples were labeled first with the letter "M" and then with a number I designated based on the order in which they were sampled. Photographs were then taken. I then collected approximately 0.3 gram (about the size of a fingernail) samples of bone for isotope analysis. Although ribs were sampled when available, ends of long bones and long bone fragments were commonly sampled. For turtles, portions of the plastron and carapace were typically sampled. Options when sampling fish were even more limited, and bones from fish heads comprise most of the fish sample.

To collect the majority of the samples, a utility knife was used to score the bone. In many cases, perhaps due to heat-treatment, a utility knife was sufficient to remove a sample. In other cases, the bone was scored with a utility knife and pliers were then used to snap the bone along the score. On denser bones, a small handsaw was used to remove the sample. The sample was then double-bagged with its acid-free tag.

Section 4.4 Isotopic Analysis Procedures

This section describes the process used to prepare and process the bone samples. Section 4.4.1 outlines the cleaning process of the bone samples. Section 4.4.2 explains the

demineralization process. Section 4.4.3 describes the process of analysis of the samples in the mass spectrometer.

Section 4.4.1 Cleaning of the Samples

After the samples were collected, I traveled to the University of Notre Dame and prepared the bones for analysis in the stable isotope analysis in the mass spectrometer. To do so, it was necessary to have a very rigorous cleaning protocol in place. It is very important to remove all cancellous bone, so the first step to prepare the ribs involved using a utility knife and pliers to split the ribs open. Dental tools were used to remove the cancellous bone. In addition, the bone was cleaned using mechanical procedures which included scrubbing in distilled water with a toothbrush and scraping off discolored surfaces and adhering contaminants with dental tools. Areas of discoloration were filed off using fine grit sandpaper. Samples were resized to the required size, then were placed into labeled test tubes filled halfway with distilled water. The test tubes were then loaded into a basket and lowered into an ultrasonic cleaner for 20 minutes. They were allowed to dry in the test tubes. Any remaining discoloration or contaminants were removed by abrading with a Dremel tool.

Once the bone segments were thoroughly clean and dry, they were weighed to confirm they weighed between 0.10 and 0.15 grams after cleaning. If necessary, they were resized to meet these criteria, as was necessary in most cases. All leftover cleaned bone samples were saved and replaced in the original bag with label. However, five samples (one faunal sample from Morton Village and four samples from Norris Farms 36) had less than 0.1 grams remaining of the sample following cleaning. For these cases, the entirety of the cleaned sample, though less than 0.1 gram, was used.

Section 4.4.2 Demineralization of the Samples

Next, the demineralization process was begun using a technique originally developed by Sealy, as outlined by Moore et al. (1989). This technique, which involves using small chunks of bone (as opposed to ground bone) may work better than comparable techniques when working with poorly preserved material (Moore et al. 1989).

Given the number of bone samples to prepare, the samples were demineralized in four groups. The first step of demineralization involved the clean and resized samples being placed back into labeled test tubes. The test tubes were then filled halfway with a 0.25 M concentration of HCl. The samples were slowly demineralized in the HCl for a period of 14 days, periodically agitated. After 14 days, the samples were rinsed thoroughly. Next, the test tubes were filled halfway with a NaOH rinse to remove the acids and any remaining lipids. They remained in the NaOH rinse for 24 hours, after which time the samples were again rinsed thoroughly.

Seven faunal samples fully dissolved during the demineralization process and were necessarily removed from further analysis. These included a beaver, two turtles, a deer, two “large mammals”, and a “medium/large mammal”.

Bone samples were then transferred into small, pre-weighed and labeled vials. As the final step in sample preparation, the bone samples were freeze-dried. After freeze drying, the vials containing the samples (collagen pseudomorphs) were weighed. Collagen yield was determined for each sample using the formula below.

$$\frac{\text{weight of vial containing dried sample} - \text{empty vial weight}}{\text{weight of clean sample}} \times 100$$

Results of the tests to examine collagen extraction showed very high collagen yields (Table 4.2). Typically, in archaeological remains low collagen yields are usually more of a concern, with samples yielding less than 2% routinely rejected as appropriate for isotope analysis in the mass spectrometer. There were 99 human samples which extraction yields over 20%, 53 of which had yields over 25%.

Table 4.2. Summary of Collagen Yields				
Collagen Yields	Number of Samples from Norris Farms	Number of Samples from Orendorf	Number of Samples from Morton Village Fauna	Total
Less than 2%	0	1	3	4
2%-10%	5	16	9	30
10-20%	8	22	16	46
20%-30%	14	31	5	50
25%-30%	46	3	1	50
Above 30%	2	2	0	4
	75	75	34	185

Such high collagen yields are unusual and caused Dr. Schurr and I to question if something had been miscalculated or mismeasured. Upon review, no mathematical errors were found. Fifteen samples with the highest collagen yields were reweighed in the vials at the Van Andel Research Institute, in Grand Rapids, Michigan. No weighing errors were found.

Simple statistical tests were run using the statistical program SPSS and showed no correlation between the date the bone samples began the demineralization process and the collagen yield; high collagen yields were found in all 4 groups. No correlation was seen between the weight of the sample and the extraction yield. Schoeninger et al. (1989) suggested that collagen yields above 25% may present poor demineralization. Since poor demineralization often

results in low %N, collagen yield was plotted against %N and showed no relationship; low %N had no significant relationship with high collagen yields. The strongest relationship was between site and extraction yield, with the faunal remains from Morton Village least likely to have high collagen yields, the human remains from Orendorf somewhat likely to have high collagen yields and the remains from Norris Farms 36 very likely to have high extraction yields.

Some of the faunal remains are believed to represent subsistence items and may have been subjected to heat. Although the remains chosen for study from Orendorf were moderately well-preserved, the remains from Norris Farms 36 were extremely well-preserved and it may be that the extraction yields reflect true success based upon taphonomic factors. Additionally, the lower collagen yields from Norris Farms 36 were principally from remains which I had noted were “weathered”.

To further test whether the high collagen yields were the result of poor demineralization, five of the samples which had the highest collagen yields and which also had remaining cleaned but non-demineralized bone were chosen. These bone samples were sent to the University of Notre Dame where students demineralized them under the guidance of Dr. Mark Schurr. The tests also revealed high extraction yields (see Table 4.3).

Table 4.3. Results from Testing of Collagen Yields					
Sample	Clean sample weight (g)	Empty vial weight (g)	Vial+dried sample weight	% Collagen Yield	Original % Collagen Yield
NF-288	0.10975	4.75587	4.77826	20.4	29.3
NF-265	0.07015	4.75185	4.76773	22.6	25.7
NF-258	0.09354	4.76638	4.78928	24.5	26.5
NF-022	0.11521	4.72281	4.75036	23.9	27.2
NF-050	0.0906	4.77987	4.80265	25.1	28.3
NF-031	0.06593	4.76406	4.778	21.1	24.8

A survey of the literature revealed that several studies report high extraction yields, particularly for more recent material (i.e. Jørkov et al. 2007; Semal and Orban 1995; Turossa et al. 1988). In living humans, collagen contributes up to 35% of the bone material (Aerssens et al. 1998; Bailey et al. 1999), so potentially yields up to that level may be usable. A literature survey also revealed that reliable collagen had been recovered in bones up to, and possibly beyond, 50,000 years (e.x Semal and Orban 1995). Upon completion of the brief literature review, it seemed that yields of up to 30% were not necessarily impossible but it was noted that care would need to be taken at every step to verify the integrity of the collagen samples. Quality indicators of particular importance would include %C values, %N values, and C:N ratios. At this point, four samples (a “large mammal”, a “medium/large mammal”, an elk, and burial 135 from Orendorf) were rejected for collagen yields under 2%. Four samples (NF-267, NF-231, O-17, and O-associated 83) were rejected for collagen yields above 30%.

Section 4.4.3 Analysis of the Bone Samples in the Mass Spectrometer

The next step was weighing of the samples in preparation of the 178 remaining bone collagen samples for analysis in the mass spectrometer. On a microbalance, an empty tin capsule was tared. The sample or standardized sample was carefully placed into the tin capsule. Each collagen sample was resized, if necessary, by using two forceps to break off any extra material. The goal was a sample size of around 0.5 mg, with a range of 0.4 mg and 0.68 mg used. Once the sample/standard was within the desired weight range, the weight was recorded and the capsule was crushed into a round shape using forceps and loaded into a sample tray.

To ensure the proper calibration of the mass spectrometer, a standardization procedure was in place utilizing the National Institute of Standards and Technology (NIST) standards. A

series of standardized samples of sulfanilamide for which values are already known was run with every group of collagen samples to ensure precision throughout the analysis. Each sample run was begun with three sulfanilamide samples, a blank sample, and another sulfanilamide sample. This fourth sulfanilamide sample was used as the reference standard for the day's run. In addition, a sulfanilamide sample was run every 10-12 collagen samples.

Once a manageable run of samples had been prepared, they were loaded into the autosampler of the Thermo Finnigan Delta Plus Stable Isotope Spectrometer at the Center for Environmental Science and Technology (CEST) at the University of Notre Dame. The tin encapsulated samples were then flash combusted within the mass spectrometer and carbon and nitrogen stable isotopes were measured simultaneously for each sample.

The output of the mass spectrometer at the end of the day's run included information entered prior to analysis (i.e. identifiers for the samples and their weight in mg) and also information determined by the spectrometer, such as the area of the nitrogen peak (AreaN), the uncalibrated $\delta^{15}\text{N}$ value, the uncalibrated $\delta^{13}\text{C}$ value, and the Amount % carbon (Amt%C). For this project, $\delta^{15}\text{N}$ is defined as the measure of the ratio of stable isotopes $^{15}\text{N}:^{14}\text{N}$, reported in parts per thousand (per mil, ‰), and $\delta^{13}\text{C}$ is defined as the measure of the ratio of $^{13}\text{C}:^{12}\text{C}$, reported in parts per thousand (per mil, ‰).

Upon completion of the analysis by the isotope ratio mass spectrometer, the results for each day's run was assessed for reliability and calibrated. The K values were determined for nitrogen and carbon in the reference standard and subsequent standards. The known values associated with sulfanilamide were used: %N=16.27 and %C = 41.84. The formulas used are listed below.

$$K_N = \frac{(\%N) \times \text{mg weight of sample}}{\text{Area}_N}$$

$$K_C = \frac{(\%C) \times \text{mg weight of sample}}{\text{Area}_C}$$

This step resulted in a series of K values for the sulfanilamide standards. These were averaged to determine the average K_N and average K_C values for each day. The average K_N value was used to determine the %N for each collagen sample and the average K_C value was used to determine the %C for each collagen sample.

$$\%N = \frac{(\text{AVG } K_N) \times (\text{Area}_N)}{\text{mg weight of sample}}$$

$$\%C = \frac{(\text{AVG } K_C) \times (\text{Area}_C)}{\text{mg weight of sample}}$$

For the final step in calculating reliability, the C:N ratio was determined for each sample using the following formula:

$$C:N = \frac{(\%C)}{(\%N)} \times \frac{14}{12}$$

Next, isotope values of the samples were calibrated. For this analysis, the isotope values for both carbon and nitrogen are reported in the standard “delta” (δ) notation of units of “per mil” (‰, parts per thousand) differences relative to a standard reference material. The reference material for carbon is Vienna PeeDee Belemnite [VPDB], which has a high $^{13}\text{C}/^{12}\text{C}$ ratio,

which means that $\delta^{13}\text{C}$ values of tested samples are typically negative. The reference standard for nitrogen atmospheric N_2 [AIR] and $\delta^{15}\text{N}$ values of tested samples are typically positive. The calculation to determine the delta value for both carbon and nitrogen can be found in Ambrose et al. (1997).

The average of the $\delta^{15}\text{N}$ values was determined for the reference standard and subsequent standards. For calibration purposes, -2.37‰ (the standard value for sulfanilamide) was subtracted from this average to result in a correction factor. For each collagen sample, the correction factor was subtracted to result in a calibrated $\delta^{15}\text{N}$ (cal $\delta^{15}\text{N}$) value.

The $\delta^{13}\text{C}$ values of the samples were then calibrated. The average of the $\delta^{13}\text{C}$ values was determined for the reference standard and subsequent standards. For calibration purposes, -28.55‰ (the standard value for sulfanilamide) was subtracted from this average to result in a correction factor. For each collagen sample, the correction factor was subtracted to result in a calibrated $\delta^{13}\text{C}$ (cal $\delta^{13}\text{C}$) value.

The end result of this process was the determination of C:N ratios, %N, %C, calibrated $\delta^{15}\text{N}$, and calibrated $\delta^{13}\text{C}$ values. From this point forth in this dissertation, $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values will refer to the calibrated values.

Section 4.5 Validation of Usable Specimens

In addition to extraction yields, researchers routinely have suggested the carbon to nitrogen (C:N) ratio be used to verify the integrity of collagen samples. Any C:N ratios outside the acceptable range of 2.7-3.6 indicates noncollagenous material and the samples must not be

used (Schwarcz and Schoeninger 1991). There were seven samples rejected from this analysis based on C:N values outside the 2.7-3.6 range. These were M-31, O-35, O-80, O-96, O-148, O-156, and NF-205.

Although C:N ratios outside the accepted range indicate noncollagenous material, values within that range do not necessarily indicate usable collagen. Some researchers have suggested %N and %C be used as an additional measure of reliability (Jørkov et al. 2007; van Klinken 1999). Ideal values are around 35 wt % C and between 11 and 16 wt % N (van Klinken 1999:691). The majority of the samples matched these expectations. However, eight samples had values that were noticeably outside of the accepted range. These samples were M-25, M-28, O-4, O-46A, O-56, O-58, O-70, and O-135. These samples were not included in the statistical analysis, since the reliability of the collagen could not be accepted. The final number of usable samples from Orendorf and Norris Farms 36 is summarized in Table 4.4 and the breakdown of useable faunal samples is shown in Table 4.5.

Table 4.4 Number of Usable Samples Each Age Category		
	Norris Farms 36	Orendorf
Neonates	4	2
Infants	5	5
1-2 years old	5	4
2-5 years old	5	5
5-15 years old	6	5
Adult Female	22	20
Adult Male	23	21
Total	70	62

Table 4.5. Number of Usable Faunal Samples		
	Species Total	Class Total
Fish Total		6
Bowfin fish	2	
Gar fish	1	
Buffalo fish	1	
Cat fish	1	
Unidentified fish	1	
Bird Total		2
Unidentified mid-size bird	1	
Wild Turkey	1	
Mammal Total		13
Beaver	1	
Deer	2	
Elk	2	
Dog	2	
Muskrat	1	
Large Mammal	2	
Large/Medium Mammal	1	
Unidentified Rodent	1	
Unidentified Mammal	1	
Turtle Total		7
Map Turtle	1	
Blanding's Turtle	2	
Snapping Turtle	1	
Softshell Turtle	1	
Unidentified Turtle	1	
Unidentified Aquatic Turtle	1	

Section 4.6 Adjustment of Burial Categories

This section explains the decisions made regarding categorization of the individuals at various stages in the analysis. First, section 4.6.1 describes the development of additional demographic categories. Section 4.6.2 explains decisions made about the determination of warfare categories. Section 4.6.3 outlines decisions that were made when assigning burials to the different disease categories. Section 4.6.4 presents information about other decisions that were made that affected the assignment of burials to particular categories. Finally, Section 4.6.5 describes the methods used in assigning grave goods to categories.

Section 4.6.1 Adjustment of Demographic Categories

Once samples were eliminated for unusable collagen yields and/or poor C:N ratios, I was left with a total sample of 72 individuals for Norris Farms and 66 individuals for Orendorf. The number of usable samples by age category is listed in Table 4.4.

It was determined that the “adult” age range may obscure age-related differences. To address this, the broad adult age category was broken down into “young adult” (15-25 years old), “middle age adult” (25-40 years old) and “older adult” (40+ years). The categories are noticeably different from the age categories found in *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994), which has been considered a discipline standard since its publication. The skeletal analysis of the Norris Farms 36 remains was prior to its publication and the authors utilized well-respected aging techniques which are still considered valid but which do not adhere exactly to the grouping in *Standards* (Milner and Smith 1991). For example, “adult” age criterion for the remains at Norris Farms 36 was considered to be 15 years of age. To maintain comparability within this study as well as between this study and existing studies on the Norris Farms 36 population, the adult age categories used in this study begin at 15 in contrast to the “young adult” category in *Standards*, which begins at age 20. Likewise, “older adult” in this study begins at 40, in contrast to *Standards*, which uses 50 as the lower boundary for this category.

To determine these adult age groups, I took the median of the age range determined by Milner and Smith (Norris Farms 36) or Steadman (Orendorf). If the median age in this range was on the line dividing two age groups (ex: 30-40= 35), they were placed in the younger age group (in the example, they would be placed in group “7” or “middle age adults. Four fragmentary

individuals from Orendorf were unable to be aged beyond “adult”. These were retained in the adult category but were excluded from more detailed analysis.

Most individuals from both sites fit nicely into these adult age categories, further justification for their use. When individuals had only one age listed as a lower boundary (i.e. 35+), I would place them into the age category for that age. This did not end up posing major problems as this event was rare and typically confined to older individuals. Two individuals from Orendorf were aged at 35+ and these individuals were placed in the middle age category. One individual from Orendorf was listed as 45+, thirteen individuals from Norris Farms 36 was listed as 50+ and three individuals from Orendorf were listed as 50+. All of these individuals were categorized as older adults. These categories were also further broken down by sex. The breakdown of the adult samples by these age and sex groups is shown in Table 4.6.

Table 4.6 Number of Usable Samples by Specific Demographic Group		
	Norris Farms 36	Orendorf
Adults	45	41
<i>Adult Females</i>	<i>22</i>	<i>18</i>
Young Adult Female	5	9
Middle-Age Adult Female	6	3
Older Adult Female	11	6
<i>Adult Males</i>	<i>23</i>	<i>23</i>
Young Adult Male	3	3
Middle-Age Adult Male	9	8
Older Adult Male	11	8
Adult	0	4

Section 4.6.2 Determination of Warfare Category

Both Orendorf and Norris Farms 36 have been shown to have very high rates of perimortem trauma and evidence of warfare (Milner and Smith 1991; Steadman 2008a). When investigating a population that has evidence of warfare, it is necessary to be aware that it is possible that not all individuals were members of the local populations and some may have been members of a raiding party. Mortuary treatment can, at times, serve a purely disposal function. Summer in west-central Illinois can be brutal and certainly would require the removal and/or disposal of corpses, even those of nonlocal groups.

To help ensure that this project was testing local individuals only and not inadvertently including members of aggressive outside groups, I examined individuals who showed evidence of death as a result of warfare separately from those with no evidence for warfare.

To attempt to separate out victims of warfare, I primarily used perimortem trauma as a proxy for warfare. Perimortem trauma used to assign an individual to the warfare category included evidence of scalping, decapitation, cranial blunt force wounds, and/or projectile injuries, which is consistent with the categories used by Dawnie Steadman in her analysis of the Orendorf population (Steadman 2008a). In addition, there were two individuals from Orendorf (O-120 and O-146) tentatively assigned to this category based on probable decapitation and unique burial treatment in the case of O-120, and association with projectile points and unique burial treatment in the case of O-146. The assignment of warfare to these individuals is consistent with Steadman's conclusions.

In cases where there was any question as to the categorization, the sample was left out during analyses that utilized this category. However, it is important to note that victims of warfare do not always show skeletal trauma. Since the lack of physical evidence of warfare

resulted in an individual being placed in a “non-warfare” category, it is important to note that the warfare category may underrepresent the number of victims of violent death.

Section 4.6.3 Determination of Disease Category

In order to determine whether disease was affecting the isotopic signature of our samples, disease was examined as a variable. One motivation for this was the fact that chronic disease has the potential to reduce the ability of an individual to secure his own food. Likewise, Strange (2006) noted an increased nitrogen value in vertebra affected by disease.

Unfortunately, a reinvestigation of pathology in the two skeletal collections was outside the scope of this project. As such, disease categories defined by previous researchers were used. Though the published report of Norris Farms 36 presents very useful rates of disease in the total population, information at an individual level was not readily available for all sampled individuals. Likewise, researchers working with the two different populations have investigated different diseases. The Norris Farms 36 report includes information regarding treponemal disease, tuberculosis, periostitis, and undiagnostic osteolytic lesions. The Orendorf database (Steadman 2008b) includes information on arthritis, porotic hyperostosis, cribra orbitalia, treponemal disease, tuberculosis, periostitis, scurvy, and osteomyelitis. For this reason, Norris Farms 36 disease categories are not identical to those from Orendorf. Due to the inherent problems in comparing diseases rates between the populations, disease was not used as a variable in intersite comparisons.

Disease was, however, used as a variable in intrasite analyses. For this project, all

categories were used for which complete information was believed to be available. It is important to note that, while the presence of a noted disease by previous researchers can be accepted, the absence of a notation of disease may not accurately represent the absence of a disease process. For these reasons, all interpretations involving disease were made very carefully.

Section 4.6.4 Grave Good Category Development

When developing categories for grave goods, the possibilities seemed endless. Category assignment could be made based on whether the source material was local or exotic, whether the artifact was finished or unfinished, whether it fit into broad categories of material type (ex: lithics, pottery, or bone), what its use was, or whether it was mundane or ceremonial. An attempt was made in this project to mirror the categories presented by Santure and Esarey (1990) and also to separate artifacts into other potentially meaningful categories in order to fully explore grave good associations. Assignment of a grave artifact into one category did not preclude its assignment to another category. For example, a projectile point would have been assigned to the lithic, chipped stone artifacts, and projectile point categories.

Section 4.6.5 Other Notes about Burial Category Decisions

For analyses that were comparing specific groups, individuals that were ambiguous were left out. For example, individuals who were questionably part of a multiple burial but could have represented an intrusive burial were assigned to neither to the single nor to the multiple category and were instead removed from analyses that were based upon interment type. This decision applies whenever specific group affiliation was unknown.

Section 4.6.6 Selection of Norris Farm Burials for Osteobiographical Analysis

The very small sample size utilized in the intrasite statistical analysis resulted in a weakening of the power of the statistical tests, which increased the possibility of Type II errors and revealed little about the individual experiences of Morton Village inhabitants. In order to further the investigation of social identity within the group, osteobiographical analyses were performed on a select number of Norris Farms 36 burials. To illustrate the diversity in life experiences of the individuals at Morton Village, a sample of burials was selected to present a variety of life histories. To choose this sample, two subadults, eight females, and eight males were selected at random, for a total of eighteen osteobiographies. The sample chosen for osteobiographical analysis included three young adult females, two middle-age adult females, three older adult females, three young adult males, three middle-age adult males, two older adult males, and two subadult burials.

These life histories, presented in Chapter Seven, are limited by the data available on an individual basis in the report written by Santure et al. (1990) and include a review of the information about interment style, grave goods, antemortem trauma, perimortem trauma, and postmortem modifications. When combined with the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values, these data reveal much about the individual experiences of people living at Morton Village.

Section 4.7 Statistical Analysis of the Isotope Values

This section briefly describes the methods of statistical analysis. Section 4.6.1 outlines what tests were performed using SPSS. Section 4.6.2 describes how ArcGIS was used to allow for spatial analysis of Norris Farms 36. Section 4.6.3 explains how a rudimentary spatial analysis was performed on the Orendorf sample.

Section 4.7.1 Statistical Analysis Using SPSS

Once all unusable samples were removed, statistical analysis was performed using the statistical program SPSS. The samples from Norris Farms 36 were compared to those from Orendorf for an intersite analysis. Intrasite analysis was then performed on each site. Faunal sample results were used to determine means for each order and were used to help interpret human results.

The first step in analysis of the human samples was to determine whether the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ had normal distributions. Using SPSS, the calibrated $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values were tested for normality using the Shapiro-Wilk test. The test was chosen given the number of human samples (132), as Shapiro-Wilk is most useful with smaller sample sizes. When looking at the adult sample from Norris Farms 36, $\delta^{13}\text{C}$ had nonnormal distribution, as was the case with the adult sample from Orendorf. Conversely, the adult samples showed a normal distribution for $\delta^{15}\text{N}$. When subadults were examined, both carbon and $\delta^{15}\text{N}$ at both sites had nonnormal distributions. As a result, nonparametric tests were used for all $\delta^{13}\text{C}$ statistical analyses and for statistical analysis of $\delta^{15}\text{N}$ that included juveniles. Parametric tests were used for statistical analysis of $\delta^{15}\text{N}$ when only adult categories were compared.

Section 4.7.2 Statistical Analysis Using ArcGIS

For spatial analysis of Norris Farms 36, ArcGIS was used. The map of the Norris Farms 36 cemetery was entered into ArcGIS and georeferenced. Then, each burial utilized in this project was entered as a feature. The burial table in ArcGIS was then joined with the SPSS

database containing the isotope values. Both the High/Low Clustering (Getis-Ord General G) and Spatial Autocorrelation (Morans I) tests were run. These tests were chosen based on an article by Fletcher (2008) which demonstrated the strengths and weakness of several statistical tests.

High/Low Cluster analysis measures how concentrated the high or low values are within a space (in this case, within the Norris Farms 36 cemetery). The null hypothesis when High/Low clustering is performed states, "there is no spatial clustering of the values" (i.e. the values are randomly distributed) (Lentz 2009). When the tests results in a very small p-value (for this project, $p < 0.05$), the null hypothesis can be rejected. In such cases, the Z scores reveal information about whether the high values (a positive Z score) or the lower values (a negative Z score) are clustering together (Lentz 2009). For the High/Low cluster analysis, tested values can only be positive numeric values. For this reason, the $\delta^{13}\text{C}$ values were transformed into positive values. This transformation is justified since it does not reduce the distance between values while still allowing the spatial analysis to be performed. However, interpretation of the Z-score needs to be made carefully, since a negative Z score would actually indicate that more positive $\delta^{13}\text{C}$ values were clustering together.

Spatial Autocorrelation (Moran's I) analysis measures feature similarity based on both feature locations & feature values simultaneously to assess whether values are clustered, dispersed, or random. The null hypothesis when Spatial Autocorrelation analysis is performed states, "there is no spatial clustering of the values associated with the features" (Lentz 2009). In general, a Moran's Index value near +1.0 indicates that the set of features exhibits a clustered pattern, while an index value near -1.0 indicates dispersion. When the tests results in an index

value near +1.0 and a very small p-value (for this project, $p < 0.05$), the null hypothesis can be rejected and clustering can be accepted.

For both the High/Low cluster analysis and spatial autocorrelation, Euclidean distance was used. No distance threshold was manually set. Instead, the minimum distance to ensure every feature has at least one neighbor was used. For this project, it was 5.27.

Section 4.8 Summary of Materials and Methods

This chapter presents a justification for the use of stable isotopes, the sampling strategy, and the methods used to prepare and process bone samples for isotopic analysis. In addition, this chapter explains the rationale used for subdividing the samples at the two sites into small subgroups for analysis. SPSS was used to calculate the statistical tests of isotope values for this study. The skeletal, isotopic, and mortuary data were also entered into ArcGIS to study the spatial distribution of isotopic values at Norris Farms 36.

The results of the stable isotope analysis of the faunal bones performed to help contextualize the human stable isotope results are presented in Chapter Five. The results of the intersite analysis are presented in Chapter Six. The intrasite analyses of Norris Farms 36 are presented in Chapter Seven.

Chapter 5: Floral and Faunal Analysis

In order to draw meaningful conclusions regarding past diets, it is important to understand the context of both the available resources and archaeological evidence for subsistence strategies. This chapter presents archaeological and isotopic information about the floral and faunal evidence for diet at the two sites. Section 5.1 focuses on the archaeological evidence for subsistence strategies at Morton Village/Norris Farms 36. Section 5.2 presents information regarding the floral and faunal remains from Orendorf. However, analyses of the floral and faunal assemblages at both sites have major limitations as a result of sampling. Sections 5.3 provides the results of stable isotope analysis of the faunal remains sampled from the Morton Village/Norris Farms 36 assemblage in order to help create a meaningful context in which to interpret the stable isotope analysis of the human remains presented in Chapters Six and Seven.

Section 5.1 Morton Village/Norris Farms 36 Subsistence Information

As discussed in Chapter 2, Oneota sites tend to be positioned to effectively exploit multiple ecozones that typically include wetland, riverine or lacustrine resources (Brown 1982; Brown and Sasso 2001; Tubbs and O’Gorman 2005). Fitting into the pattern of site location, Morton Village afforded access to a variety of biotic zones.

The potential existed for inhabitants of Morton Village to have access to a variety of fish, mollusk, reptile, amphibian, bird, and mammal species. Potentially available species include (but are not limited to) sunfish, bass, crappie, pike, buffalo, redhorse, drum, bowfin, gar, numerous mussel species, turtles, frogs, muskrat, beaver, white-tailed deer, squirrels, raccoon, turkey,

passenger pigeon, cottontail, woodchuck, bobwhite, striped skunk, prairie chicken, elk, and various species of aquatic birds (King 1990). In addition, there would have been a variety of seasonally available wild plant species in the area. These species would include (but would not have been limited to) arrowheads, cattails, pond lilies, American lotus, hickory, black walnut, butternut, pecans, acorns, paw paw, crabapple, mulberry, gooseberry, blackberry, grapes, sugar maple, shagbark hickory, hazelnut, plum, black cherry, raspberry, dewberry, and elderberry (King 1990; King 1993).

The diversity of available resources is consistent with Oneota sites but unlike other Oneota groups, preliminary analyses of a small sample of floral and faunal remains from the 1980s excavations at Morton Village suggest the population was not taking full advantage of potentially available food resources and it is possible that there was limited consumption of red meat (Styles and King 1990a). For example, mammal bone is restricted to white-tailed deer, elk, and beaver and no waterfowl remains were recovered.

The preliminary data from the 1980s also suggest an emphasis on maize cultivation (Styles and King 1990a:64). In addition, floral remains associated with the Eastern Agricultural Complex, including beans, squash, sunflower, chenopod, knotweed and little barely were recovered. It was suggested that sociopolitical stress, as evidenced by high rates of interpersonal violence, prevented Morton peoples from accessing the broad spectrum of resources, particularly red meat, available in the Central Illinois River Valley, forcing them to increase their reliance on corn and acorns (Milner and Smith 1990).

However, as recognized by previous researchers, the sample size represents a very small sample of a large village site. Though analysis is not complete on the floral and faunal remains recovered during the ongoing excavations at Morton Village by O’Gorman and Conner, there is

evidence of a much more diverse diet (O’Gorman, personal communication 2012). Therefore, it cannot be assumed that the floral and faunal assemblages recovered at Morton Village in the 1980s are a true reflection of diet. This project will help fill in some of the gaps in our knowledge by contributing to the understanding of diet at Morton Village and Norris Farms 36 through a presentation of composite information about consumed diet.

Section 5.2 Orendorf Subsistence Information

Similar to Morton Village, a number of different environmental zones were available in the vicinity of the Orendorf site, affording the Orendorf inhabitants access to essentially the same varieties of faunal and floral resources available to the group at Morton Village (King 1990; King 1993; Speth 1981). However, Middle Mississippian diet is understood to focus heavily on maize and white-tailed deer with only minor exploitation of other available resources (Emerson 1981:161). Indeed, a large amount of deer elements were recovered at Orendorf, suggesting an important, year-round focus on deer and supporting the use of Orendorf as a Mississippian comparison site (Emerson 1981). In addition, evidence from analysis of bird bones indicates that the Orendorf population extensively utilized marsh resources (Speth 1981). Bird species that would have been likely to frequent agricultural fields, such as turkey, were also commonly recovered at Orendorf (Speth 1981). Various types of fish were also recovered at Orendorf, indicating that fishing contributed to their overall subsistence (Paloumpis 1981).

Floral remains from Orendorf include corn, hickory, walnut, hazelnut, polygonum, chenopodium, pecan, sunflower, domestic bean, maygrass, squash and an unidentifiable tuber (Esarey and Conrad 1981). Maize was recovered in the majority of flotations from Orendorf (Conrad 1991). Given the ubiquity of maize at the site, as well as the frequent presence of manos

and metates recovered in domestic structures, it is clear that maize was an important component of the diet at Orendorf (Perazio 1981).

Unfortunately, a full reconstruction of diet based on the floral and faunal assemblages at Orendorf is not possible at this time due to the lack of published information about ubiquity of mammalian species and floral specimens at the site.

Both Morton Village and Orendorf were situated in locations which would have afforded them access to a diverse array of floral and faunal resources. However, relatively little is known about how the inhabitants utilized these food resources, as there are gaps in the understanding of both Morton Village and Orendorf. This project will complement the relatively limited floral and faunal analyses at the two sites by presenting information about the composite diet consumed by the two groups.

Section 5.3 Isotope Analysis of Morton Village/Norris Farms 36 Faunal Remains

In order to properly interpret isotope values from human remains, it is necessary to have an understanding of regional isotope levels. For example, Strange (2006) noted that $\delta^{15}\text{N}$ values at Orendorf were difficult to interpret without knowing the values for food animals in the region. Likewise, Katzenberg (1993) noted that a significant amount of a human's dietary protein often comes from faunal resources. Since the protein component of a diet is the primary influence on collagen isotope ratios, it is important to have an understanding of the isotopic signature of faunal resources in order to appropriately interpret both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values. Previous research into stable isotopes of faunal bone revealed a marked amount of variation in the $\delta^{13}\text{C}$ values of

terrestrial herbivores, leading Katzenberg and Weber (1999) to emphasize the importance of including local faunal samples when interpreting past diets.

With this in mind, this section of this dissertation explores faunal stable isotopes. Section 5.3.1 presents the results of the isotope analysis of the faunal sampled from Morton Village. Section 5.3.2 reviews each class of fauna to place the results into a broader context. Section 5.3.3 presents published isotopic values for archaeological faunal remains. Finally, Section 5.3.4 discusses the challenges of isotope analysis.

Section 5.3.1 Results of the Isotope Analysis of Morton Village Fauna

A small number of fauna from the habitation area at Morton Village was sampled for this analysis. The selection and processing methods can be found in Chapter Four. The results of the stable isotope analysis are presented in Table 5.1. Figure 5.1 is a scatterplot of all isotope samples for this project and provides a visual of the differences between faunal and human diet in the central Illinois River valley. Figure 5.2 is an idealized representation of isotope ratios in modern food groups, based on information presented by the United States Geological Survey in their “Foods and Diet” chart (2006).

Section 5.3.2 Comparisons with Other Archaeological Investigations of Faunal Isotopes

In order to examine the results from the Morton Village fauna and see how they fit with broader patterns, each class of fauna must be looked at individually.

Table 5.1. Stable Isotope Ratios of Usable Faunal Samples from Morton Village				
	Species	Common Name	$\delta^{13}\text{C}$ (‰)	$\delta^{15}\text{N}$ (‰)
M-10	Lepisosteus osseus	gar fish	-20.2	10.6
M-14	Pylodictus olivarius	cat fish	-21.8	10.5
M-25	Micropterus	fish	-21.2	9.0
M-26	Amia calva	bowfinfish	-21.7	10.4
M-3	Amia calva	bowfinfish	-22.2	10.2
M-30	Ictiobus interopere	buffalofish	-24.8	7.6
M-24	Fish	fish	-25.2	6.8
Fish <i>Mean Value (±Std. Deviation)</i>			-22.4 (±1.8)	9.3 (±1.6)
M-28	Meleagris gallopavo	wild turkey	-18.0	5.1
M-21	Bird, mid-size	bird	-23.9	7.2
Birds <i>Mean Value (±Std. Deviation)</i>			-21.0 (±4.2)	6.2 (±1.5)
M-16	mammal (muskrat?)	muskrat	-20.3	3.5
M-7	rodent	rodent	-16.0	7.3
M-19	Canis cf. familiaris	dog	-14.5	8.9
M-6	Canis cf. familiaris	dog	-15.0	7.9
M-8	Canis cf. familiaris	dog	-15.5	8.6
M-1	Cervus elaphus	elk	-21.5	4.5
M-17	Cervus elaphus	elk	-20.6	3.8
M-4	cf. Odocoileus virginianus	deer	-21.8	5.6
M-4	cf. Odocoileus virginianus	deer	-21.5	6.1
M-2	cf. Odocoileus virginianus	deer	-20.5	5.4
M-9	Lg. mammal	mammal	-20.8	3.9
M-22	md/lg mammal	mammal	-21.0	3.6
M-27	lg. mammal	mammal	-21.2	4.5
Mammals <i>Mean Value (±Std. Deviation)</i>			-19.2 (±2.8)	5.7 (±1.9)
M-35	cf. Graptemys	turtle	-23.6	7.8
M-40	cf. Graptemys	turtle	-25.4	8.6
M-11	Chelydra serpentina	turtle	-24.8	7.0
M-23	Emys blandingi	turtle	-23.7	7.7
M-39	Emys blandingi	turtle	-24.7	7.3
M-32	turtle-aquatic	turtle	-24.3	7.0
M-38	turtle	turtle	-26.3	8.6
Turtles <i>Mean Value (±Std. Deviation)</i>			-24.7 (±0.9)	7.7 (±0.7)

Figure 5.1. Isotope Ratios of All Usable Human and Faunal Samples

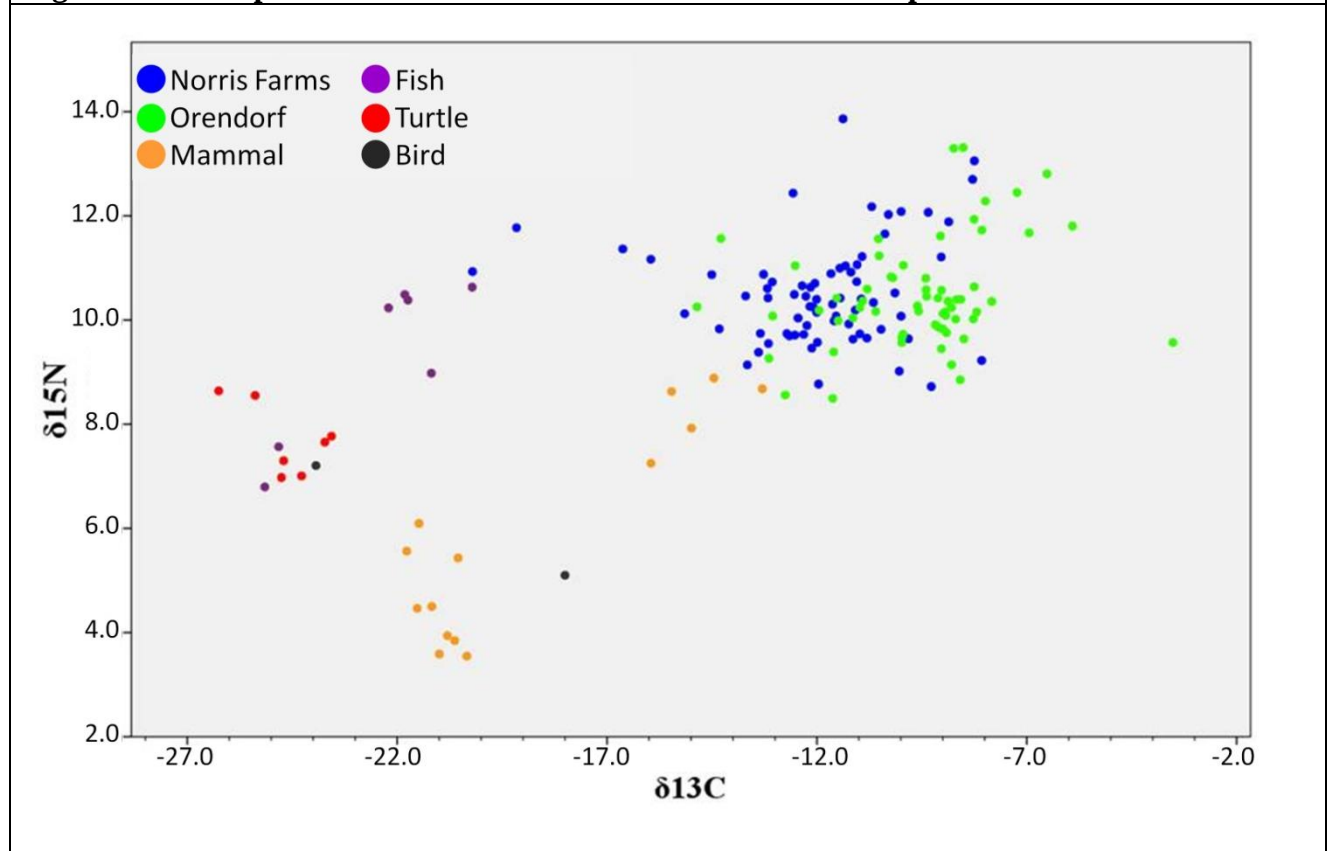
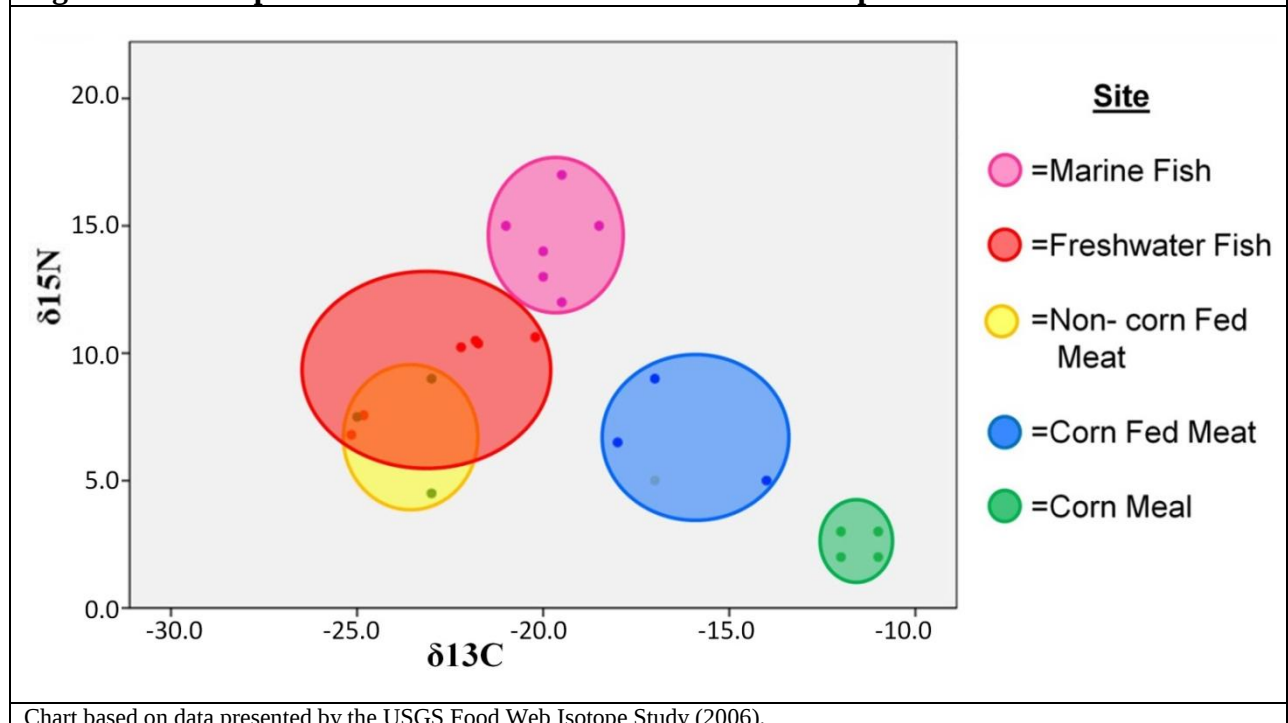


Figure 5.2. Isotope Ratios in Modern New World Food Groups



Section 5.3.2.1 Fish

Aquatic environments support complex food webs and there is resulting variability in stable isotopes of aquatic resources. In the terrestrial environment, carbon enters the food web when atmospheric CO₂ is taken up by plant resources. Conversely, carbon in freshwater lakes and streams comes from a variety of sources (van der Merwe et al. 2003). Research on modern fish by Katzenberg and Weber (1999) yielded results in line with previous researchers: freshwater fish had highly variable $\delta^{13}\text{C}$ values, with fish inhabiting pelagic, or open water, environments having more negative values than those littoral species living in shallow water. This pattern was again demonstrated by a study performed on archaeological specimens by van der Merwe et al. (2003). Appendix A presents a sampling of published isotope information for prehistoric subsistence resources, including the archaeological fish specimens tested in van der Merwe's study. The relatively limited sample from Morton Village reported on here represents primarily littoral species and the $\delta^{13}\text{C}$ values (mean -22.4 ± 1.8) are in line with previously published reports. When compared to published archaeological fish values, the results from Morton Village are consistent in terms of $\delta^{13}\text{C}$.

The mean $\delta^{15}\text{N}$ value for fish from Morton Village is 9.3, with a range of 6.8-10.6. In a study of archaeological fish from Moundville, Schoeninger and Schurr (1998:125-126) found that the fish $\delta^{15}\text{N}$ values were significantly more positive than other categories of fauna. This is presumably due to the complex food webs associated with aquatic environments and the fact that fish utilize decomposing terrestrial organic matter (Schoeninger and Schurr 1998). Supporting this, previous studies have shown that bottom feeders, such as suckers, tend to have lower $\delta^{15}\text{N}$

values (e.x. Katzenberg 1989). Likewise, fish that are predatory typically have higher $\delta^{15}\text{N}$ values and this is reflected in the higher $\delta^{15}\text{N}$ values of the gar fish, catfish, and bowfin fish recovered at Morton Village.

Section 5.3.2.2 Birds

Though relatively little published information is available for archaeological bird specimens, the $\delta^{13}\text{C}$ values (mean -21.0 ± 4.2) and $\delta^{15}\text{N}$ values (6.2 ± 1.6) for the two Morton Village birds are in line with the geese and turkey reported on by Katzenberg (1989). Notably, both the Morton Village turkey and the turkey reported on by Katzenberg have $\delta^{13}\text{C}$ values above -20.0 . Historically, turkeys are known to occasionally feed on corn in agricultural fields and it is possible that the turkey reported on here and in Katzenberg (1989) were feeding on at least some amount of corn (MacGowan et al. 2006).

Section 5.3.2.3 Mammals

The mean $\delta^{13}\text{C}$ value for all mammals tested from Morton Village was $-19.2 (\pm 2.8)$. The mean $\delta^{15}\text{N}$ value for all Morton Village mammals was $5.7 (\pm 1.9)$. Though the mean values from Morton Village are consistent with mean values from other sites, the mammal category is a broad category associated with a great deal of variation. Common species are looked at individually.

Section 5.3.2.3.1 Deer

The analysis of fauna from Morton Village yielded results for three deer. The mean $\delta^{13}\text{C}$ value for the deer tested from Morton Village was -21.3. The mean $\delta^{15}\text{N}$ value for all Morton Village deer was 5.7. These results are in line with the common values for archaeological deer.

Section 5.3.2.3.2 Dogs

The $\delta^{13}\text{C}$ values of dogs at Morton Village (-15.0 ± 0.5) are relatively high, supporting the conclusion that they were regularly consuming some amount of maize. Domesticated dogs often consumed significant amounts of maize (Tykot et al. 1996; White et al. 1993; White et al. 2001b). While the $\delta^{15}\text{N}$ results (8.5 ± 0.5) from the dogs at Morton Village are lower than the averages reported by Katzenberg (1989), they are in line with other published reports (Tykot et al. 1996; White et al. 1993).

Researchers (e.g. Allitt 2011; Hogue 2003; Katzenberg 1989) have noted that dogs often have diets similar to humans, particularly when raised as companions, and some have suggested that isotope analysis of dog remains in absence of available human skeletal remains may provide valuable information about human diet. The isotope values for dog remains from Morton Village clearly point to the consumption of maize resources and suggest that dogs at Morton Village were either directly fed human food or were allowed to scavenge left-over human food and/or consumed human fecal matter.

However, the stable isotope ratios from dog bones from Morton Village do not directly mimic or reflect human diet. The average $\delta^{13}\text{C}$ value for adult humans from Morton Village was -12.0. The mean $\delta^{15}\text{N}$ value for adult humans from Morton Village was 10.3. The human $\delta^{13}\text{C}$

value is enriched over dogs by -3.0 and the human $\delta^{15}\text{N}$ isotope value is enriched by 1.8. This indicates that dog diet was not a direct representation of human diet. Instead, the spacing between dog isotope values and human isotope values may suggest dogs served as a dietary resource for the inhabitants at Morton Village. This is also supported by the inclusion of dog remains in refuse pits.

Section 5.3.2.4 Turtles

Seven turtles yielded usable stable isotope results. The mean $\delta^{13}\text{C}$ value for the turtles was -24.7 (± 0.9) and the average $\delta^{15}\text{N}$ value was 7.7 (± 0.7). There are no published reports on isotope values of turtles recovered archaeologically in the Eastern Woodlands. Therefore, these results are hard to place in a broader context. Tykot et al. (1996) published a mean of -20.8 (± 1.4) for terrestrial fauna, which included mud turtles. However, given the disparate animals included in this group (deer and peccary), it still remains difficult to interpret the isotope ratios for the Morton Village turtles. However, their overall similarity to fish is consistent with expectations given their similar diets.

Section 5.3.2.5 Freshwater Mollusks

It was not possible to analyze freshwater mollusks for this project, though it is likely they were being utilized at Morton Village. Freshwater mussels from the Great Lakes region have $\delta^{15}\text{N}$ values ranging from about 1 to 9 ‰. The majority of the values fall between 3 and 6 per mil (Cabana and Rasmussen 1996; Vander Zanden et al. 1997).

Section 5.3.3 Stable Isotopes of Floral Remains

Although this project did not include any isotopic analysis of floral remains, an understanding of typical isotopic values for some of the commonly utilized plant foods is important to properly interpret human isotope values.

Due to the different carbon pathways between C3 and C4 plants, $\delta^{13}\text{C}$ values in plants have a bimodal distribution, with C3 having far more negative values than C4 plants. As no amaranth has been recovered as Morton Village and since there is no archaeological evidence of intensive amaranth use in the Eastern Woodlands, maize is believed to be the primary C4 component of the diet. The $\delta^{13}\text{C}$ value for maize recovered from archaeological contexts varies considerably. Examples cited in Table 5.2 range from -15.1 to -7.4.

Beans are a C3 plant so the $\delta^{13}\text{C}$ values are characteristically low. However, the $\delta^{15}\text{N}$ value of beans is somewhat debatable. Beans are nitrogen-fixing legumes, meaning that instead of getting their nitrogen from the soil substrate they use bacteria to fix nitrogen from the atmosphere. As a result, it was expected that there would be no nitrogen fractionation occurring in legumes and therefore the isotopic signature of leguminous plants (peas, beans, etc.) would be nearly identical to atmospheric nitrogen levels (Schoeninger 1995). However, studies have shown a range of $\delta^{15}\text{N}$ levels for beans from 1.5-5.1 (Schoeninger 1995; Spielmann 1990; Tykot et al. 1996). Though some studies have shown C3 plants with higher $\delta^{15}\text{N}$ (ex: chenopodium as reported by Spielmann 1990), the somewhat lower $\delta^{15}\text{N}$ values of beans does not result in a clear bimodal distribution like exists for carbon between C3 and C4 plants.

The rest of potentially usable plants at Morton Village would have had typical C3 plant isotope values (-27.5 to -25.5 $\delta^{13}\text{C}$ and 3.0 - 7.0 $\delta^{15}\text{N}$).

Table 5.2. Published Isotope Values for Floral Remains

Location	Species	N	$\delta^{13}\text{C}$ (‰)	$\delta^{15}\text{N}$ (‰)	Source
Pecos Pueblo –	<i>Zea mays</i> (Maize)	2	-11.2	7.0	Spielmann et al. 1990
Misc. Eastern Woodland sites	<i>Zea mays</i> (Maize Kernel)	3 5	-8.4 to -15.1	-	Hart et al. 2007
Misc. Eastern Woodland sites	<i>Zea mays</i> (Maize cob)	5	-7.4 to -12.6		Hart et al. 2007
Moundville site	<i>Zea mays</i> (Maize)	5	-8.4	4.0	Schoeninger and Schurr 1998
Misc. Eastern Woodland sites	<i>Phaseolus vulgaris</i> (Bean seed)	3 4	-23.3 to -28.6	-	Hart et al. 2002
Pecos Pueblo	<i>Phaseolus vulgaris</i> (Beans)	2	-24.8	5.4	Spielmann et al. 1990
Pecos Pueblo	<i>Amaranthus</i> sp. (Amaranth seeds)	1	-11.3	9.0	Spielmann et al. 1990
Pecos Pueblo	Chenopodium seeds	1	-25.5	8.1	Spielmann et al. 1990
Ozark rockshelters and various Great Plains sites	<i>Iva annua</i> (Sumpweed seed)	1 1	-23.4 to -28.5	-	Hart et al. 2007
Various Great Plains sites	<i>Cucurbita pepo</i> (Squash seed)	3	-24.9 to -26.4	-	Hart et al. 2007
Michigan sites	<i>Cucurbita pepo</i> (Uncharred squash seed)	4	-23.6 to -26.6	-	Hart et al. 2007
Great Plains, Michigan, and Ozark sites	<i>Cucurbita pepo</i> (Squash Rind)	6	-23.7 to -28.3	-	Hart et al. 2007
When no range is given but the N is greater than 1, the isotope value presented is a mean value.					

Section 5.3.4 Interpretation of Stable Isotope Results

In general, $\delta^{13}\text{C}$ values are enriched around 6‰ between diet and bone collagen. This means that the $\delta^{13}\text{C}$ of a human sample will be around 6‰ higher than the composite $\delta^{13}\text{C}$ value

of the diet he or she consumed. For example, an individual with a $\delta^{13}\text{C}$ value of -10.2 was consuming a diet with an average $\delta^{13}\text{C}$ value of around -16.2‰. Likewise, $\delta^{15}\text{N}$ values are enriched around 2-3‰. Early isotope research was based on the concept that the percentage of C3 and C4 foods in the diet could be determined by simple calculation of the $\delta^{13}\text{C}$ values of bone collagen once this enrichment was accounted for. For example, individuals who only ate C3 plants would have a $\delta^{13}\text{C}$ value of around -20.5‰. Individuals who consumed 50% C3 plants and 50% C4 plants would then have a $\delta^{13}\text{C}$ value of around -14‰ (Tykot 2004). Likewise, $\delta^{15}\text{N}$ was seen as a reflection of the amount of red meat and/or beans in the diet.

However, it soon became clear that these principals could not be easily applied in most cases. Collagen represents primarily dietary protein, though physiological stresses may result in carbohydrates and other proteins supplying carbon to developing bone collagen. In the case of pure herbivores or pure carnivores, this does not necessarily pose an interpretation issue. However, in the case of omnivores it can be a complication, as the amount of protein in floral resources varies considerably. Table 5.3 lists the protein content for some modern selected food resources (USDA 2012).

As is demonstrated in Table 5.3, it is possible to consume a generous portion of food that contains little protein. Likewise, a relatively small amount of meat may contain a large amount of protein. This quickly leads to ambiguity. For example, low to moderate consumption of freshwater fish, which have elevated $\delta^{15}\text{N}$ values, may theoretically have a similar signature as a diet focused on consumption of terrestrial fauna (Hedges and Reynard 2007). Likewise, a meat-poor diet composed primarily of corn with supplementary beans may result in a moderate $\delta^{13}\text{C}$

isotope value, as a small amount of beans yield more protein than a comparable amount of maize.

Table 5.3. Protein Amounts for Different Food Resources	
Food	Protein per 100g
Fish, pike, northern, liver	16.60
Duck, scoter, white-winged, meat	20.20
Squirrel, ground, meat	19.30
Fish, whitefish, broad, liver	11.00
Corn, dried (Navajo)	9.88
Cornmeal, blue (Navajo)	10.40
Corn, white, steamed (Navajo)	5.18
Cornmeal, white (Navajo)	10.99
Cornmeal, yellow (Navajo)	9.85
Squash, Indian, raw (Navajo)	0.52
Squash, Indian, cooked, boiled (Navajo)	0.09
Blueberries, wild, raw (Alaskan Native)	1.22
Elk, free range, ground, cooked patties (Shoshone Bannock)	29.45
Buffalo, free range, top round steak, raw (Shoshone Bannock)	21.44
Chokecherries, raw, pitted (Shoshone Bannock)	2.89
Steelhead trout, dried, flesh (Shoshone Bannock)	77.27
Acorn stew (Apache)	6.81
Corn, dried, yellow (Northern Plains Indians)	14.48
Cattail, Narrow Leaf Shoots (Northern Plains Indians)	1.18
Lambsquarters, raw (Northern Plains Indians)	4.21
Lambsquarters, steamed (Northern Plains Indians)	4.06
Raspberries, wild (Northern Plains Indians)	1.12
Chokecherries, raw, pitted (Northern Plains Indians)	3.04
Stinging Nettles, blanched (Northern Plains Indians)	2.71
Plums, wild (Northern Plains Indians)	0.43
Hazelnuts, beaked (Northern Plains Indians)	14.89
Yellow pond lily, Wocas, tuber, cooked, Oregon,	0.69
Yellow pond lily, Wocas, dried seeds, Oregon,	7.90
Source: United States Department of Agriculture (USDA), Agricultural Research Service. 2011 “USDA National Nutrient Database for Standard Reference, Release 24”. Nutrient Data Laboratory Home Page, http://www.ars.usda.gov/ba/bhnrc/ndl	

An individual who received the majority of their protein from beans (low $\delta^{13}\text{C}$, low $\delta^{15}\text{N}$) and corn (high $\delta^{13}\text{C}$, low $\delta^{15}\text{N}$) with only a small amount of fish (low $\delta^{13}\text{C}$, high $\delta^{15}\text{N}$) consumed may have moderate values of both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$. This isotopic signature could also apply to someone eating moderate amounts of maize (high $\delta^{13}\text{C}$, low $\delta^{15}\text{N}$) and red meat (low $\delta^{13}\text{C}$, high $\delta^{15}\text{N}$).

Section 5.4 Summary

The interpretation of human stable isotope values is dependent upon an understanding of the isotopic signature of their diet. This value is itself dependent upon a composite of the isotope values of the specific food resources contributing to the diet. In addition, the contribution of individual food resources to the isotopic signature of bone collagen is dependent upon their relative contribution of protein to the diet.

For these reasons, it is critical to have an appreciation of the isotopic values of available floral and faunal resources. Although the isotopic values of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ do not directly translate to a specific diet, they can yield valuable information when carefully interpreted. The data presented in this chapter will be used as a context in which to interpret the results presented in Chapters Six and Seven.

Chapter 6: Comparative Results

This dissertation seeks to reveal how the Oneota migrants utilized diet as a deliberate symbol of ethnic identity following the prehistoric migration of an Oneota group to west-central Illinois (ca. A.D. 1300). This chapter addresses my first research question: Was food used to emphasize ethnic boundaries between the Oneota and Middle Mississippians within the central Illinois River valley? If the Oneota at Morton Village emphasized their ethnic identity, the differences between the Oneota and the Middle Mississippians would be emphasized. It would be expected that the Oneota would then work to maintain a more traditional diet by exploiting a diverse array of resources with a low to moderate consumption of maize. This is particularly true if ethnic identity was the most important aspect of social identity operating at Morton Village, overruling other common identity categories, such as age and gender.

If the Oneota at Morton Village were seeking assimilation with the Middle Mississippian groups in the central Illinois River valley, it would be expected that they would deemphasize their differences. In this case, their diet would be very similar to Middle Mississippian groups in the region and that their maize consumption would be higher than other Oneota groups. In order to address this research question, analysis of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values was performed on skeletal remains from the Bold Counselor phase Oneota cemetery, Norris Farms 36 (A.D. 1250-1400), and compared to remains from the Spoon River Middle Mississippian habitation and mortuary site, Orendorf (A.D. 1150-1250).

This chapter discusses the results of this comparative analysis. Section 6.1 gives a brief overview of the sites and demography of the sample. Section 6.2 presents the results of the intersite comparison. Section 6.3 places the Orendorf sample into the broader Middle

Mississippian context and section 6.4 places the Norris Farms 36 sample into the broader Upper Mississippian context. Section 6.5 summarizes the results of the intersite comparison. Appendix B lists the burial number, age, sex, interment style, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, and C:N ratio for all of the usable isotope values.

Section 6.1 Overview of Sites and Brief Demographic Overview

The Norris Farms 36 cemetery is situated on a bluff edge of the Illinois River Valley in close proximity to Morton Village. Both this proximity and the similarity of pottery design elements at both the habitation and mortuary areas suggests that the individuals interred at Norris Farms 36 resided at the Morton site. The Norris Farms 36 cemetery contained 264 burials assigned to the Bold Counselor Oneota phase (A.D. 1250-1400).

The Orendorf site is a large Middle Mississippian Orendorf Phase temple town in the central Illinois River valley attributed to the Spoon River Culture dated to approximately A.D. 1150-1250. Though earlier than the Bold Counselor Oneota occupation of Morton Village, Orendorf is the most appropriate available site to use in a comparison with Morton Village. Orendorf is located approximately 25 kilometers upriver. It is associated with a large skeletal population and also has published information regarding floral and faunal data. Such data are comparable to those produced by investigations of Morton Village and Norris Farms 36 and enables the comparison of the two sites. The total minimum number of individuals recovered from the Orendorf cemetery as reported by Dawnie Steadman is 268 (Steadman 2008a).

The breakdown of usable human samples by specific demographic grouping can be found in Table 4.4. This table, and the methods for assigning individuals to these categories, can be found in Chapter Four.

Section 6.2 Statistical Analysis

This section outlines the results of the intersite statistical analysis. As explained in Chapter 4, normality tests showed that $\delta^{13}\text{C}$ did not have a normal distribution and $\delta^{15}\text{N}$ had a normal distribution when only adults were tested. As such, significance for differences in $\delta^{13}\text{C}$ values between sites was always assessed using the Mann-Whitney U Test. The Mann-Whitney U Test was used to assess significance for differences in $\delta^{15}\text{N}$ values between sites when subadults were examined. When only adults were included, the independent samples t-test for equality of means was used. For all analysis, the level of significance was set at $p < 0.05$. All intersite statistics were performed using SPSS.

Section 6.2.1 compares the subadults from the two sites, both in an overview and by subgroups based on age. Following the subadult site comparison, adult age groups are compared between the sites in Section 6.2.2. Next, sample groups based on sex are compared between the sites in Section 6.2.3. Finally, comparisons are made based on warfare-status in Section 6.2.4 and interment type in Section 6.2.5. Results will be presented in tables and selected scatter plots.

Section 6.2.1 Intersite Analysis of Subadults

This section investigates whether there were significant differences in diet between the children of Morton Village and Orendorf by specifically comparing $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ values between the two sites. When all subadults at the two sites were compared, it was revealed that Orendorf $\delta^{13}\text{C}$ values are higher, suggesting a heavier reliance on maize (Table 6.1). This hints at a true difference in diet between the two sites, one which may be the result of the Oneota at Morton Village emphasizing their ethnic identity over other identity categories based on age.

This result will be discussed in greater detail in Chapter Eight.

There was not a statistically significant difference between the $\delta^{15}\text{N}$ values (Figure 6.1, Table 6.2). While this result may seem straightforward, the broad category of “subadult” is problematic. Dietary stages of childhood, such as nursing and weaning ages, are influenced both by biological and cultural influences and the stages may not be consistent between populations. To attempt to investigate age-related differences between the two sites, subadults were broken down even further by group (Tables 6.1 and 6.2).

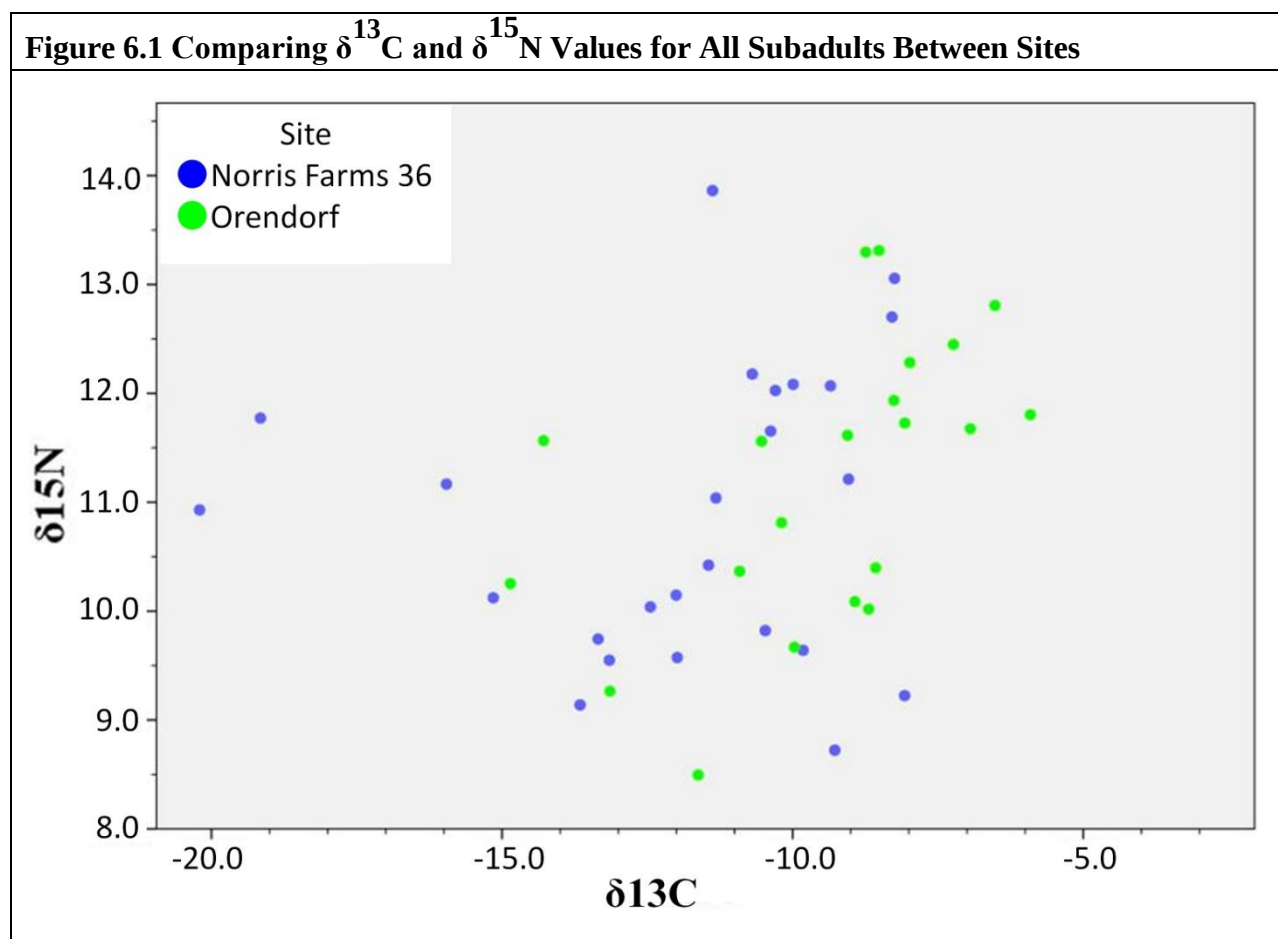


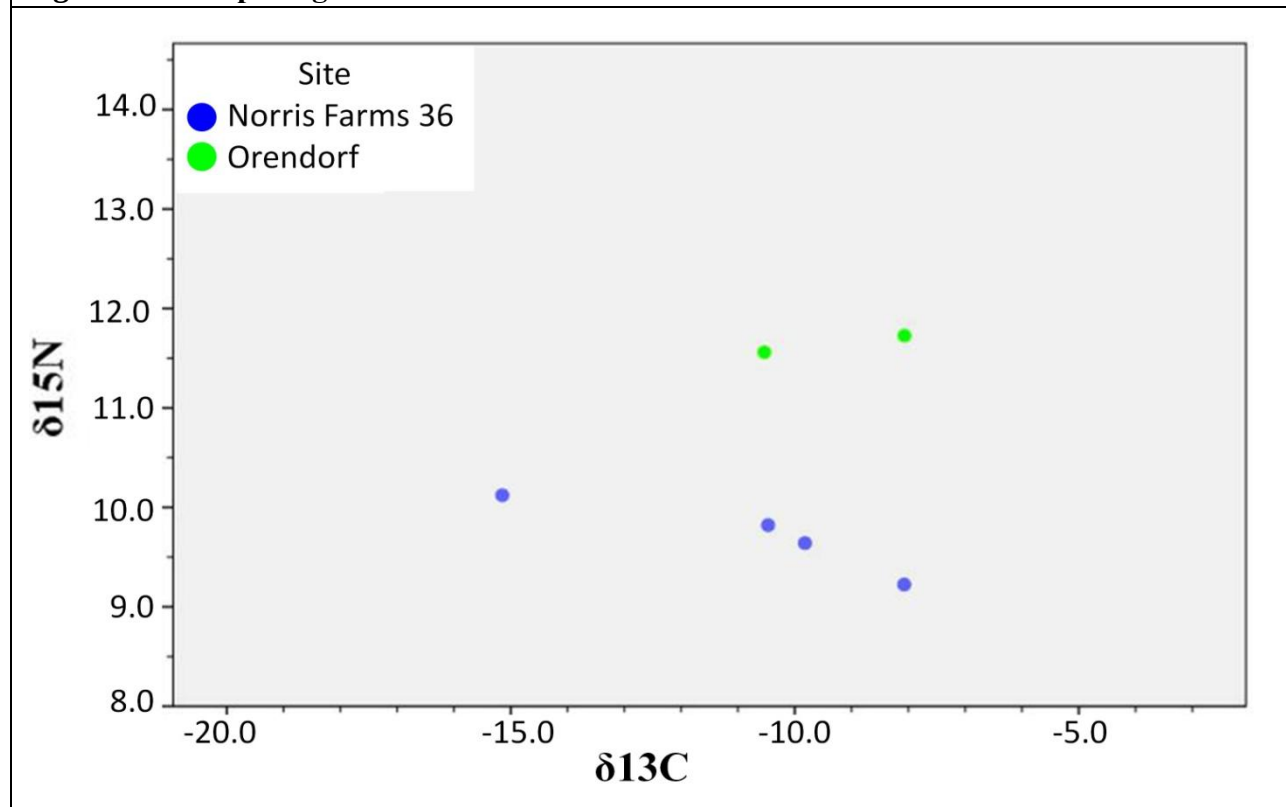
Table 6.1 Comparison of $\delta^{13}\text{C}$ (‰) Values from Subadult Groups at Both Sites			
	Norris Farms 36 $\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Orendorf $\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Significance
All Subadults	-11.8 ($\pm$ 3.1)	-9.5 ($\pm$ 2.6)	0.007*
Fetus/Neonates	-10.9 ($\pm$ 3.0)	-9.3 ($\pm$ 1.7)	1.000
0-1 Year Olds	-11.5 ($\pm$ 4.4)	-7.6 ($\pm$ 1.7)	0.056
1-2 Year Olds	-12.1 ($\pm$ 4.7)	-9.4 ($\pm$ 3.3)	0.286
2-4 Year Olds	-12.5 ($\pm$ 2.5)	-10.5 ($\pm$ 2.6)	0.222
5-15 Year Olds	-11.9 ($\pm$ 1.5)	-10.5 ($\pm$ 2.0)	0.177
*Statistically significant at the $p < 0.05$ level; Mann-Whitney U Test was used to determine statistical significance for all demographic categories.			

Table 6.2 Comparison of $\delta^{15}\text{N}$ (‰) Values from Subadult Group at Both Sites			
	Norris Farms 36 $\delta^{15}\text{N}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Orendorf $\delta^{15}\text{N}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Significance
All Subadults	10.9 ($\pm$ 1.4)	11.0 ($\pm$ 1.3)	0.660
Fetus/Neonates	9.7 ($\pm$ 0.4)	11.6 ($\pm$ 0.1)	0.133
0-1 Year Olds	11.9 ($\pm$ 0.6)	11.9 ($\pm$ 1.4)	0.690
1-2 Year Olds	12.2 ($\pm$ 1.3)	12.1 ($\pm$ 0.4)	1.000
2-4 Year Olds	10.9 ($\pm$ 1.3)	11.1 ($\pm$ 1.4)	0.841
5-15 Year Olds	9.7($\pm$ 0.6)	9.8 ($\pm$ 0.9)	1.000
*Statistically significant at the $p < 0.05$ level; Mann-Whitney U Test was used to determine statistical significance for all demographic categories.			

Looking at the subsets of children between the two sites, a new pattern arises. No statistically significant differences were found between sites for the majority of the subadult age groups (Tables 6.1 and 6.2). Despite the lack of statistical significance, a general trend exists in which Orendorf has consistently higher $\delta^{13}\text{C}$ and generally also has higher $\delta^{15}\text{N}$. A broad range of variation, however, is apparent and it should again be noted that subadult isotope values can be difficult to interpret.

For example, fetal bone is believed to be representative of the adult mother's dietary isotope values but the isotopic signal of breast milk rapidly become apparent in the collagen of newborns (Richards et al. 2002). This results in higher $\delta^{15}\text{N}$ isotope values soon following birth. Some studies have also found higher $\delta^{13}\text{C}$ values in young children, presumably due to diet supplementation with either C4 foods or nonhuman milk, though some have suggested a “carnivore effect” is responsible for the enrichment of $\delta^{13}\text{C}$ by up to 1% (Dupras, Schwarcz, and Fairgrieve 2001; Fuller et al. 2006; Richards et al. 2002).

Figure 6.2 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Neonate at Both Sites



The two neonate samples from Orendorf were categorized by Dawnie Steadman (2008b) as late term fetuses, as opposed to Norris Farms 36, which were categorized by Milner and Smith

(1990) as newborns. In this case, if the Norris Farms 36 neonates represent newborns that lived long enough to undergo significant breastfeeding and growth, we would expect them to show enriched $\delta^{15}\text{N}$ values, and possibly $\delta^{13}\text{C}$ values, over the fetuses from Orendorf. However, the opposite appears to be true (Figure 6.2).

This helps illustrate the point of caution: If I only looked at the results of the Mann-Whitney U test, I might assume that diet, particularly of pregnant and/or nursing mothers, was similar between the two sites. However, the nitrogen enrichment of the Orendorf “fetuses”, the small sample size, and the culturally variable experience of pregnancy and birth require a careful interpretation, as will be discussed in the Chapter Eight.

In summary, few statistically significant differences are seen. However, a general trend exists in which Orendorf has consistently higher $\delta^{13}\text{C}$ and generally also has higher $\delta^{15}\text{N}$. It may be that the lack of statistical significance is Type II error introduced by the small size of the subadult subsamples.

Section 6.2.2 Intersite Analysis of Adults

When only adults between the two sites are compared, there is a significant difference between $\delta^{13}\text{C}$ values (Figure 6.3). However, no significant difference in $\delta^{15}\text{N}$ exists between Norris Farms 36 and Orendorf (Figure 6.3). Tables 6.3 and 6.4 list the level of significance for the differences seen between the sites.

To further investigate age-related differences between the two sites, the broad category of adult was broken down into younger, middle, and older adult categories. The pattern of higher

$\delta^{13}\text{C}$ values at Orendorf exists for all age categories (Table 6.3). Nitrogen isotope ratios are significantly different only between older adults at the two sites (Table 6.4).

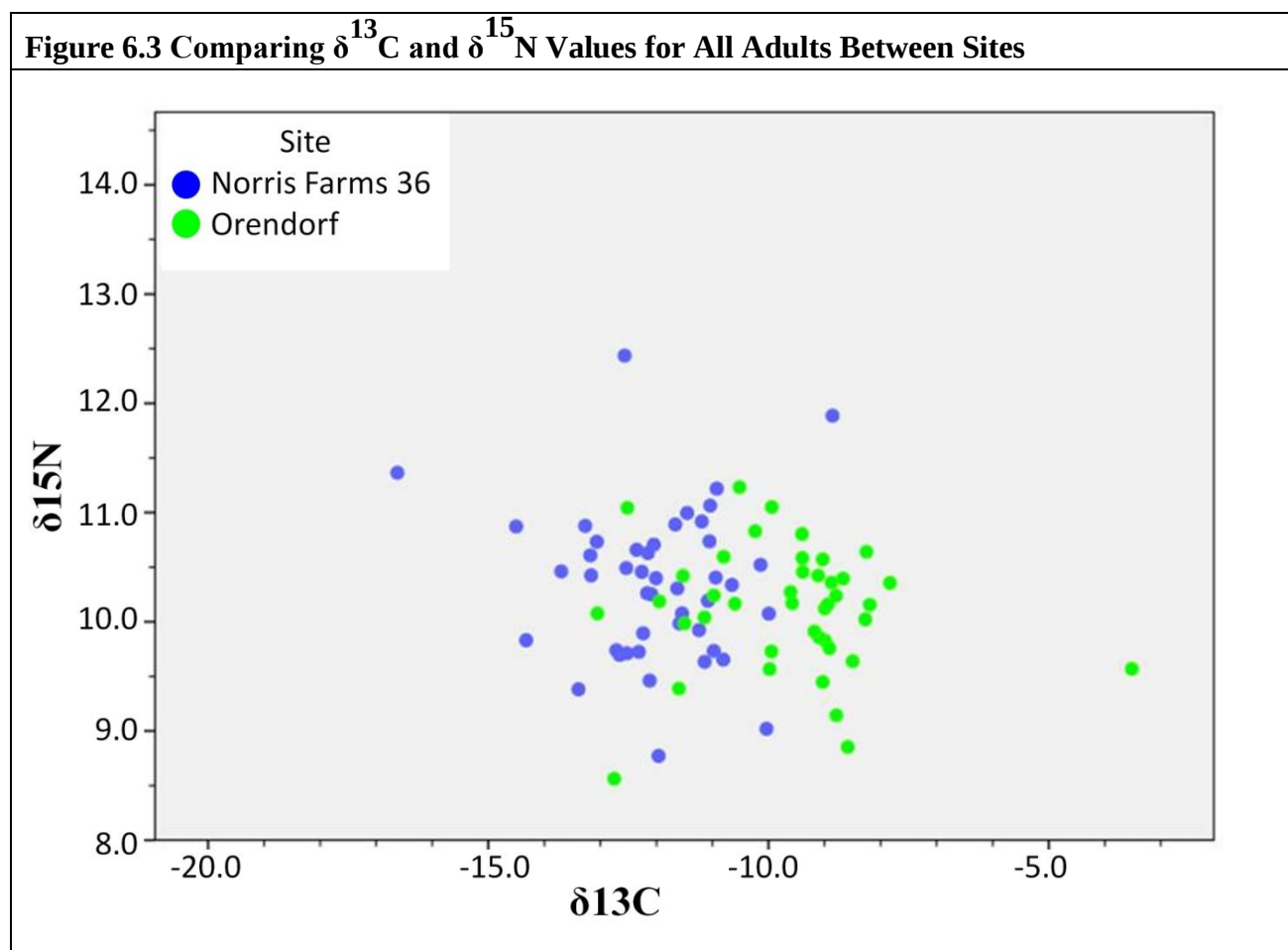


Table 6.3 Comparison of $\delta^{13}\text{C}$ (‰) Values from Broad Demographic Groups at Both Sites			
	Norris Farms 36 $\delta^{13}\text{C}$ Mean Values ($\pm$ Std. Deviation)	Orendorf $\delta^{13}\text{C}$ Mean Values ($\pm$ Std. Deviation)	Significance
All Adults	-12.0 ($\pm$ 1.3)	-9.7 ($\pm$ 1.7)	0.000*
Young Adults	-11.7 ($\pm$ 1.6)	-9.0 ($\pm$ 0.6)	0.000*
Middle Age Adults	-11.9 ($\pm$ 0.8)	-9.8 ($\pm$ 1.2)	0.000*
Older Adults	-12.2 ($\pm$ 1.6)	-10.2 ($\pm$ 1.6)	0.004*
*Statistically significant at the $p < 0.05$ level; Mann-Whitney U Test was used to determine statistical significance for all demographic categories			

Table 6.4 Comparison of $\delta^{15}\text{N}$ (‰) Values from Broad Demographic Groups at Both Sites			
	Norris Farms 36 $\delta^{15}\text{N}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Orendorf $\delta^{15}\text{N}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Significance
All Adults	10.3 ($\pm$ 0.7)	10.1 ($\pm$ 0.6)	0.103
Young Adults	10.0 ($\pm$ 0.8)	10.2 ($\pm$ 0.6)	0.530
Middle Age Adults	10.2 ($\pm$ 0.6)	10.3 ($\pm$ 0.4)	0.645
Older Adults	10.6 ($\pm$ 0.7)	10.0 ($\pm$ 0.7)	0.013*
*Statistically significant at the $p < 0.05$ level; the independent samples t-test was used to determine statistical significance for all demographic categories.			

Section 6.2.3 Intersite Comparisons Between Sites for Different Sexes

Recognizing the potential for different sexes to have different dietary signatures due to factors such as gender-specific diets and intermarriage with Middle Mississippian females, the broad “Adult” category was subdivided by sex. The mean values and significance level are shown in Tables 6.5 and 6.6.

The overall intersite pattern of higher $\delta^{13}\text{C}$ values at Orendorf but no significant difference in $\delta^{15}\text{N}$ values was repeated in adult females, with only the $\delta^{13}\text{C}$ values significantly different (Tables 6.5 and 6.6). However, both the difference in $\delta^{15}\text{N}$ values and the difference in $\delta^{13}\text{C}$ values are statistically significant between adult males at the two sites (Tables 6.5 and 6.6).

This seems to indicate that the diet at the two sites between adult males was significantly different in terms of both floral and faunal consumption. To further investigate differences between adults at the two sites, both male and females were broken down into more the specific age categories introduced for the entire adult population. The methods use for this categorization can be found in Chapter Four.

Both “Young Adult Females” and “Middle-Age Adult Females” showed significant differences in $\delta^{13}\text{C}$ but not $\delta^{15}\text{N}$ values (Tables 6.5 and 6.6; Figures 6.4 and 6.5). However, “Older Adult Females” did not demonstrate any statistically significant differences in $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values (Tables 6.5 and 6.6; Figure 6.6). Likewise, no significant differences in $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values were seen in “Young Adult Males” between sites (Tables 6.5 and 6.6; Figure 6.7). “Middle Age Adult Males” conformed to the overall site pattern of statistically significant differences in $\delta^{13}\text{C}$ but not $\delta^{15}\text{N}$ (Tables 6.5 and 6.6; Figure 6.8). Finally, “Older Adult Males” had both significantly different $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values (Tables 6.5 and 6.6; Figure 6.9).

Table 6.5 Comparison of $\delta^{13}\text{C}$ (‰) Values from Broad Demographic Groups at Both Sites			
	Norris Farms 36 $\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Orendorf $\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Significance
All Adult Females	-11.7 ($\pm$ 1.0)	-9.2 ($\pm$ 1.9)	0.000*
Young Adults Females	-11.3 ($\pm$ 1.6)	-8.9 ($\pm$ 0.5)	0.001*
Middle Age Adult Females	-11.9 ($\pm$ 0.9)	-9.0 ($\pm$ 0.9)	0.024*
Older Adult Females	-11.7 ($\pm$ 0.8)	-10.3 ($\pm$ 1.9)	0.180
All Adult Males	-12.3($\pm$ 1.6)	-10.1 ($\pm$ 1.3)	0.000*
Young Adult Males	-12.5 ($\pm$ 1.7)	-9.4 ($\pm$ 0.5)	0.100
Middle Age Adult Males	-11.9 ($\pm$ 0.8)	-10.1 ($\pm$ 1.2)	0.004*
Older Adult Males	-12.6 ($\pm$ 2.0)	-10.2 ($\pm$ 1.6)	0.016*
*Statistically significant at the $p < 0.05$ level; Mann-Whitney U Test was used to determine statistical significance for all demographic categories			

Table 6.6 Comparison of $\delta^{15}\text{N}$ (‰) Values from Broad Demographic Groups at Both Sites

	Norris Farms 36 $\delta^{15}\text{N}$ Mean Values ($\pm$ Std. Deviation)	Orendorf $\delta^{15}\text{N}$ Mean Value ($\pm$ Std. Deviation)s	Significance
All Adult Females	10.1 ($\pm$ 0.7)	10.0 ($\pm$ 0.6)	0.640
Young Adults Females	9.6 ($\pm$ 0.7)	10.1 ($\pm$ 0.5)	0.248
Middle Age Adult Females	9.8 ($\pm$ 0.4)	10.3 ($\pm$ 0.5)	0.243
Older Adult Females	10.4 ($\pm$ 0.7)	9.7 ($\pm$ 0.9)	0.111
All Adult Males	10.6 ($\pm$ 0.6)	10.3 ($\pm$ 0.5)	0.030*
Young Adult Males	10.6 ($\pm$ 0.7)	10.5 ($\pm$ 0.7)	0.970
Middle Age Adult Males	10.4 ($\pm$ 0.5)	10.3 ($\pm$ 0.5)	0.549
Older Adult Males	10.8 ($\pm$ 0.6)	10.2 ($\pm$ 0.5)	0.022*

*Statistically significant at the $p < 0.05$ level; the independent samples t-test was used to determine statistical significance

Figure 6.4 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Young Adult Females at Both Sites

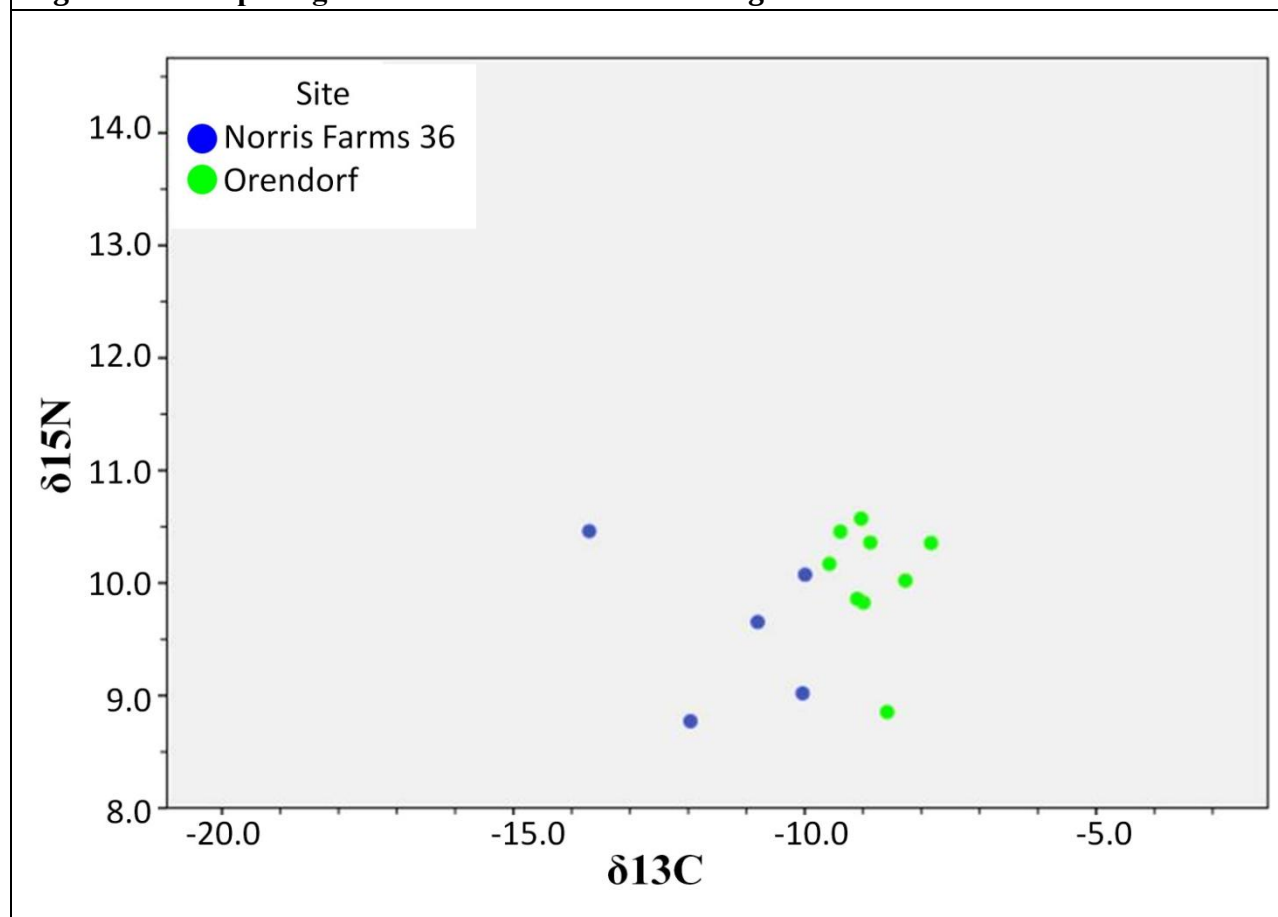


Figure 6.5 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Middle Age Adult Females at Both Sites

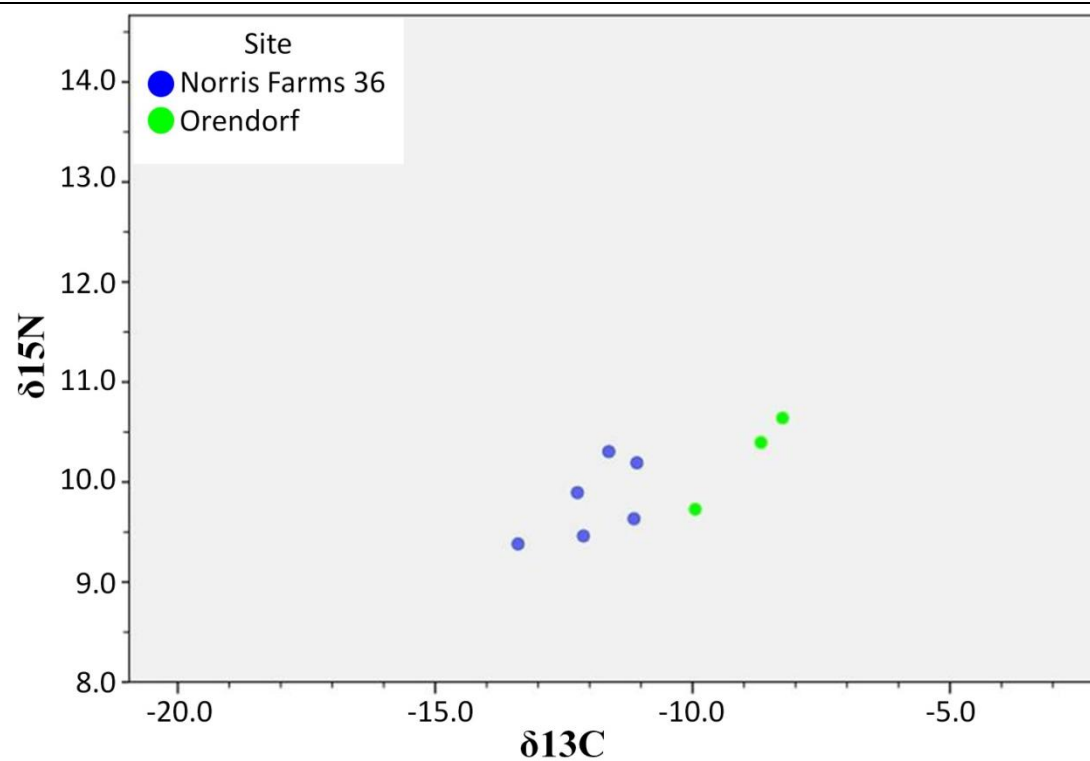


Figure 6.6 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Older Adult Females at Both Sites

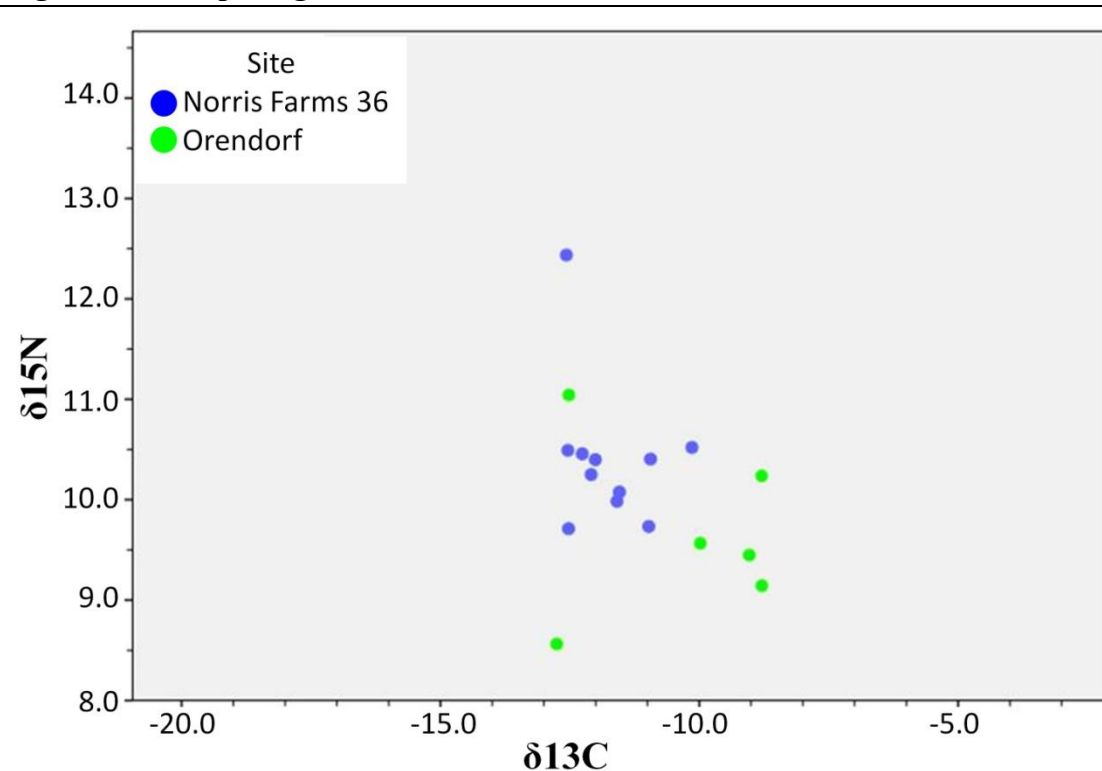


Figure 6.7 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Young Adult Males at Both Sites

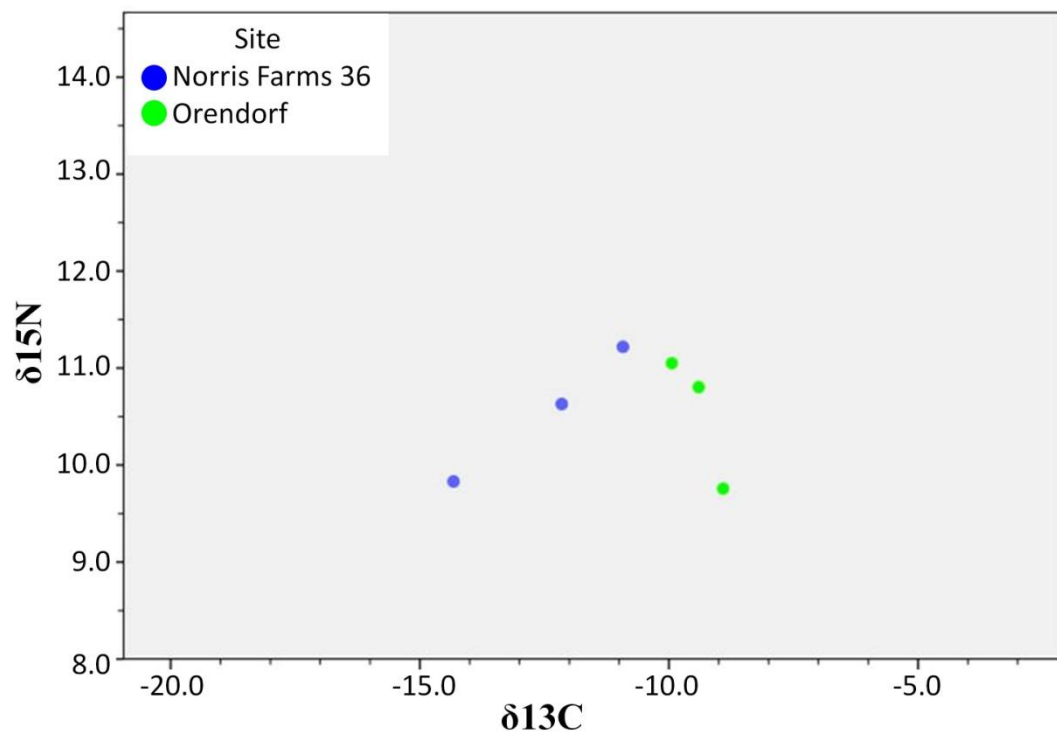


Figure 6.8 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Middle Age Adult Males at Both Sites

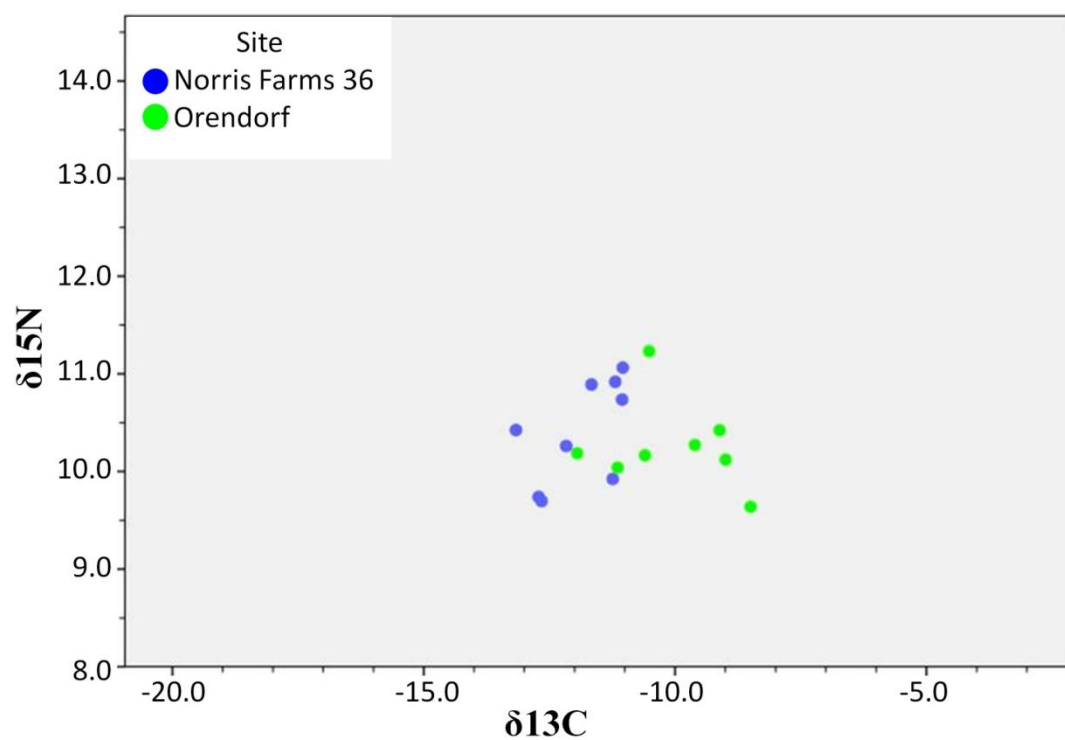
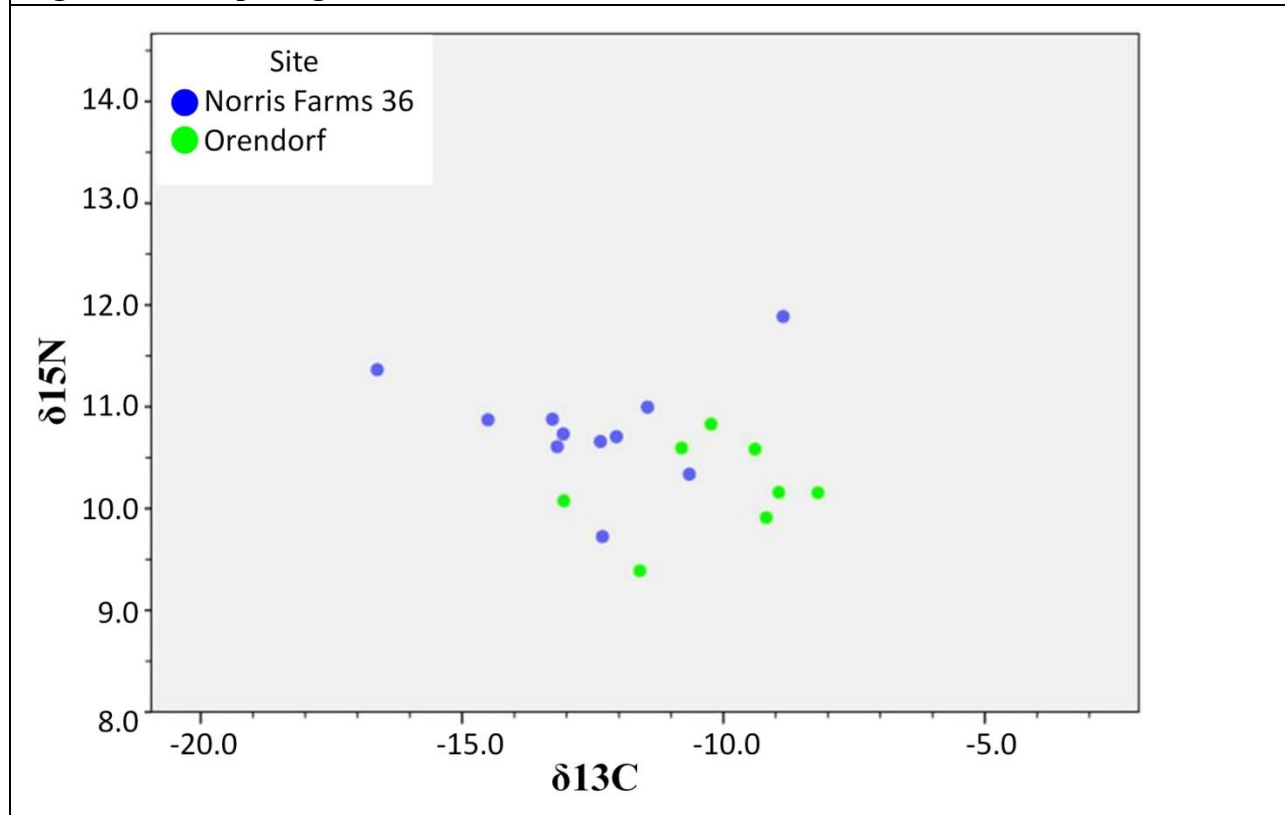


Figure 6.9 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Older Adult Males at Both Sites



Section 6.2.4 Intersite Comparisons Between Sites for Evidence of Warfare

Both Orendorf and Norris Farms 36 have been shown to have very high rates of perimortem trauma and evidence of warfare (Milner and Smith 1991; Steadman 2008a, 2008b). In addition, individuals who died as a result of interpersonal violence were more likely to be interred on the periphery of the cemetery. When investigating a population that has evidence of warfare, it is necessary to be aware that it is possible that not all individuals were members of the local populations and some may have been members of a raiding party. To help ensure that this project was testing local individuals only and not inadvertently including members of aggressive outside groups, I examined individuals who showed evidence of dying as a result of warfare separately from those with no evidence for warfare. The methods use for this categorization can be found in Chapter Four.

If we consider individuals with evidence of warfare to be attackers from an outside group or groups, we would expect the intrasite variation to be higher than intersite. This is not supported by these results. Instead, the overall site pattern appears, with a statistically significant difference between sites for the $\delta^{13}\text{C}$ values but not for $\delta^{15}\text{N}$ values (Tables 6.7 and 6.8; Figures 6.10-6.17).

Breaking down evidence of warfare between sex, females with evidence of warfare show no statistically significant differences. Females without evidence of warfare show a statistically significant difference between sites for the $\delta^{13}\text{C}$ values but not for $\delta^{15}\text{N}$ values. However, males without evidence of warfare demonstrate significant differences in both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values. Males with evidence of warfare also demonstrate no significant differences between sites.

Table 6.7 Comparison of $\delta^{13}\text{C}$ (‰) Values from Broad Demographic Groups at Both Sites			
	Norris Farms 36 $\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Orendorf $\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Significance
Adults with evidence of warfare	-12.3 ($\pm$ 1.7)	-9.8 ($\pm$ 1.9)	0.038*
Adults lacking evidence of warfare	-11.9 ($\pm$ 1.2)	-9.5 ($\pm$ 1.6)	0.000*
Females with evidence of warfare	-11.8 ($\pm$ n/a)	-10.04 ($\pm$ n/a)	0.394
Females without evidence of warfare	-11.7 ($\pm$ n/a)	-8.08 ($\pm$ n/a)	0.000*
Males with evidence of warfare	-12.5 ($\pm$ n/a)	-10.83 ($\pm$ n/a)	0.267
Males without evidence of warfare	-12.2 ($\pm$ n/a)	-10.05 ($\pm$ n/a)	0.000*
Norris Farm 36 Adults with evidence of warfare; Orendorf adults without evidence of warfare	-12.3 ($\pm$ 1.7)	-9.5 ($\pm$ 1.6)	0.000*
Norris Farms 36 Adults without evidence of warfare; Orendorf adults with evidence of warfare	-11.9 ($\pm$ 1.2)	-9.8 ($\pm$ 1.9)	0.025*
*Statistically significant at the $p < 0.05$ level; Mann-Whitney U Test was used to determine statistical significance for categories of all individuals.			

Table 6.8 Comparison of $\delta^{15}\text{N}$ (‰) Values from Broad Demographic Groups at Both Sites			
	Norris Farms 36 $\delta^{15}\text{N}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Orendorf $\delta^{15}\text{N}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Significance
Adults with evidence of warfare	10.3 ($\pm$ 0.6)	10.2 ($\pm$ 1.0)	0.28
Adults lacking evidence of warfare	10.4 ($\pm$ 0.8)	10.1 ($\pm$ 0.5)	0.09
Females with evidence of warfare	10.1 ($\pm$ n/a)	10.2($\pm$ n/a)	0.687
Females without evidence of warfare	10.1 ($\pm$ n/a)	9.9 ($\pm$ n/a)	0.403
Males with evidence of warfare	10.3 ($\pm$ n/a)	10.7 ($\pm$ n/a)	0.708
Males without evidence of warfare	10.8 ($\pm$ n/a)	10.2 ($\pm$ n/a)	0.002*
Norris Farm 36 Adults with evidence of warfare; Orendorf adults without evidence of warfare	10.3 ($\pm$ 0.6)	10.1 ($\pm$ 0.5)	0.512
Norris Farms 36 Adults without evidence of warfare; Orendorf adults with evidence of warfare	10.4 ($\pm$ 0.8)	10.2 ($\pm$ 1.0)	0.535
*Statistically significant at the $p < 0.05$ level; the independent samples t-test was used to determine statistical significance			

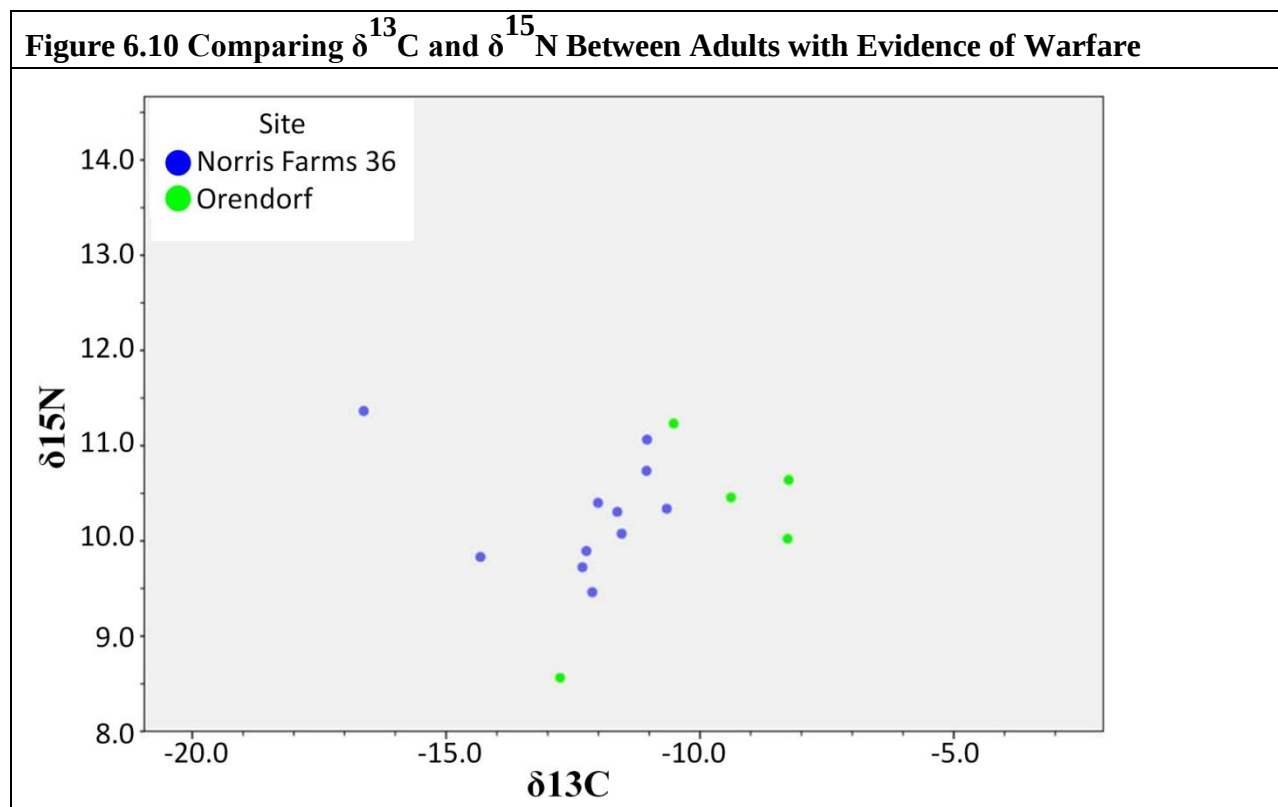


Figure 6.11 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Adults Without Evidence of Warfare

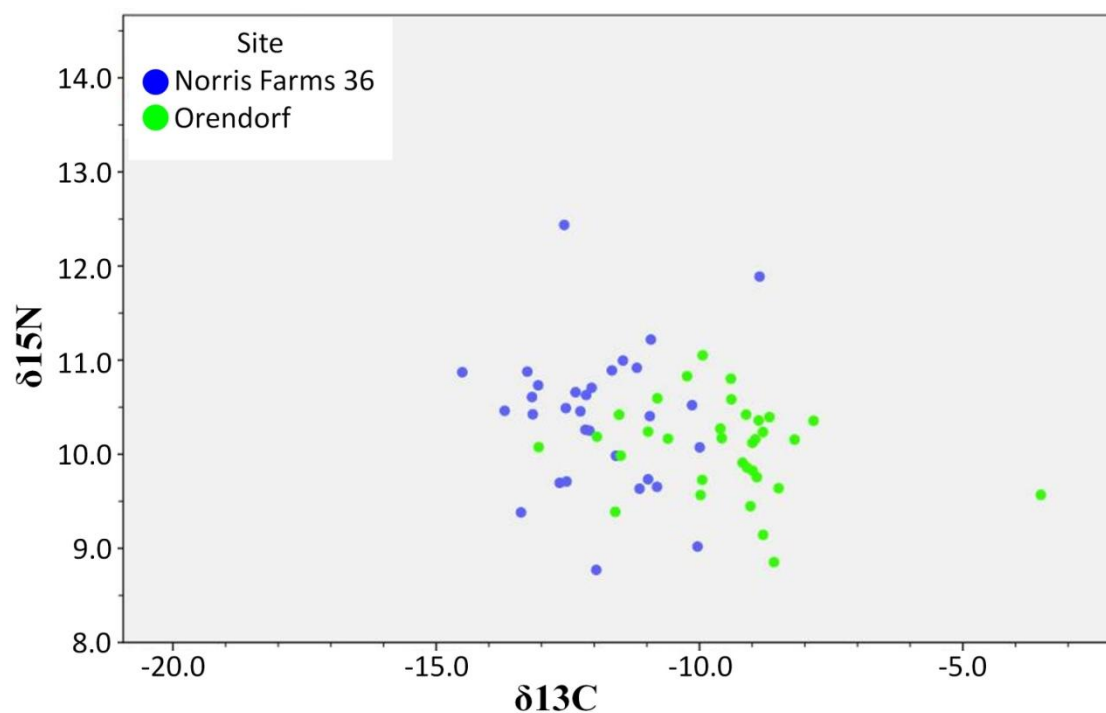


Figure 6.12 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Females with Evidence of Warfare

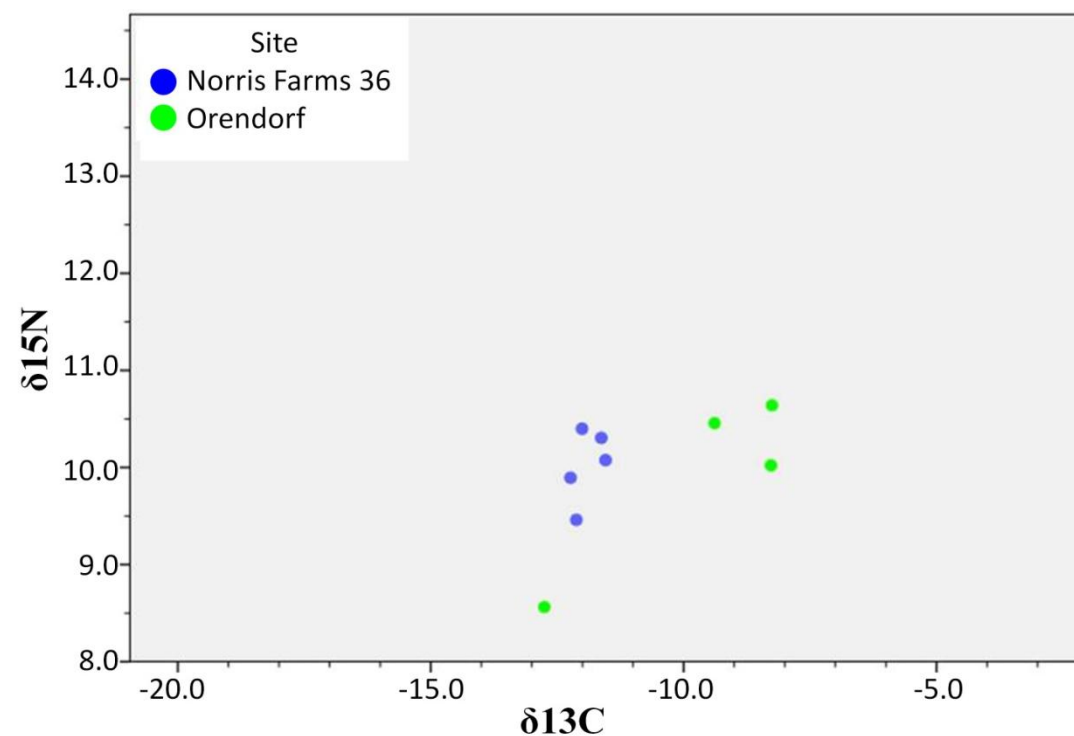


Figure 6.13 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Females without Evidence of Warfare

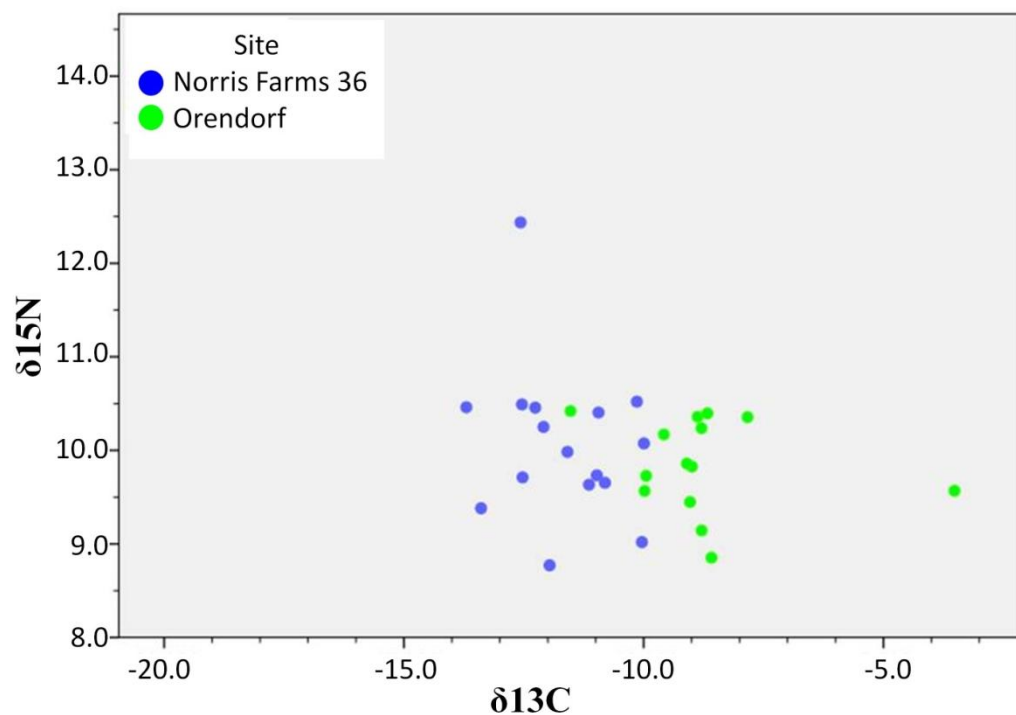


Figure 6.14 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Males with Evidence of Warfare

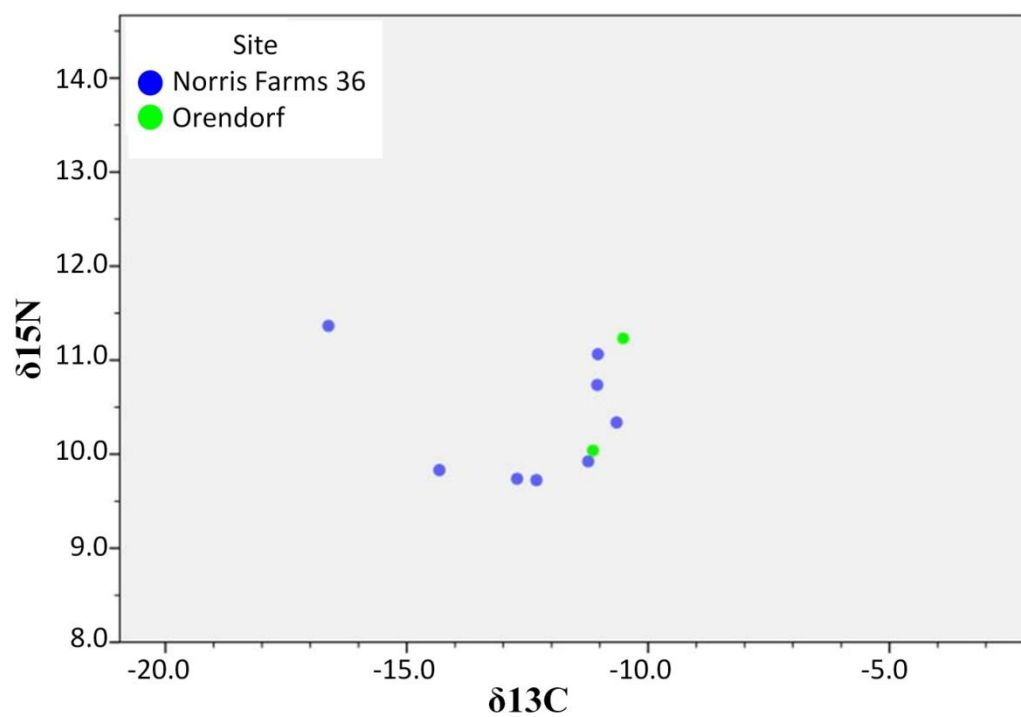


Figure 6.15. Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Males Without Evidence of Warfare

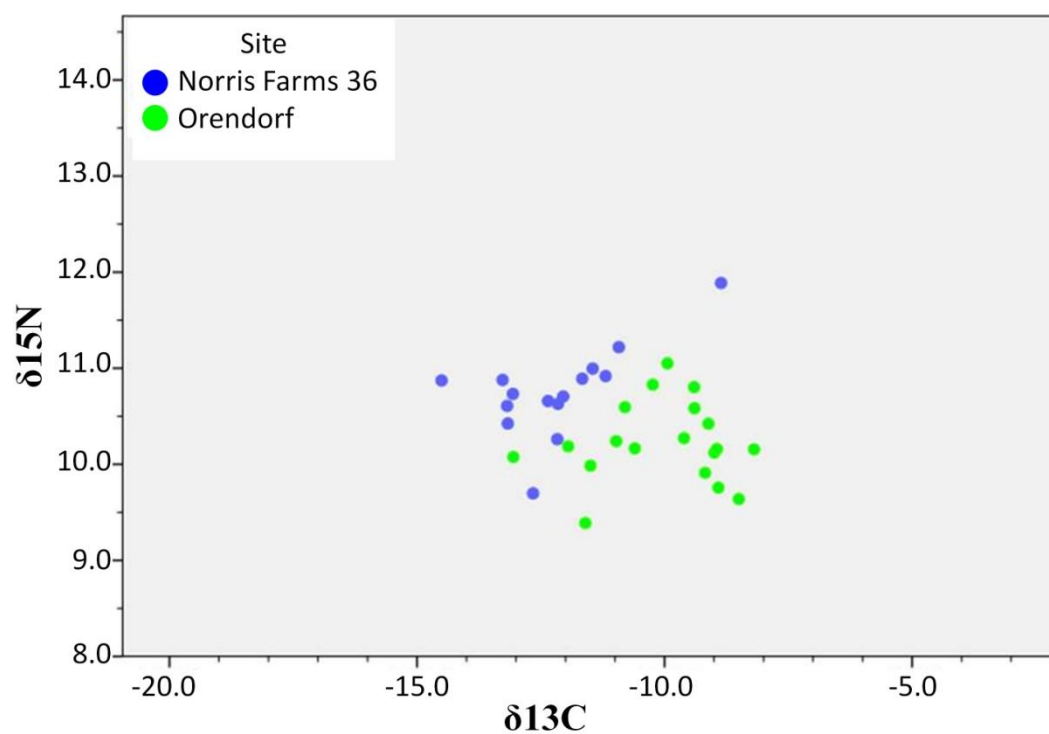


Figure 6.16 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Norris Farm 36 Adults with evidence of warfare, compared to Orendorf adults without evidence of warfare

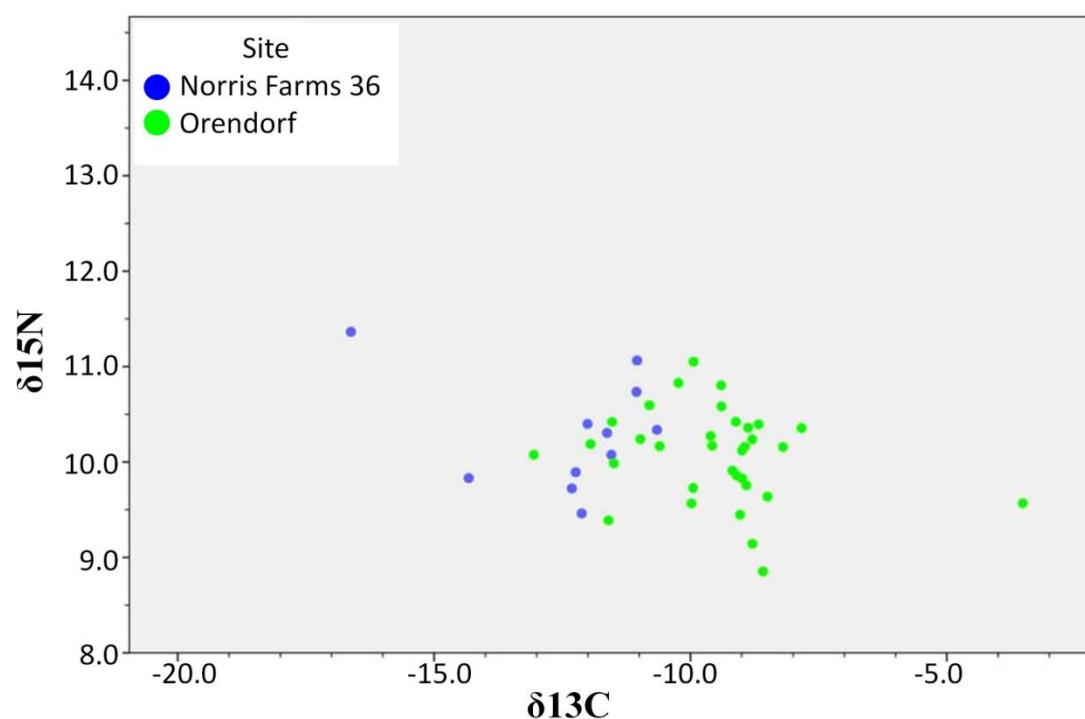
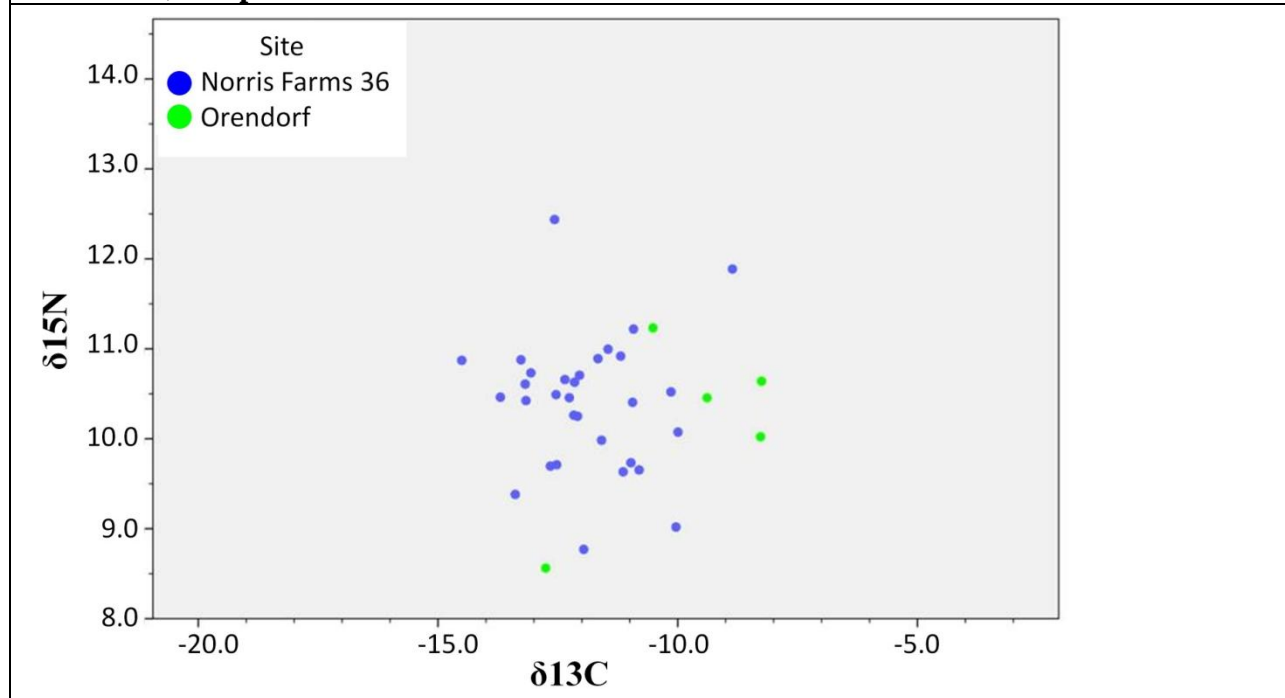


Figure 6.17. Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Norris Farm 36 Adults without evidence of warfare, compared to Orendorf adults with evidence of warfare



Section 6.2.5 Intersite Comparisons Between Sites for Different Interment Types

Differential mortuary treatment may be interpreted to represent different social identities, and individuals who receive different burial treatment may represent nonlocal individuals. As such, it was decided that single and multiple interments were going to be looked at individually as part of the intersite analysis. The demographic breakdown of the interment types of the samples from this project is shown in Table 6.9.

Table 6.9 Demographic Breakdown of Interment Types		
	Norris Farms 36	Orendorf
Adult Single Interment Individuals	36	14
Subadult Single Interment Individuals	24	6
Adult Multiple Interment Individuals	9	23
Subadult Multiple Interment Individuals	1	13

For single interments of adults, the standard intersite pattern appears: $\delta^{13}\text{C}$ values were significantly lower at Orendorf, while no such difference existed in $\delta^{15}\text{N}$ values (Tables 6.10 and 6.11, Figure 6.18). No significant difference was found in either $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values in subadult single burials between the two sites (Tables 6.10 and 6.11, Figure 6.19).

Adult multiple burials were found to have the same intersite pattern: $\delta^{13}\text{C}$ values were significantly lower at Orendorf, while no such difference existed in $\delta^{15}\text{N}$ values (Tables 6.10 and 6.11, Figure 6.20). There was only a single subadult multiple burial sampled for this project and its values are included in the Tables 6.10 and 6.11 for comparison purposes.

Table 6.10 Intersite Comparison of $\delta^{13}\text{C}$ (‰) Values of Single Interments by Age Group			
	Norris Farms 36 $\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Orendorf $\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Significance
Adult Single Interment Individuals	-12.0 ($\pm$ 1.5)	-10.1 ($\pm$ 1.4)	0.001*
Subadult Single Interment Individuals	-12.0 ($\pm$ 3.1)	-11.7 ($\pm$ 3.1)	0.900
Adult Multiple Interment Individuals	-12.1 ($\pm$ 0.8)	-9.6 ($\pm$ 1.3)	0.000*
Subadult Multiple Interment Individual	-8.3 ($\pm$ n/a)	-8.6 ($\pm$ 1.5)	n/a
*Statistically significant at the $p < 0.05$ level; the Mann-Whitney U test was used to determine significance for all demographic categories			

Table 6.11 Intersite Comparison of $\delta^{15}\text{N}$ (‰) Values of Multiple Interments by Age Group

	Norris Farms 36 $\delta^{15}\text{N}$ Mean Values ($\pm$ Std. Deviation)	Orendorf $\delta^{15}\text{N}$ Mean Values ($\pm$ Std. Deviation)	Significance
Adult Single Interment Individuals	10.3 ($\pm$ 0.8)	10.1 ($\pm$ 0.7)	0.440
Subadult Single Interment Individuals	10.8 ($\pm$ 1.3)	10.8 ($\pm$ 1.2)	0.860
Adult Multiple Interment Individuals	10.4 ($\pm$ 0.4)	10.1 ($\pm$ 0.6)	0.120
Subadult Multiple Interment Individual	13.1 ($\pm$ n/a)	11.12 ($\pm$ 1.3)	n/a

*Statistically significant at the $p < 0.05$ level; the Mann-Whitney U test was used to determine significance for test which involved subadults; the independent samples t-test was used to determine significance for tests which included only adults.

Figure 6.18 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Single Adult Burials at Both Sites

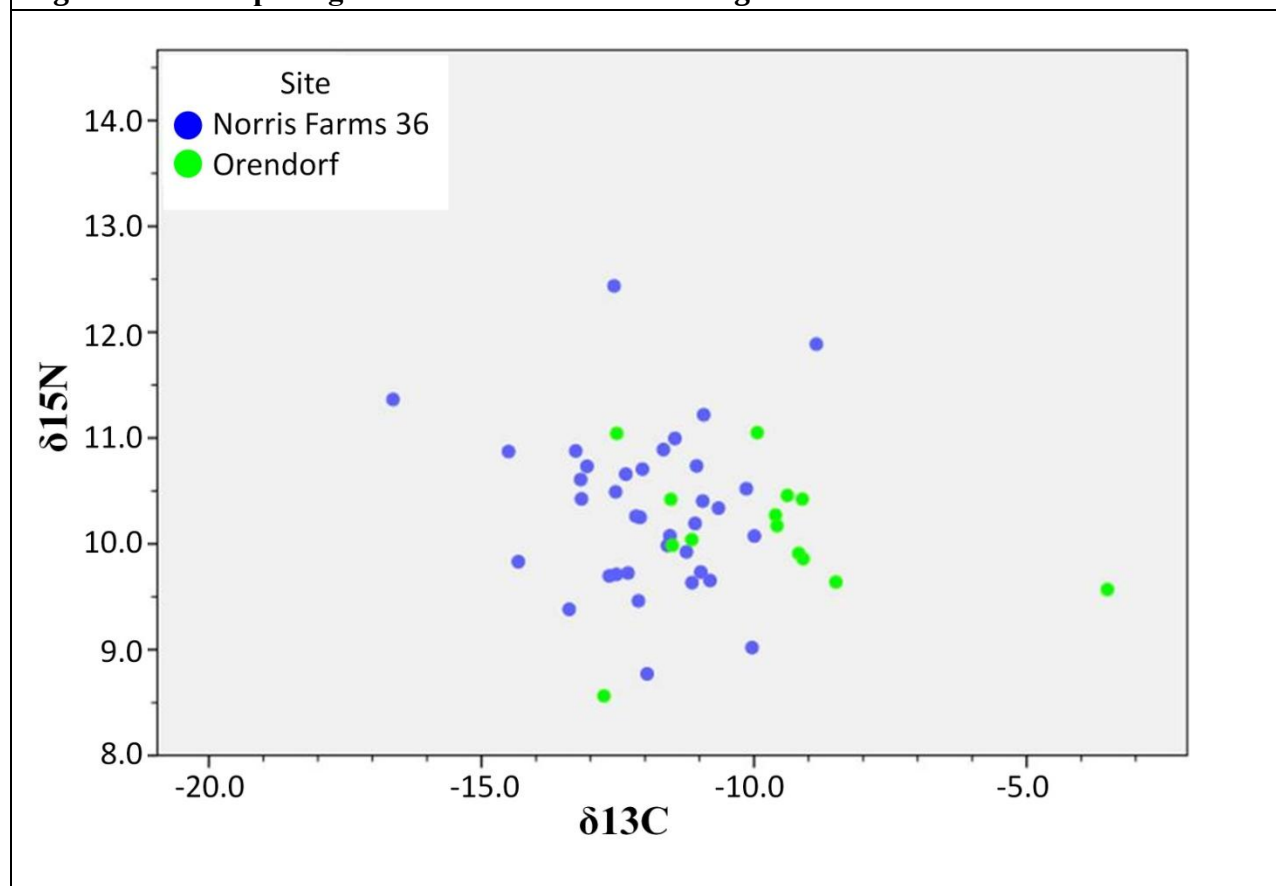


Figure 6.19 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Single Subadult Burials

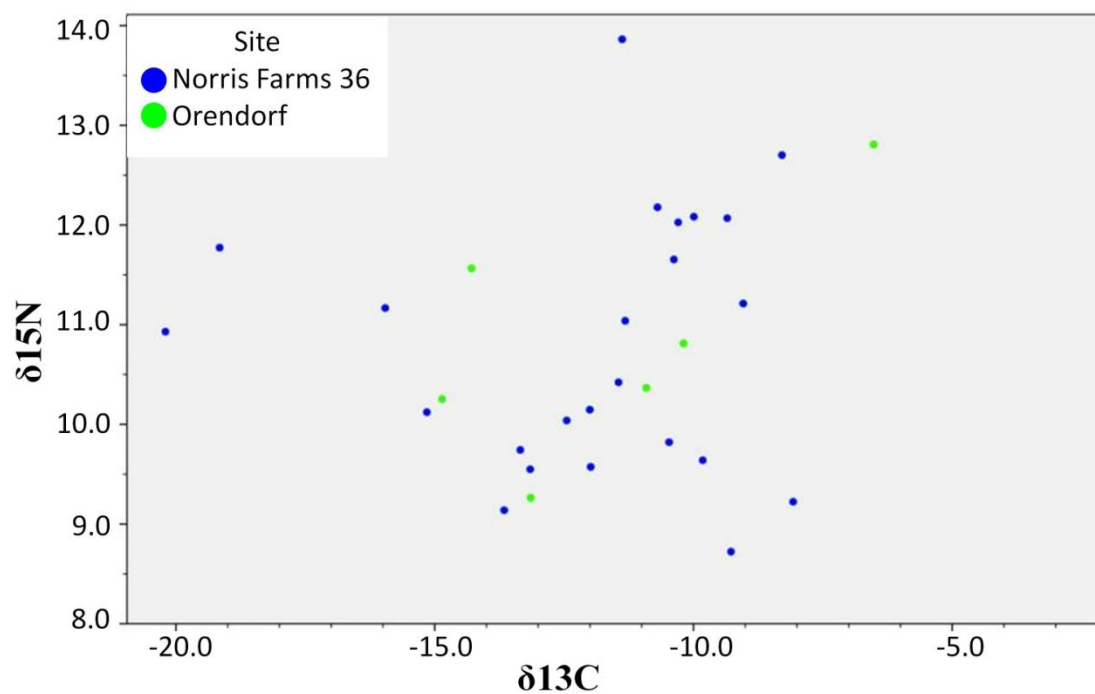
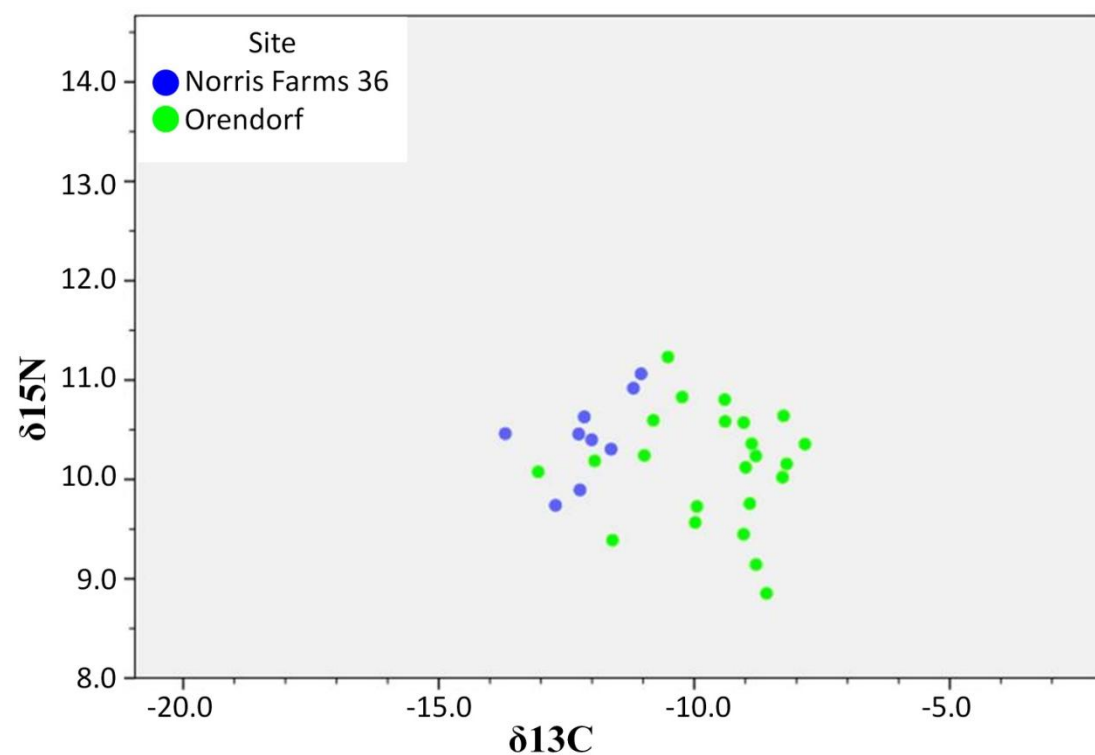


Figure 6.20 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Multiple Adult Burials at Both Sites



It was acknowledged as possible that the predominant interment type could represent the “typical” member of each population. The most common type of interment at Norris Farms 36 was single, whereas Orendorf burials were most commonly multiple. For that reason, single interments from Norris Farms 36 were compared with multiple burials at Orendorf (Tables 6.12 and 6.13, Figure 6.21). The overall site pattern appeared, with $\delta^{13}\text{C}$ values significantly different between sites and $\delta^{15}\text{N}$ values relatively similar.

Finally, “atypical” interment types were compared: multiple graves at Norris Farms 36 were compared to single graves at Orendorf. No significant differences were found (Tables 6.12 and 6.13, Figure 6.22).

Table 6.12 Intersite Comparison of $\delta^{13}\text{C}$ (‰) Values of “Typical” and “Atypical” Interments			
	Norris Farms 36 $\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Orendorf $\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	Significance
Adult Single Graves at Norris Farms 36 Compared to Adult Multiple Graves at Orendorf	-12.0 ($\pm$ 1.5)	-9.6 ($\pm$ 1.3)	0.000*
Adult Multiple Graves at Norris Farms 36 Compared to Adult Single Graves at Orendorf	-12.1 ($\pm$ 10.8)	-9.8 ($\pm$ 2.3)	0.005*
*Statistically significant at the $p < 0.05$ level; the Mann-Whitney U test was used to determine significance for all demographic categories			

Table 6.13 Intersite Comparison of $\delta^{15}\text{N}$ (‰) Values of “Typical” and “Atypical” Interments

	Norris Farms 36 $\delta^{15}\text{N}$ Mean Values ($\pm$ Std. Deviation)	Orendorf $\delta^{15}\text{N}$ Mean Values ($\pm$ Std. Deviation)	Significance
Adult Single Graves at Norris Farms 36 Compared to Adult Multiple Graves at Orendorf	10.3 ($\pm$ 0.8)	10.1 ($\pm$ 0.6)	0.265
Adult Multiple Graves at Norris Farms 36 Compared to Adult Single Graves at Orendorf	10.4 ($\pm$ 0.4)	10.1 ($\pm$ 0.6)	0.388
*Statistically significant at the $p < 0.05$ level; the Mann-Whitney U test was used to determine significance for all demographic categories			

Figure 6.21 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Adult Single Norris Farms 36 Burials and Adult Multiple Orendorf Burials

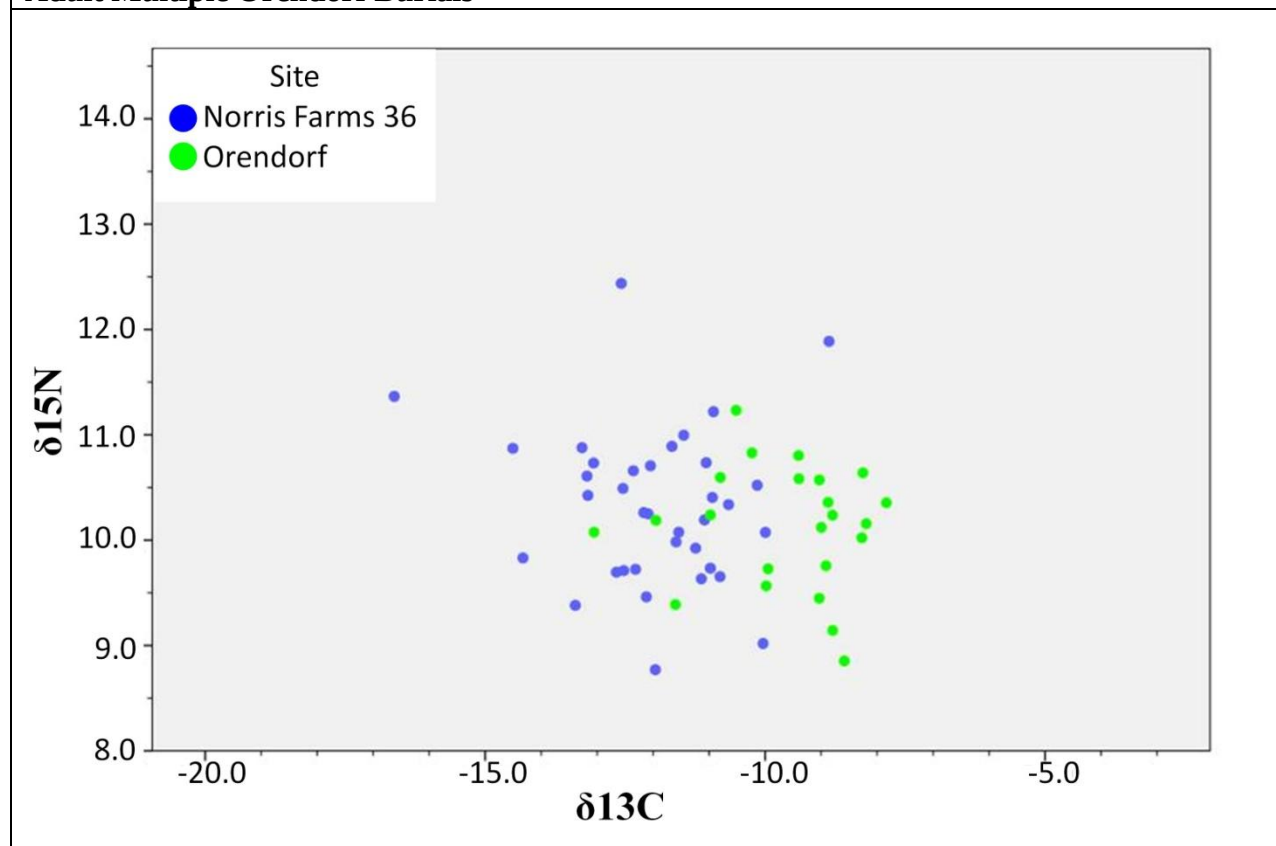
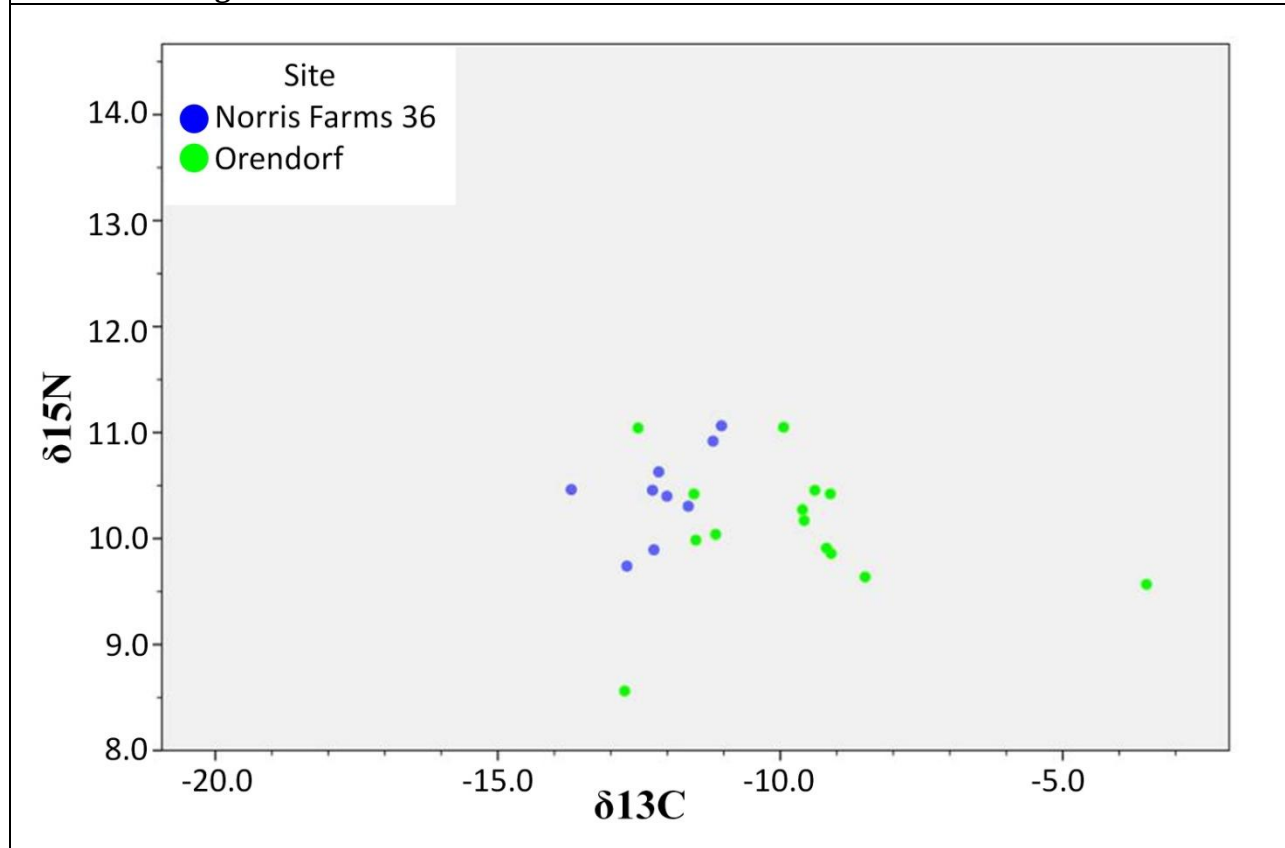


Figure 6.22 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Adult Multiple Norris Farms 36 Burials and Adult Single Orendorf Burials



Section 6.3 Orendorf Isotope Values in Context

One of the goals of this dissertation is to place the diet at Morton Village/Norris Farms 36 into a broader context to reveal information about how the inhabitants perceived themselves in relation to the larger world. In order to appreciate the strengths and weaknesses of using Orendorf as the proxy for Middle Mississippian diet in the intersite analysis portion of this project, it is necessary to place Orendorf isotopes in the broader Middle Mississippian context.

The mean $\delta^{13}\text{C}$ value for all Orendorf individuals sampled for this project was -9.6 (± 1.9). This value is higher than many of the published values from other Middle Mississippian sites (Appendix C presents a review of some published isotope values for the Eastern

Woodlands). However, these values are consistent with previous analyses of remains from Orendorf (Buikstra, Rose, and Milner 1994; Strange 2006). In addition, some Middle Mississippian sites yield even higher $\delta^{13}\text{C}$ mean values (Buikstra et al. 1987; Buikstra et al. 1988; Schurr 1989, 1992).

The mean $\delta^{15}\text{N}$ value of the burials from Orendorf was 10.5‰ (± 1.0). Although lower than some of the higher status individuals from Mound 72 (Ambrose et al. 2003), it is higher than many of the other sites reported on for the American Bottom (Hedman et al. 2002). One potential explanation for this variation is the possibility that individuals at Orendorf were consuming less beans. This explanation not only accounts for the higher $\delta^{15}\text{N}$ at Orendorf but also accounts for the more positive $\delta^{13}\text{C}$ values. However, it should be noted that this is not the only other explanation. Another explanation would be a regular staple of corn-fed meat, such as domesticated dog.

In summary, the individuals at Orendorf were consuming large amount of maize. They were also theoretically either eating less beans than other Middle Mississippians or supplementing their diet with moderate amount of aquatic fauna or large amounts of terrestrial fauna. As Middle Mississippian diet is not as “monotonous” as once suggested, the pattern seen at Orendorf is in line with other Middle Mississippian groups (Yerkes 2005).

Section 6.4 Norris Farms 36 Isotope Values in Context

In order to appreciate how the Norris Farms 36 isotope values fit into the broader context of the late prehistoric period, it is important to compare the isotope values to the published

isotope values for other Oneota and Upper Mississippian sites in eastern North America. The mean $\delta^{13}\text{C}$ value for all of the Norris Farms 36 adults sampled for this project was -12.0‰ (± 1.3). This value is somewhat more positive than some, but not all, of the published values for Oneota remains from the OT site of the Tremaine site complex in Wisconsin (Vradsburg 1993). Likewise, it is similar to one but not both of the Oneota remains from the King Hill site in Missouri (Vradsburg and Hollinger 1994). When compared to Upper Mississippian Langford tradition sites, it is higher than the mean for the Material Services Quarry site but lower than the mean for the Langford tradition Gentleman Farm site (Emerson et al. 2005). Finally, this mean value is somewhat lower than means reported for Fort Ancient sites (Schurr and Schoeninger 1995).

The mean $\delta^{15}\text{N}$ value of the adult burials from Norris Farms 36 was 10.3‰ (± 0.7). This is slightly lower than Oneota values reported on for the OT and King Hill sites (Vradsburg 1993, Vradsburg and Hollinger 1994). No comparable information for Langford tradition sites has been published. When compared to Fort Ancient sites, the individuals from Norris Farms 36 have noticeably higher $\delta^{15}\text{N}$ values. This may suggest the consumption of more fish by Norris Farms 36 than Fort Ancient peoples. Overall, however, the individuals at Norris Farms 36 seem more similar to their Upper Mississippian counterparts than they do to the individuals at the nearby site of Orendorf.

Section 6.5 Summary of Intersite Differences

The results of the intersite analysis reveal a broad pattern with Norris Farms 36 carbon isotope ratios being significantly lower than Orendorf and lacking any significant difference

between $\delta^{15}\text{N}$ stable isotope ratios. This indicates the Oneota population at Norris Farms 36 was making different food choices than the Middle Mississippian population at Orendorf.

This pattern is reflected in the total subadult population. However, the differences in the $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ values changes within more specific subadult age categories. For “fetus/neonates”, “0-1 Year Olds”, “1-2 year olds”, “2-4 year olds”, and “5-15 year olds”, there were no significant differences in either the $\delta^{13}\text{C}$ or the $\delta^{15}\text{N}$ values. In no group of subadult was there any significant difference in $\delta^{15}\text{N}$ values between the sites.

The total site pattern of significantly different $\delta^{13}\text{C}$ but not $\delta^{15}\text{N}$ values is also reflected in the overall adult populations when compared by site. This is also true when adults were broken down into the categories of “young adult”, “middle age adult”, and “older adult”. However, the “older adult” category also showed significant difference in $\delta^{15}\text{N}$ values, with Norris Farms 36 older adults having higher $\delta^{15}\text{N}$ values.

When females at the two sites are compared, the typical site pattern appears: Orendorf females have higher $\delta^{13}\text{C}$ values but do not have $\delta^{15}\text{N}$ values which are significantly different from those of Norris Farms 36 females. When the category of adult females was subdivided by age, the pattern does not change. “Young Adult Females”, “Middle-Age Adult Females”, and “Older Adult Females” all show significant differences in $\delta^{13}\text{C}$ values between sites without significant difference in $\delta^{15}\text{N}$ values.

Males at the two sites revealed a different pattern. When examining all adult males, significant differences in both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values are apparent, with Norris Farms 36 having

lower $\delta^{13}\text{C}$ values but higher $\delta^{15}\text{N}$ values. However, this pattern does not remain consistent when adult males are broken down into age groupings. “Young Adult Males” do not demonstrate significant differences in either $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values. “Middle-age Adult Males” reflect the overall site pattern of significantly different $\delta^{13}\text{C}$ values but no significant differences in $\delta^{15}\text{N}$ values. “Older Adult Males” reveal differences in both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values, with Norris Farms 36 having lower $\delta^{13}\text{C}$ values but higher $\delta^{15}\text{N}$ values.

When victims of warfare are examined, the site pattern persists, with significant differences between Norris Farms 36 and Orendorf in the $\delta^{13}\text{C}$ values but not the $\delta^{15}\text{N}$ values. Females with evidence of warfare do not demonstrate significant differences between sites in either $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values. Males with evidence of warfare likewise do not reveal any significant differences in $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values.

When only examining individuals with evidence of warfare, the overall site pattern appears again, with $\delta^{13}\text{C}$ values significantly different between the sites but no significant difference in $\delta^{15}\text{N}$ values. Females have an identical pattern. However, when only males without evidence of warfare are examined, significant differences in both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values appear.

When looking at all of the single interments between the sites, the overall site pattern of higher $\delta^{13}\text{C}$ values at Orendorf but similar $\delta^{15}\text{N}$ values between the sites persists. This pattern is repeated when only adult single burials are examined. However, subadult single burials show no significant differences in either $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values. This pattern is repeated when all multiple

interments are considered. The overall site pattern holds true when multiple burials from the two sites are compared and when only adult multiple burials are compared. However, no significant differences are seen in either $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values when subadult multiple burials from the two sites are compared. When the “typical” single burials from Norris Farms 36 are compared to the “typical” multiple burials from Orendorf, the overall pattern again appears. However, when comparing the “atypical” multiple burials from Norris Farms 36 to the “atypical” single burials from Orendorf, no significant differences in either $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values are seen.

Chapter 7: Results of Norris Farms 36 Intrasite Analysis

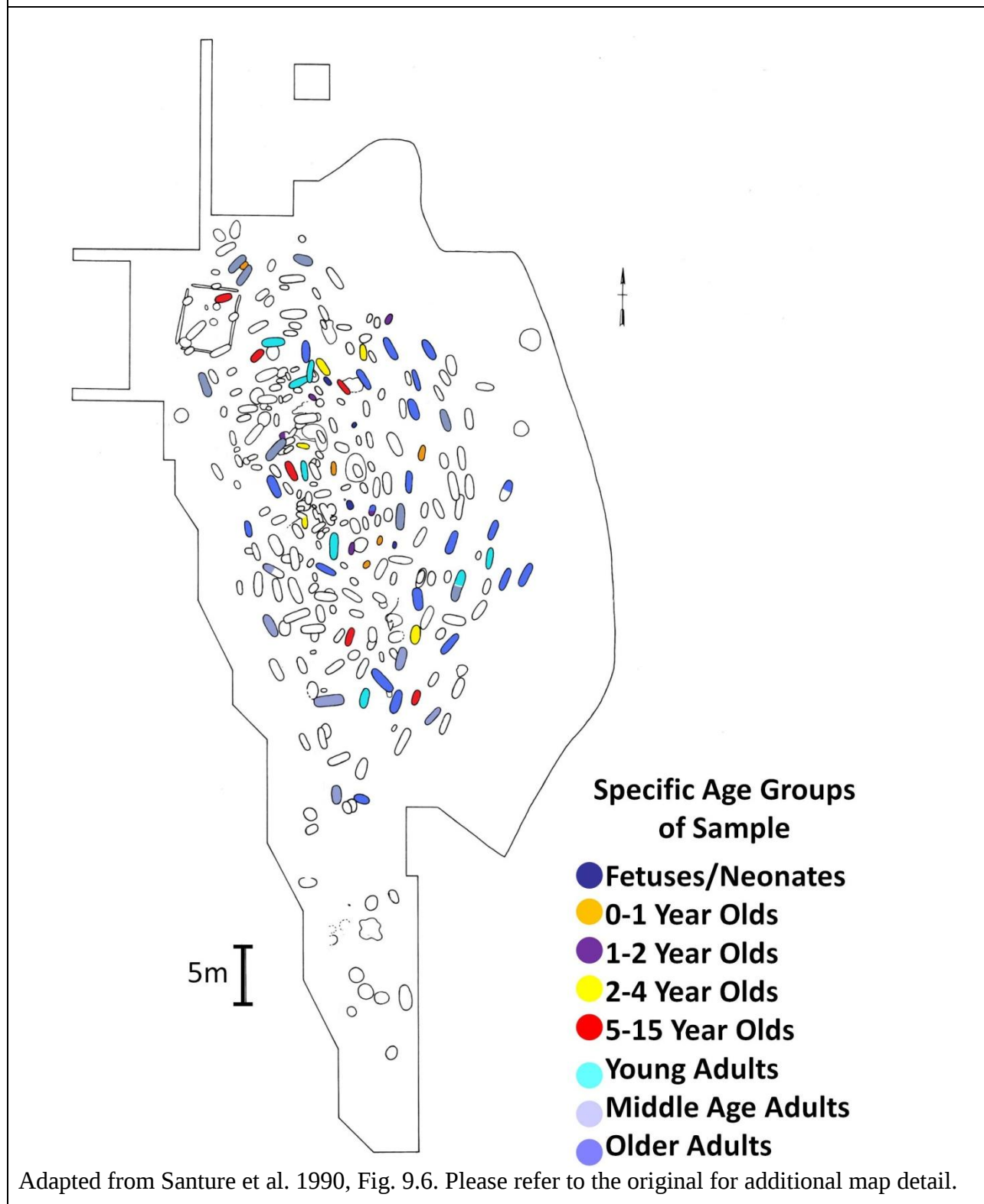
Diasporic groups, such as those living in ethnic enclaves, typically emphasize their ethnic identity (Bell 2003). Continually reifying a traditional ethnic identity would likely involve routine consumption of traditional food, prioritizing the ethnic identity over other social categories, resulting in a relatively homogenous diet within the site. In order to examine the homogeneity of the diet at Norris Farms 36, a series of statistical tests were performed based on the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from the stable isotope analysis and information from the published site report. This chapter discusses the results of this intrasite analysis. Section 7.1 gives a brief overview of the site and demography of the sample. Section 7.2 presents the results of the intrasite comparison. Section 7.3 explores the life history of select Norris Farms 36 burials, using an osteobiographic approach. Section 7.4 summarizes the results of the intrasite comparison.

Section 7.1 Brief Overview of the Norris Farms 36 Sample

The Norris Farms 36 cemetery contained 264 burials assigned to the Bold Counselor Oneota phase (A.D. 1250-1400). Once samples were eliminated for unusable collagen yields and/or poor C:N ratios, I was left with a total sample of 70 individuals for Norris Farms 36, as shown in Table 4.4 in Chapter Four. During analysis, it was determined that the “adult” age range may obscure age-related differences. To address this, the broad adult age category was broken down into “young adult” (15-25 years old), “middle age adult” (25-40 years old) and “older adult” (40+ years). These categories were also further broken down by sex. The methods used to assign individuals into these categories are outlined in Chapter Four and the number of individuals assigned to each category can be found in Table 4.5. Figure 7.1 shows the spatial

distribution of the total Norris Farms 36 sample, by age group, within the site.

Figure 7.1 Spatial Distribution of Age Groups at Norris Farms 36



Section 7.2 Intrasite Statistical Analysis

This section presents the results of an analysis of intrasite variation at Norris Farms 36 in both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values. As explained in Chapter 4, normality tests showed that $\delta^{13}\text{C}$ did not have a normal distribution and $\delta^{15}\text{N}$ only had a normal distribution when adults were tested. As such, significance for differences in $\delta^{13}\text{C}$ values between groups at Norris Farms 36 was always tested using nonparametric tests, such as the Mann-Whitney U Test and the Kruskal-Wallis one-way analysis of variance. These nonparametric tests were also used to assess significance for differences in $\delta^{15}\text{N}$ values with the site when subadults were included. When adults were examined, the independent samples t-test for equality of means or a one-way ANOVA was used. For all analyses, the level of significance was set at $p < 0.05$. These tests were performed using SPSS.

Total subadult sample from Norris Farms 36 had a mean $\delta^{13}\text{C}$ value of -11.8, with a standard deviation of 3.1. The $\delta^{15}\text{N}$ mean value for subadults was 10.9, with a standard deviation of 1.4. The total adult sample had a mean $\delta^{13}\text{C}$ value of -12.0, with a standard deviation of 1.3, and a mean $\delta^{15}\text{N}$ value of 10.3, with a standard deviation of 0.7.

Section 7.2.1 presents the results of analyses by demographic groups. Age and sex-related variation was tested. Section 7.2.2 presents the results of an analysis between groups based on warfare and trauma. Section 7.2.3 investigates potential intrasite variation based on interment type. Section 7.2.4 looks at the effect of disease on the stable isotope results. Section 7.2.5 investigates the relationship between grave goods and isotope values. Section 7.2.6 presents the results of spatial analysis of the site using ArcGIS.

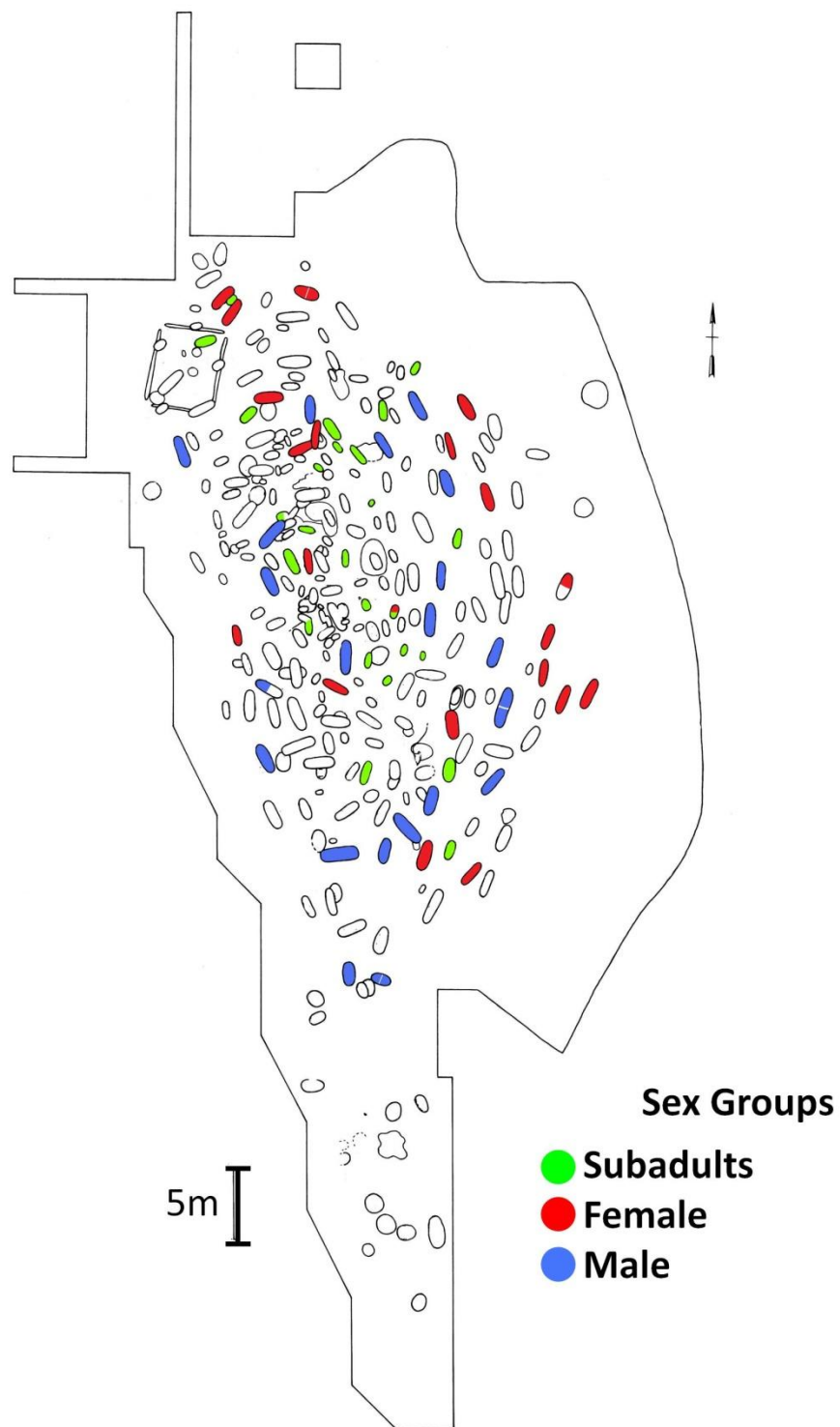
Section 7.2.1 Effects of Demographic Groups on Isotope Values

The first characteristic used to assess intrasite variation at Norris Farms 36 was sex. Subadults were excluded from this test due to the inability to determine sex. Since only two groups were compared, tests were used to compare the means of males and females.

Table 7.1 shows the mean values of the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for adult males and adult females at Norris Farms 36. The map in Figure 7.2 shows the spatial distribution of male, female, and subadult burials that were used in this project.

Table 7.1 Sex-Related Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36		
	$\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	$\delta^{15}\text{N}$ <i>Mean Values</i> ($\pm$ Std. Deviation)
Adult Females	-11.7 ($\pm$ 1.0)	10.1($\pm$ 0.7)
Adult Males	-12.3 ($\pm$ 1.6)	10.6 ($\pm$ 0.6)
<i>Significance</i>	<i>0.146</i>	<i>0.007*</i>
*Statistically significant at the 0.05 level; the Mann-Whitney U Test was used to compare means for the $\delta^{13}\text{C}$ values and the independent samples t-test was to compare the $\delta^{15}\text{N}$ means.		

Figure 7.2. Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ for All Individuals Between Sites



Adapted from Santure et al. 1990, Fig. 9.6. Please refer to the original for additional map detail.

A significant difference was seen between the $\delta^{15}\text{N}$ values, with males having a higher $\delta^{15}\text{N}$ mean value. The $\delta^{13}\text{C}$ values were not significantly different between sexes (Figures 7.3 and 7.4).

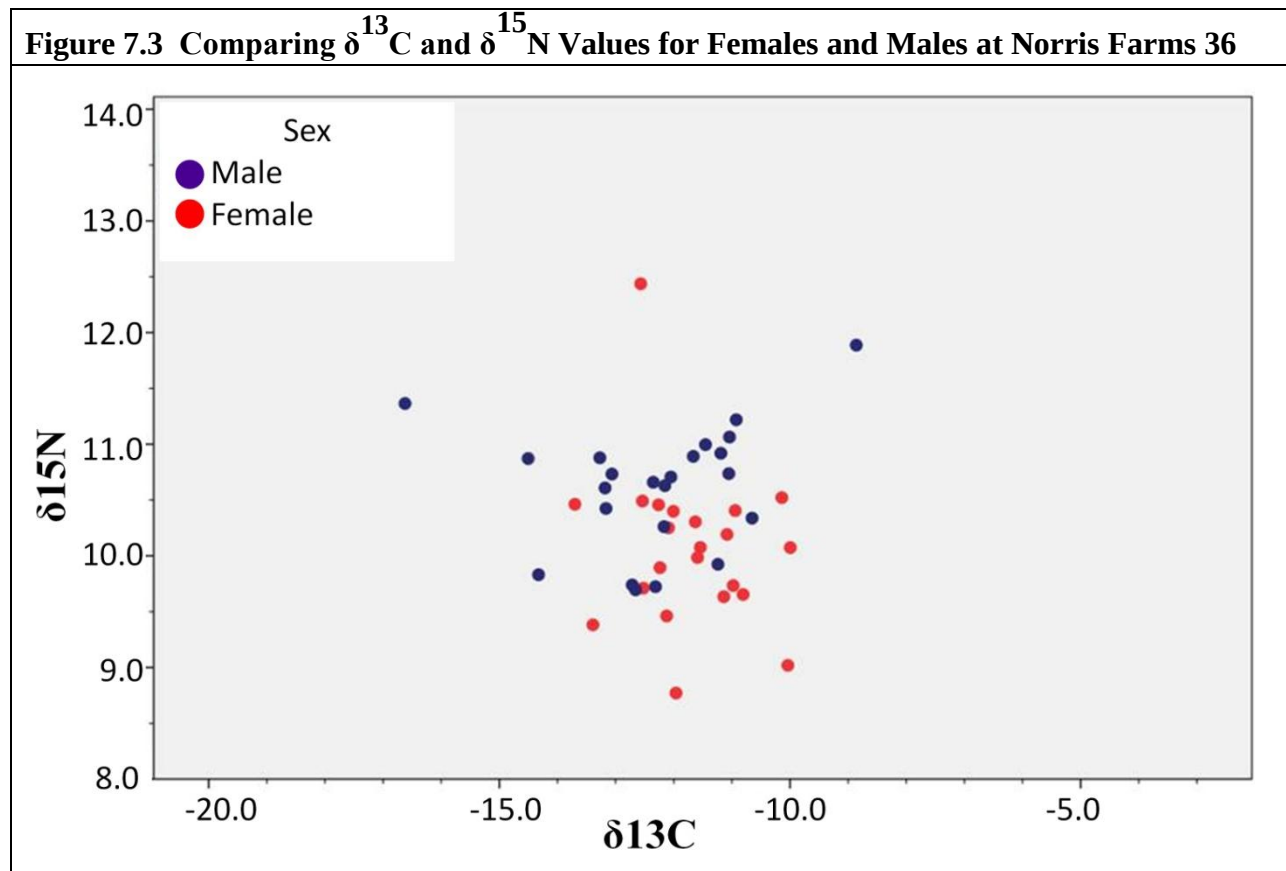
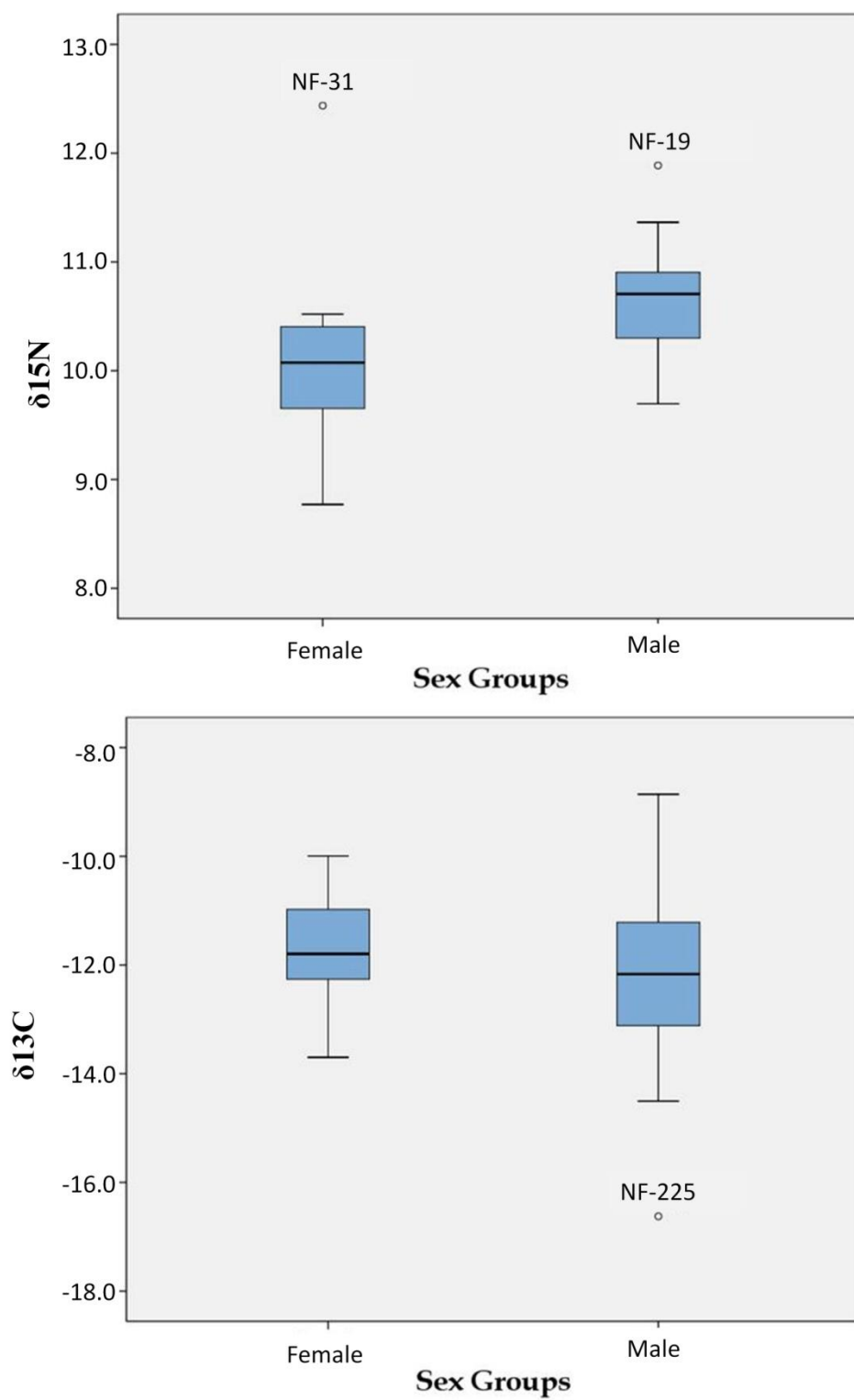


Figure 7.4. Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Values for Females and Males at Norris Farms 36



The next demographic characteristic used to assess intrasite variation at Norris Farms 36 was age. The means of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of the specific subadult and adult age categories were initially examined (Table 7.5).

Table 7.2 Age-Related Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36		
	$\delta^{13}\text{C}$ Mean Values ($\pm$ Std. Deviation)	$\delta^{15}\text{N}$ Mean Values ($\pm$ Std. Deviation)
Fetuses/Neonates	-10.9 ($\pm$ 3.0)	9.7 ($\pm$ 0.4)
0-1 Year Olds	-11.5 ($\pm$ 4.4)	11.9 ($\pm$ 0.6)
1-2 Year Olds	-12.1 ($\pm$ 4.7)	12.2 ($\pm$ 1.3)
2-4 Year Olds	-12.5 ($\pm$ 2.5)	10.9 ($\pm$ 1.3)
5-15 Year Olds	-11.9 ($\pm$ 1.5)	9.7 ($\pm$ 0.6)
Young Adults	-11.7 ($\pm$ 1.6)	10.0 ($\pm$ 0.8)
Middle-Age Adults	-11.9 ($\pm$ 0.8)	10.2 ($\pm$ 0.6)
Older Adults	-12.2 ($\pm$ 1.6)	10.6 ($\pm$ 0.7)
Significance	0.456	0.000*
*Statistically significant at the 0.05 level; Kruskal-Wallis one-way analysis of variance test was used to compare means of both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values .		

Age variation was noticeable in $\delta^{15}\text{N}$ but not $\delta^{13}\text{C}$ values (Table 7.2, Figure 7.5). The Kruskal-Wallis one-way analysis of variance revealed that the $\delta^{15}\text{N}$ values varied significantly by age group. When the boxplots (Figure 7.6) are examined, $\delta^{15}\text{N}$ values seem to peak in the 1-2 year old age group before declining and slowly rising again in adulthood.

Figure 7.5 Age-Related Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ values at Norris Farms 36

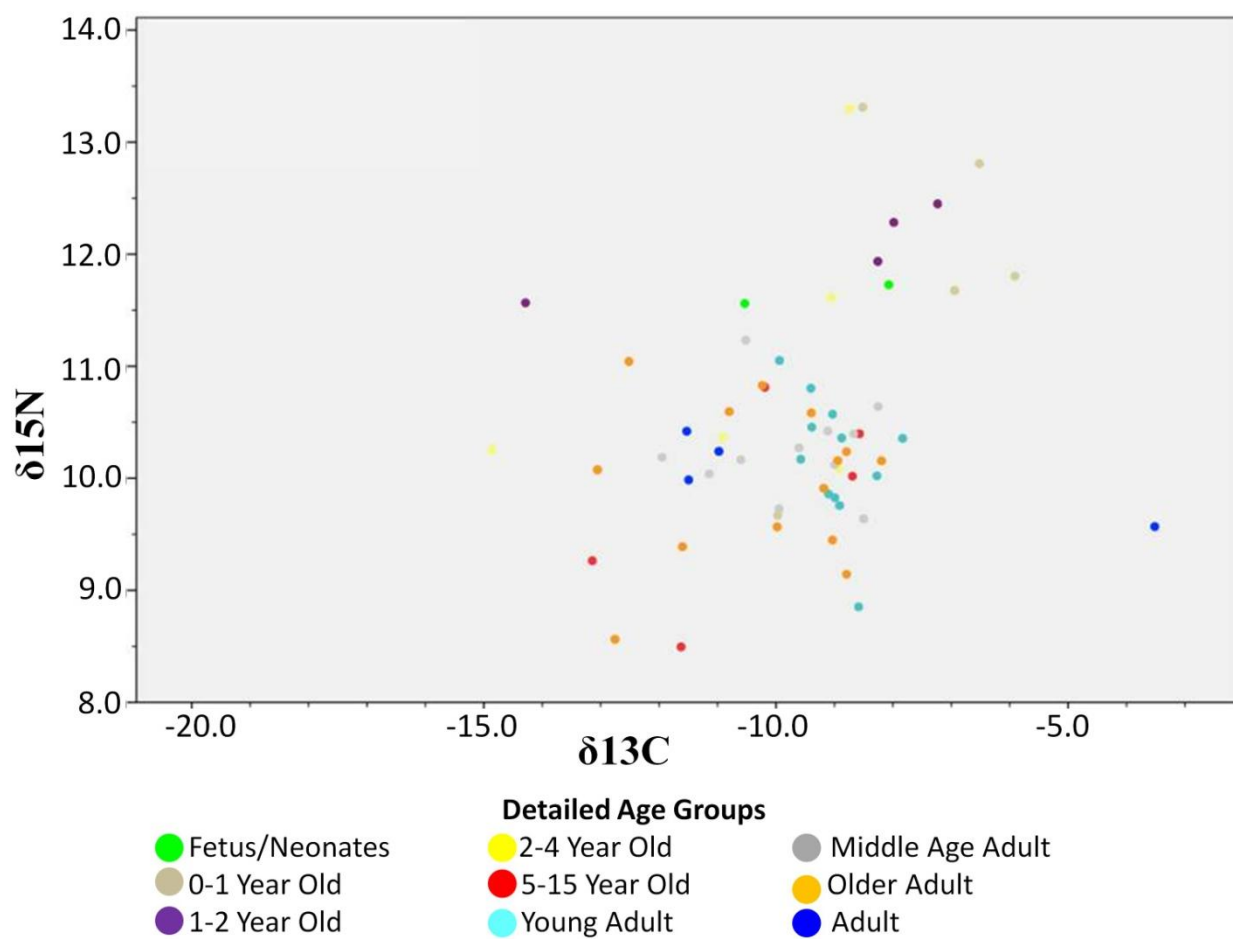
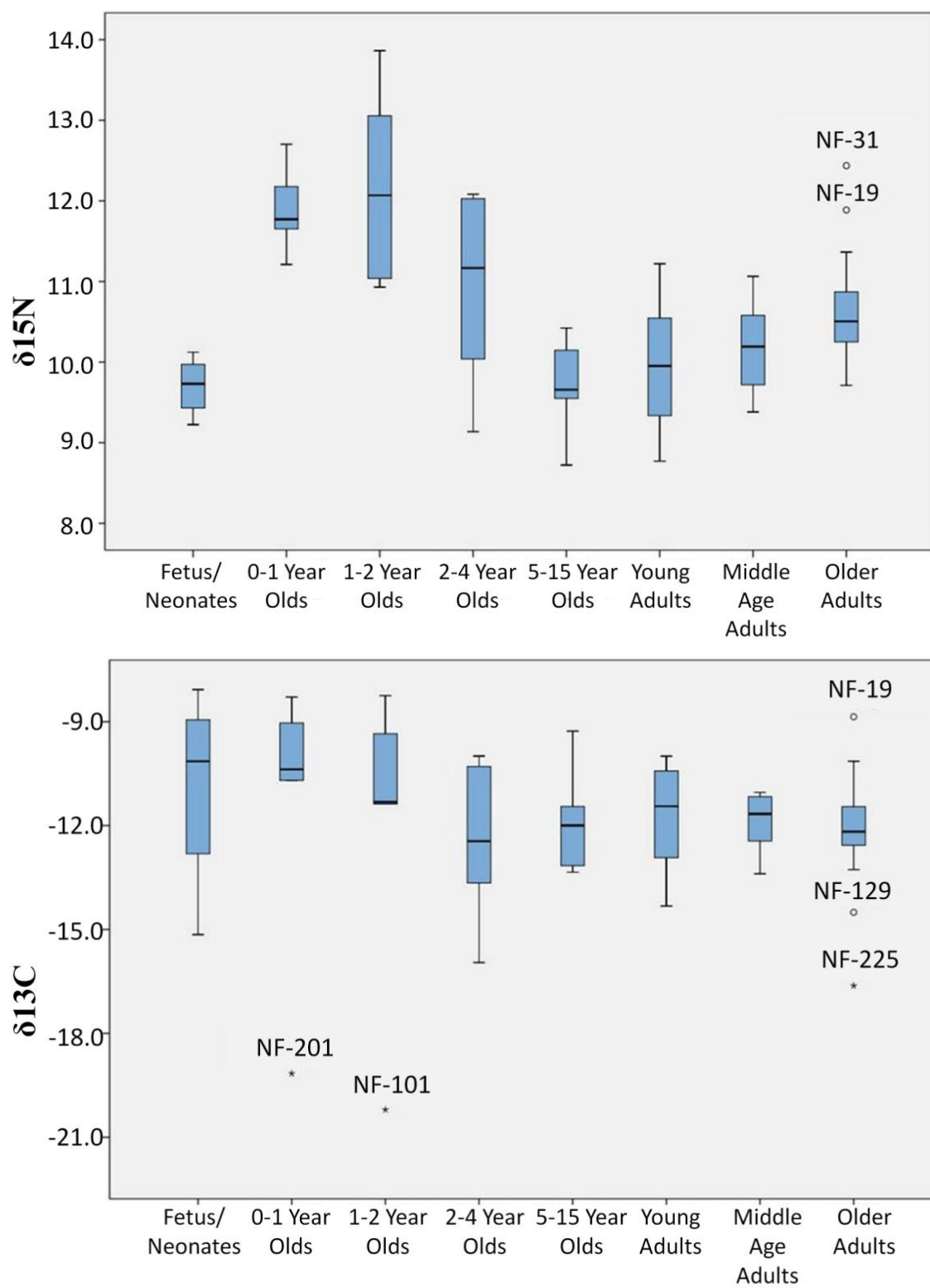


Figure 7.6 Age-Related Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ values at Norris Farms 36



Norris Farms 36 Detailed Age Groups

The elevation of $\delta^{15}\text{N}$ values in subadults under four years of age is likely related to nursing and weaning practices. Subadults younger than 5 years old were excluded and the Kruskal-Wallis test was then run again. The results of this analysis again support age-related variation of $\delta^{15}\text{N}$ values but not of $\delta^{13}\text{C}$ values (Table 7.3). The general trend of rising $\delta^{15}\text{N}$ values and decreasing $\delta^{13}\text{C}$ values in older individuals suggests variation in the amount and type of meat intake but not of the relative amount of maize in the diet.

Table 7.3 Age-Related Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36 in Individuals Over 5 years of Age		
	$\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	$\delta^{15}\text{N}$ <i>Mean Values</i> ($\pm$ Std. Deviation)
5-15 Year Olds	-11.9 ($\pm$ 1.5)	9.7 ($\pm$ 0.6)
Young Adults	-11.7 ($\pm$ 1.6)	10.0 ($\pm$ 0.8)
Middle-Age Adults	-11.9 ($\pm$ 0.8)	10.2 ($\pm$ 0.6)
Older Adults	-12.2 ($\pm$ 1.6)	10.6 ($\pm$ 0.7)
<i>Significance</i>	<i>0.780</i>	<i>0.019*</i>
*Statistically significant at the 0.05 level; independent samples Kruskal-Wallis test was used to compare means of both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values .		

Section 7.2.2 Variation in Isotope Values Related to Warfare and Trauma Status

Norris Farms 36 has been shown to have very high rates of perimortem trauma and evidence of warfare (Milner 1999; Milner, Anderson, and Smith 1991; Milner and Smith 1990; Milner, Smith, and Anderson 1991). To confirm that the victims of violent death interred at Norris Farms 36 and sampled for this project represent members of the local community, as opposed to casualties inflicted on a raiding party and interred in the cemetery, variation based on evidence of warfare and trauma-status was examined. Information about how warfare status was

determined can be found in Chapter Four. In cases where there was any question as to the categorization, the sample was left out during the warfare-specific analyses. However, it is important to note that victims of warfare do not always show skeletal trauma. Since the lack of physical evidence of warfare resulted in an individual being placed in a “non-warfare” category, it is important to note that the warfare category may underrepresent the number of victims of violent death.

In addition to evidence of warfare, individuals with and without evidence of decapitation, scalping, and antemortem trauma were compared to address several sub-hypotheses. No significant differences between any of the warfare or trauma categories were found (Table 7.4).

Table 7.4 Adult Trauma Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$(‰) values at Norris Farms 36		
	$\delta^{13}\text{C}$ Mean Values ($\pm$ Std. Deviation)	$\delta^{15}\text{N}$ Mean Values ($\pm$ Std. Deviation)
Adults with Evidence of Warfare	-12.18 ($\pm$ 1.58)	10.22 ($\pm$ 0.54)
Adults without Evidence of Warfare	-11.91 ($\pm$ 1.24)	10.40 ($\pm$ 0.76)
Significance	0.922	0.425
Adult Victims of Decapitation	-11.60 ($\pm$ 0.69)	10.23 ($\pm$ 0.43)
Adult Non-victims of Decapitation	-12.11 ($\pm$ 1.46)	10.37 ($\pm$ 0.76)
Significance	0.262	0.573
Adult Victims of Scalping	-12.66 ($\pm$ 1.47)	9.79 ($\pm$ 0.31)
Adult Non-victims of Scalping	-11.97 ($\pm$ 1.35)	10.39 ($\pm$ 0.71)
Significance	0.534	0.152
Adults with Evidence of Antemortem Trauma	-11.79 ($\pm$ 1.44)	10.38 ($\pm$ 0.59)
Adults without Evidence of Antemortem Trauma	-12.34 ($\pm$ 1.12)	10.27 ($\pm$ 0.87)
Significance	0.117	0.615
*Statistically significant at the 0.05 level; the Mann-Whitney U Test was used to compare means for the $\delta^{13}\text{C}$ values and the independent samples t-test was to compare the $\delta^{15}\text{N}$ means.		

Section 7.2.3 Variation in Isotope Values Related to Interment Type

Mortuary treatment has the potential to reveal information about social identity. In order to learn more about the relationship between diet and social identity at Norris Farms 36, relationships between diet and mortuary treatment were examined.

The majority of burials at Norris Farms 36 were single burials. However, there were multiple burials as well. Santure (1990b, 1990c) and Milner (1999) note that the multiple burials tend to be associated with victims of interpersonal violence. However, not all individual interred with others demonstrated skeletal evidence of violence. To test whether these interment types may then represent different social identities associated with different diets, the mean values of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ were examined for each interment type. Given the fact that only a single subadult multiple burial was sampled for this project, only adult single and multiple burials were compared. There are no significant differences between single and multiple burials in either $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values (Table 7.5, Figures 7.8 and 7.9).

Table 7.5 Single/Multiple Burial Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36		
	$\delta^{13}\text{C}$ <i>Mean Values</i> ($\pm$ Std. Deviation)	$\delta^{15}\text{N}$ <i>Mean Values</i> ($\pm$ Std. Deviation)
Adult Single Burials	-12.0 ($\pm$ 0.2)	10.3 ($\pm$ 0.1)
Adult Multiple Burials	-12.1 ($\pm$ 0.3)	10.4 ($\pm$ 0.1)
<i>Significance</i>	<i>0.606</i>	<i>0.572</i>
*Statistically significant at the 0.05 level; the Mann-Whitney U Test was used to compare means for the $\delta^{13}\text{C}$ values and the independent samples t-test was to compare the $\delta^{15}\text{N}$ means.		

Figure 7.8 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Single and Multiple Burials

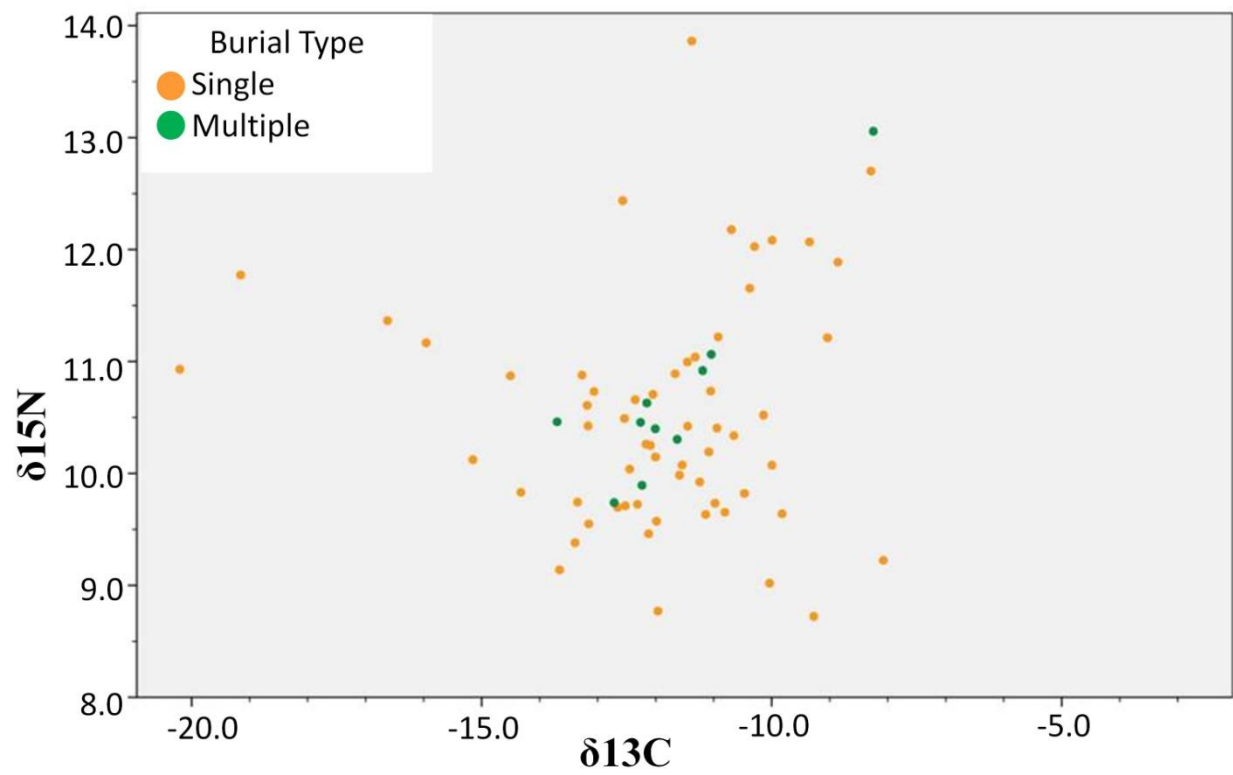
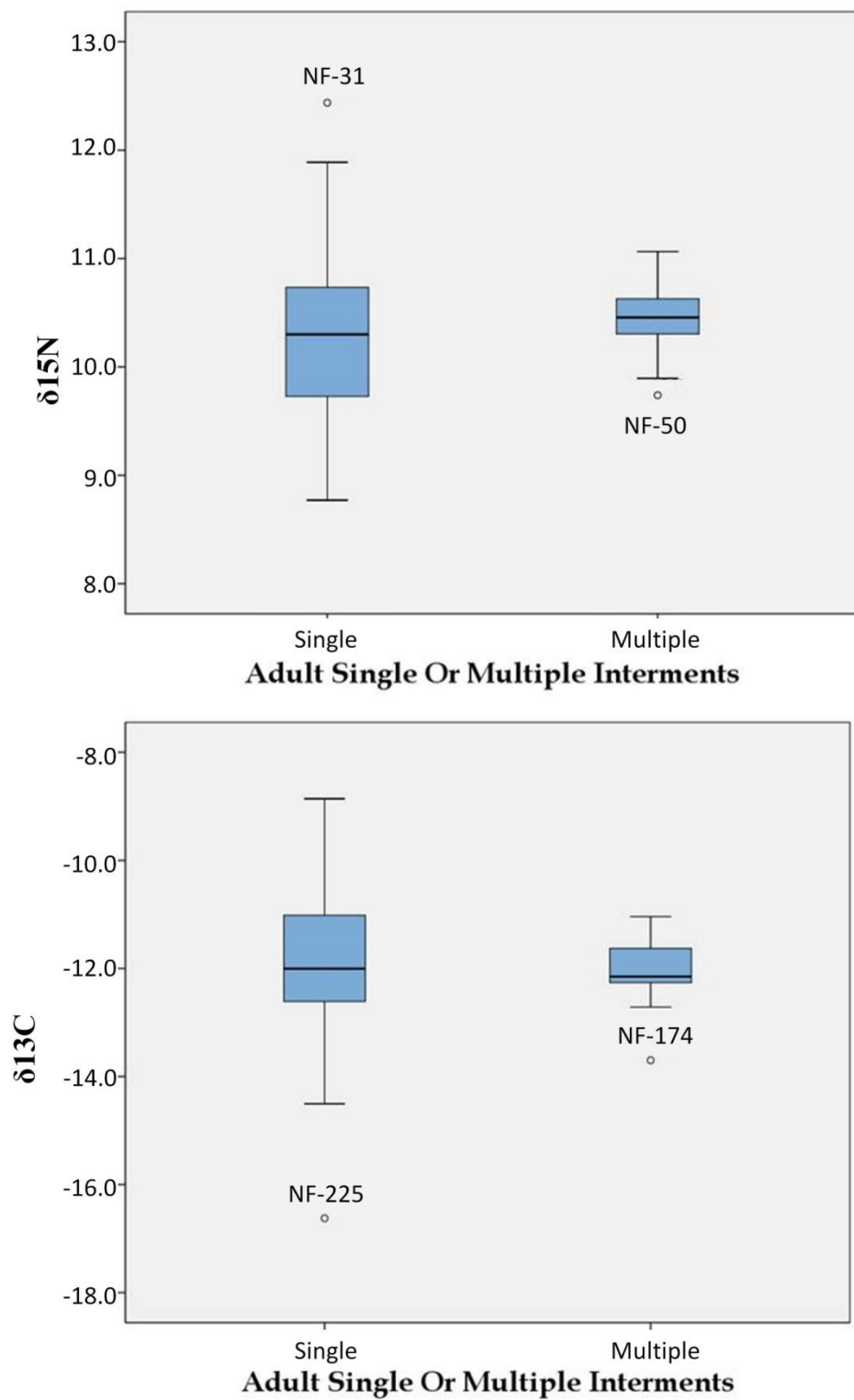


Figure 7.9 Comparing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Between Adult Single and Adult Multiple Burials



Information about skeletal position was included in the published report. The majority of interments at Norris Farms 36 was supine and articulated. However, 12.9% of this project's sample of the cemetery were interred in a position other than supine and articulated (Table 7.6).

Table 7.6 Skeletal Position of Adult Norris Farms 36 Sample	
Supine, articulated	37
Supine, disarticulated	1
Prone, articulated	3
Prone, disarticulated	1
Semiflexed	1
Bundle	2
Total	45

Since these different interment styles represent differential mortuary treatment, and potentially different social persona, their relationship to $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values at Norris Farms 36 was investigated. Results of the Kruskal-Wallis test (Table 7.7) did not indicate statistical differences in either $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values between the different types of skeletal position.

Table 7.7 Adult Skeletal Position Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36		
	$\delta^{13}\text{C}$ <i>Mean Values</i>	$\delta^{15}\text{N}$ <i>Mean Values</i>
Supine, articulated	-12.1 (± 0.2)	10.4 (± 0.1)
Supine, disarticulated	-12.1 ($\pm n/a$)	9.5 ($\pm n/a$)
Prone, articulated	-12.1 (± 0.2)	10.0 (± 0.2)
Prone, disarticulated	-11.0 ($\pm n/a$)	11.1 ($\pm n/a$)
Semiflexed	-11.0 ($\pm n/a$)	9.7 ($\pm n/a$)
Bundle	-11.3 (± 0.7)	10.4 (± 0.0)
<i>Significance</i>	<i>0.622</i>	<i>0.259</i>
*Statistically significant at the 0.05 level; independent samples Kruskal-Wallis test was used to compare means of both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values .		

Section 7.2.4 Disease-Related Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ values at Norris Farms 36

This section examines the relationship of chronic disease status and isotope values. Not only does chronic disease have the potential to reduce the ability of an individual to secure his own food, but Strange (2006) noted an increased $\delta^{15}\text{N}$ value in vertebra affected by disease in the Orendorf sample. Though the Norris Farms 36 published report has information about rates of several diseases, not all of the diseases are reported by individuals. For this reason, periostitis and undiagnostic lytic lesions were used as a proxy for chronic disease. First, individuals with either periostitis or undiagnostic lytic lesions (falling under the category “individuals with signs of chronic disease”) were examined. Undiagnostic lytic lesions and periostitis were examined individually.

No significant differences in either the $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values at Norris Farms 36 were found when overall chronic disease was investigated. This was also true for undiagnostic lytic lesions. However, periostitis was associated with significantly different $\delta^{15}\text{N}$ values between groups at Norris Farms 36 (Table 7.8). However, in contrast to Strange’s results, the $\delta^{15}\text{N}$ values of the individuals with periostitis were lower than the $\delta^{15}\text{N}$ values of individuals lacking periostitis (Strange 2006). The lower $\delta^{15}\text{N}$ values from the individuals with periostitis are more consistent with the findings of Katzenberg and Lovell (1999) who found lower, though nonsignificant, $\delta^{15}\text{N}$ values in bones with periostitis. However, great care was taken in this project to avoid sampling visibly pathological bone and the relationship between periostitis found elsewhere in the skeleton with the isotopic signature of sternal rib ends is unknown. Further investigation revealed that the two individuals at Norris Farms 36 noted to have

periostitis were both adult females in single graves lacking grave goods. It is possible that the association seen between periostitis and lower $\delta^{15}\text{N}$ values may not be a true correlation but an artifact of incidentally sampling a specific demographic.

Table 7.8 Disease-Related Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) values at Norris Farms 36		
	$\delta^{13}\text{C}$ <i>Mean Values</i>	$\delta^{15}\text{N}$ <i>Mean Values</i>
Adults with Evidence of Chronic Disease	-11.7 (± 1.4)	10.2 (± 0.7)
Adults without Evidence of Chronic Disease	-12.1 (± 1.3)	10.4 (± 0.7)
<i>Significance</i>	<i>0.864</i>	<i>0.226</i>
Adults with Undiagnostic Lytic Lesions	-12.3 (± 1.2)	10.2 (± 0.4)
Adults without Undiagnostic Lytic Lesions	-12.0 (± 1.4)	10.4 (± 0.7)
<i>Significance</i>	<i>0.243</i>	<i>0.483</i>
Adults with Periostitis	-11.1 (± 1.5)	9.2 (± 0.3)
Adults without Periostitis	-12.0 (± 1.3)	10.4 (± 0.7)
<i>Significance</i>	<i>0.368</i>	<i>0.020</i>
*Statistically significant at the 0.05 level; the Mann-Whitney U Test was used to compare means for the $\delta^{13}\text{C}$ values and the independent samples t-test was to compare the $\delta^{15}\text{N}$ means.		

Section 7.2.5 Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ values Associated With Grave Goods

A major goal of this project is to determine whether ethnic identity was being prioritized over other social identities in relation to food choice. Grave goods yield information about various social identities and, thus, examining how $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ isotopes vary in relation to grave good inclusions reveals valuable information about the relative importance of ethnic identity within the community.

The relationship between the isotopic signatures of adults at Norris Farms 36 and their associated grave goods was examined first. The Mann-Whitney U test was used to compare the

mean values of $\delta^{13}\text{C}$ and the independent samples t-test was used to compare the mean values of $\delta^{15}\text{N}$ between grave good groups. First, adults with and without grave goods were compared. Then, individual categories of grave goods were used to compare subsets of the sample. Individual categories of grave goods were compared, with few significant differences found. The adult categories of grave goods with significant differences are presented in Table 7.9. A complete listing of results is presented in Appendices D-G.

When only adults were analyzed, a significant difference was found between those with grave goods and those without, with $\delta^{15}\text{N}$ values significantly higher in those adults without grave goods. Adults with freshwater shell had significantly higher $\delta^{15}\text{N}$ levels than those without. This was reflected in the individual buried with a hoe made of freshwater shell, with a much higher mean $\delta^{15}\text{N}$ value than the rest of the adult sample. The individual buried with a shell spoon had both a significantly lower $\delta^{13}\text{C}$ value and a significantly higher $\delta^{15}\text{N}$ value. There were two adults who were buried with bone fishhooks. These individuals had a more negative $\delta^{13}\text{C}$ and more negative $\delta^{15}\text{N}$ value than the rest of the Norris Farms 36 adult sample. The single adult interred with beads had a more negative $\delta^{13}\text{C}$ value than the rest of the Norris Farms 36 sample, but this relationship was not significant at the 0.05 level. Adults buried with lithics had a significantly higher $\delta^{15}\text{N}$ values than adults buried without any lithics. Though not significant at a 0.05 level, this relationship is echoed in adults who were buried with chipped stone artifacts. The significance reappears only when adults with projectile points are compared to those without projectile points.

Table 7.9 Grave Good Associated Variation in Adult $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) Values		
	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adults with Grave Good(s)	-12.2 (± 1.6)	10.6 (± 0.7)
Adults without Grave Good(s)	-11.8 (± 1.0)	10.1 (± 0.6)
Significance	0.480	0.018*
Adults with Freshwater Shell	-11.5 (± 2.3)	11.7 (± 0.9)
Adults without Freshwater Shell	-12.0 (± 1.3)	10.3 (± 0.6)
Significance	0.915	0.007*
Adults with a Shell Hoe(s)	-12.6 ($\pm n/a$)	12.4 ($\pm n/a$)
Adults without a Shell Hoe(s)	-12.0 (± 1.4)	10.3 (± 0.6)
Significance	0.533	0.002*
Adults with a Freshwater Shell Spoon(s)	-8.9 ($\pm n/a$)	11.9 ($\pm n/a$)
Adults without a Freshwater Shell Spoon(s)	-12.1 (± 1.3)	10.3 (± 0.7)
Significance	0.044	0.023*
Adults with Lithic(s)	-12.4 (± 1.8)	10.6 (± 0.6)
Adults without Lithic(s)	-11.9 (± 1.1)	10.2 (± 0.7)
Significance	0.506	0.044*
Adults with Projectile Point(s)	-12.5 (± 1.8)	10.6 (± 0.6)
Adults without Projectile Point(s)	-11.8 (± 1.1)	10.2 (± 0.7)
Significance	0.161	0.049*
*Statistically significant at the 0.05 level; the Mann-Whitney U Test was used to compare means for the $\delta^{13}\text{C}$ values and the independent samples t-test was to compare the $\delta^{15}\text{N}$ means.		

Next, only adult females were compared (Table 7.10). Significant differences were found between an adult female buried with freshwater shell and those buried without. The female with the freshwater shell was in the form of a shell hoe. This individual had a more negative $\delta^{13}\text{C}$ value and more positive $\delta^{15}\text{N}$ value. The difference in $\delta^{15}\text{N}$ level was significant.

Table 7.10 Grave Good Associated Variation in Adult Female $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) Values		
	$\delta^{13}\text{C}$ <i>Mean Values</i>	$\delta^{15}\text{N}$ <i>Mean Values</i>
Females with Faunal Remain(s)	-12.6 (± 0.0)	11.5 (± 1.4)
Females without Faunal Remain(s)	-11.6 (± 1.0)	9.9 (± 0.5)
Significance	0.078	0.355
Females with Freshwater Shell	-12.6 ($\pm n/a$)	12.4 ($\pm n/a$)
Females without Freshwater Shell	-11.7 (± 1.0)	10.0 (± 0.5)
Significance	0.273	0.000*
*Statistically significant at the 0.05 level; the Mann-Whitney U test was used to compare means of $\delta^{13}\text{C}$ values and the independent samples student t-test was used to compare means of the $\delta^{15}\text{N}$ values.		

When adult males were analyzed no significant differences were found in most of the grave good categories (Table 7.11). The only exception to this was the male who was buried with a freshwater shell spoon. The $\delta^{13}\text{C}$ value of this individual was significantly lower than the mean of all other adult males and the $\delta^{15}\text{N}$ value was significantly higher.

Table 7.11 Grave Good Associated Variation in Adult Male $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) Values		
	$\delta^{13}\text{C}$ <i>Mean Values</i>	$\delta^{15}\text{N}$ <i>Mean Values</i>
Males with Freshwater Shell	-11.0 (± 3.0)	11.3 (± 0.8)
Males without Freshwater Shell	-12.4 (± 1.4)	10.6 (± 0.5)
Significance	0.569	0.407
Males with a Freshwater Shell Spoon(s)	-8.9 ($\pm n/a$)	11.9 ($\pm n/a$)
Males without a Freshwater Shell Spoon(s)	-12.4 (± 1.4)	10.6 (± 0.5)
Significance	0.022*	0.017*
*Statistically significant at the 0.05 level; the Mann-Whitney U test was used to compare means of $\delta^{13}\text{C}$ values and the independent samples student t-test was used to compare means of the $\delta^{15}\text{N}$ values.		

Finally, subadults were analyzed. The Mann-Whitney U test was used to compare the mean values of $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ between groups. The significant and near significant results of the analysis are presented in Table 7.12. A complete table of grave good categories interred with subadults can be found in Appendix G. Grave good categories which resulted in a p values of <0.1 are listed in Table 7.12.

When only subadults were compared, the relationship of $\delta^{15}\text{N}$ values to grave good inclusions disappears, though a near-significant relationship between $\delta^{13}\text{C}$ values and grave good inclusion appears. A significant relationship is apparent between subadults with lithics and $\delta^{15}\text{N}$ levels, though it is the inverse of the relationship seen in adults, with subadults with lithics having lower $\delta^{15}\text{N}$ values than those without. Subadults who were buried with pottery have a lower mean $\delta^{15}\text{N}$ value than those without, but this relationship was not significant.

Table 7.12 Grave Good Associated Variation in Subadult $\delta^{13}\text{C}(\text{‰})$ and/or $\delta^{15}\text{N}(\text{‰})$ Values		
	$\delta^{13}\text{C}$ <i>Mean Values</i>	$\delta^{15}\text{N}$ <i>Mean Values</i>
Subadults with Grave Good(s)	-12.6 (± 1.8)	10.4 (± 1.2)
Subadults without Grave Good(s)	-11.4 (± 3.6)	11.1 (± 1.4)
Significance	0.057	0.255
Subadults with Lithic(s)	-12.5 (± 0.8)	9.8 (± 0.3)
Subadults without Lithic(s)	-11.7 (± 3.3)	11.0 (± 1.4)
Significance	0.273	0.003*
Subadults with Pottery	-12.4 (± 1.3)	10.0 (± 1.0)
Subadults without Pottery	-11.6 (± 3.5)	11.1 (± 1.4)
Significance	0.138	0.057
*Statistically significant at the 0.05 level; the Mann-Whitney U test was used to compare means of both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values.		

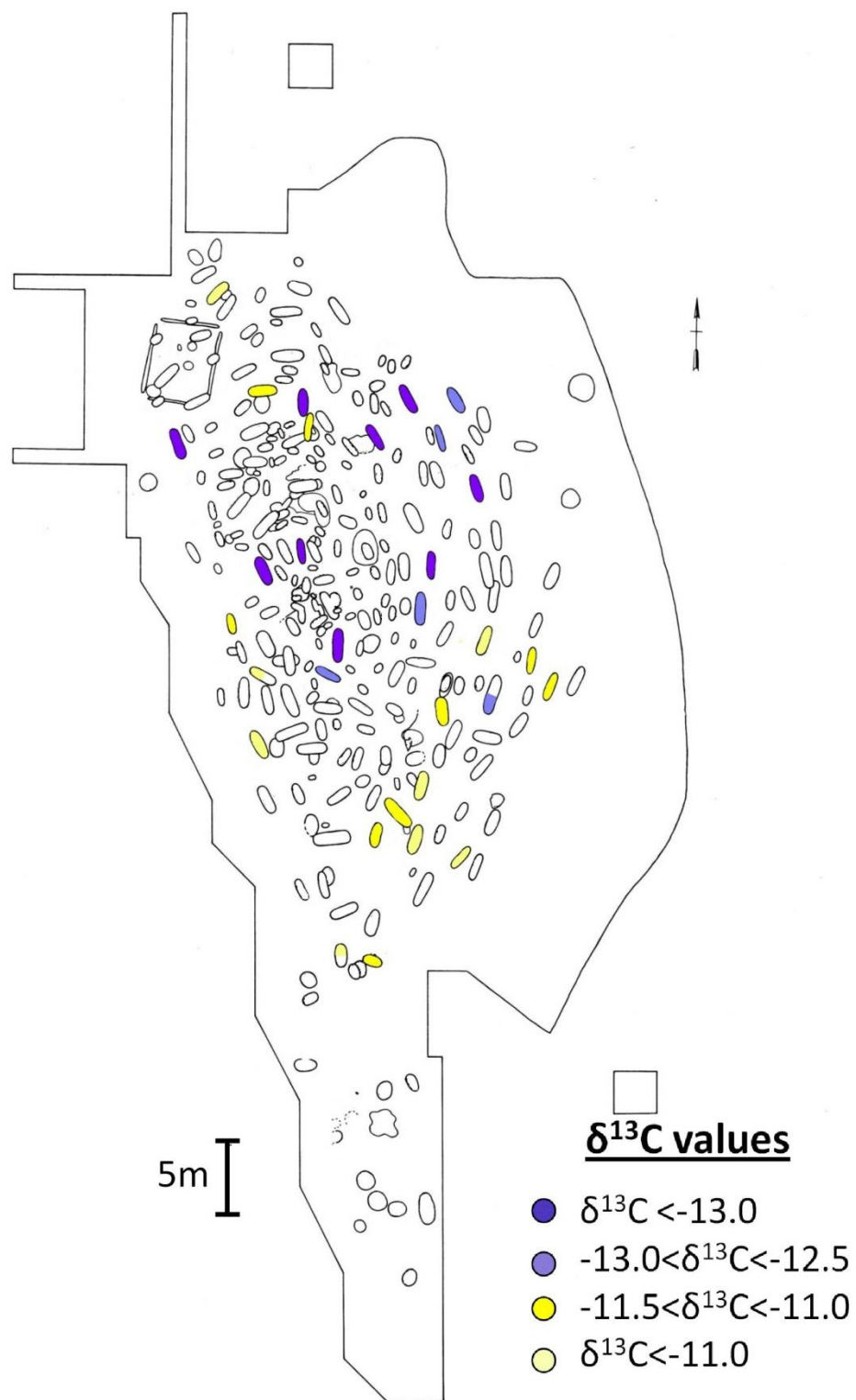
Section 7.2.6 Spatial Variation at Norris Farms 36

It has often been noted that the distribution of burials in space can reveal valuable information about past populations. This section presents the results of spatial analysis of the Norris Farms 36 site. Chapter 4, Section 4.6.2 presents information about the methods used for this portion of the analysis.

Both the High/Low Clustering (Getis-Ord General G) and Spatial Autocorrelation (Morans I) tests were run using ArcGIS. These tests were chosen based on an article by Fletcher (2008) which demonstrated the strengths and weakness of several statistical tests. Specifically, the $\delta^{13}\text{C}$ and the $\delta^{15}\text{N}$ values for adults at Norris Farms 36 were analyzed. Neither High/Low cluster analysis nor the spatial autocorrelation test revealed any significant spatial patterning in the isotope values at the $p < 0.05$ level, though the Spatial Autocorrelation test indicated there was less than a 10% chance that the distribution of adult $\delta^{13}\text{C}$ values within the cemetery was the result of random choice (see Table 7.13).

Table 7.13 Spatial Analysis of Mortuary Variation in $\delta^{13}\text{C}$ (‰) and/or $\delta^{15}\text{N}$ (‰) Values				
	High/Low Cluster Analysis	High/Low Cluster Analysis	Spatial Autocorrelation Analysis	Spatial Autocorrelation Analysis
	Z Score	p Value	Index Value	p Value
$\delta^{13}\text{C}$	-1.644	0.100	0.174	0.062
$\delta^{15}\text{N}$	-0.138	0.890	0.029	0.630

Figure 7.10 Spatial Distribution of Adult $\delta^{13}\text{C}$ Values at Norris Farms 36



Adapted from Santure et al. 1990, Fig. 9.6. Please refer to the original for additional map detail.

The adults that were sampled for this project tended to have higher $\delta^{13}\text{C}$ values the further away they were buried from the center of the cemetery (Figure 7.10). Santure (1990b) noted that the cemetery seemed to have expanded over time from a central starting point, with limited expansion to the west, suggesting that the peripheral burials likely were interred later than those towards the center of the cemetery. Given this assumption, the distribution of $\delta^{13}\text{C}$ values may suggest an increase in corn consumption through time, with later inhabitants of Morton Village consuming more corn than their predecessors.

Since there was some evidence for spatial patterning of the isotope values, a brief review of spatial patterning at the site as a whole is warranted. This analysis draws on the discussion by Santure and Esarey (1990) of the spatial distribution of artifacts and demographic groups at Norris Farms 36 and is supported by the results of the ArcGIS analysis as presented in Appendix H.

Santure and Esarey (1990) noted that many of the burials in the center of the cemetery were subadults. However, they also noted that subadults are found throughout the cemetery. This clustering of subadults was noted by the High/Low Cluster analysis and the Spatial Autocorrelation tests revealed age-related patterning within the Norris Farms 36 cemetery. In general, younger individuals tend to be located in the center of the cemetery, which can be seen in Figure 7.1. It is unclear whether this distribution reflects intentional use of mortuary space or the timing of the interments.

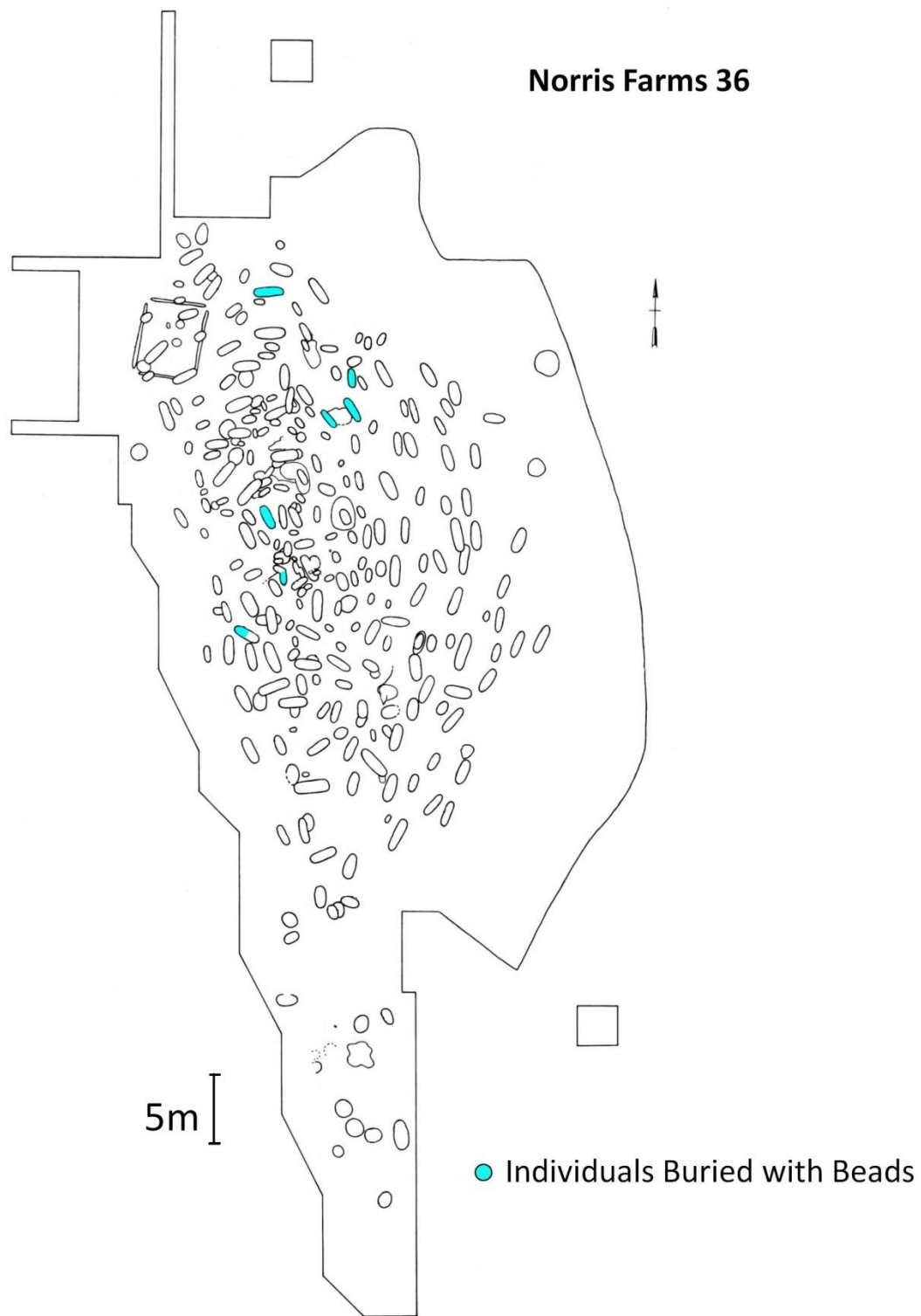
Santure and Esarey (1990) also recognized a sex-related spatial pattern, with women more likely to be buried on the periphery of the cemetery. Figure 7.2, at the beginning of this chapter, shows the sex-related pattern within the cemetery. This finding was confirmed by both High/Low Cluster analysis and the Spatial Autocorrelation tests, which revealed sex-related

clustering within the Norris Farms 36 cemetery. This relationship was significant in the High/Low Cluster analysis but was not significant at the 0.05 level in the Spatial Autocorrelation test. Again, it is unclear whether this distribution reflects intentional use of mortuary space or the timing of the interments, though Santure and Esarey (1990) felt that the distribution of males and females was more likely to reflect timing of death than burial precincts.

Santure and Esarey's analysis revealed few patterns to the distribution of grave goods. This lack of spatial patterns was mostly supported by the ArcGIS analysis. The only grave good from this project's sample which showed spatial clustering were beads. There were five individuals in the Norris Farms 36 sample interred with beads. Three of those individuals were buried in close proximity, as shown in Figure 7.11. In general, most individuals with beads tend to be found in the center of the cemetery. Beads were most commonly found with subadults and the pattern of bead inclusion may be reflective of their association with children rather than a decrease in popularity as the cemetery expanded throughout time.

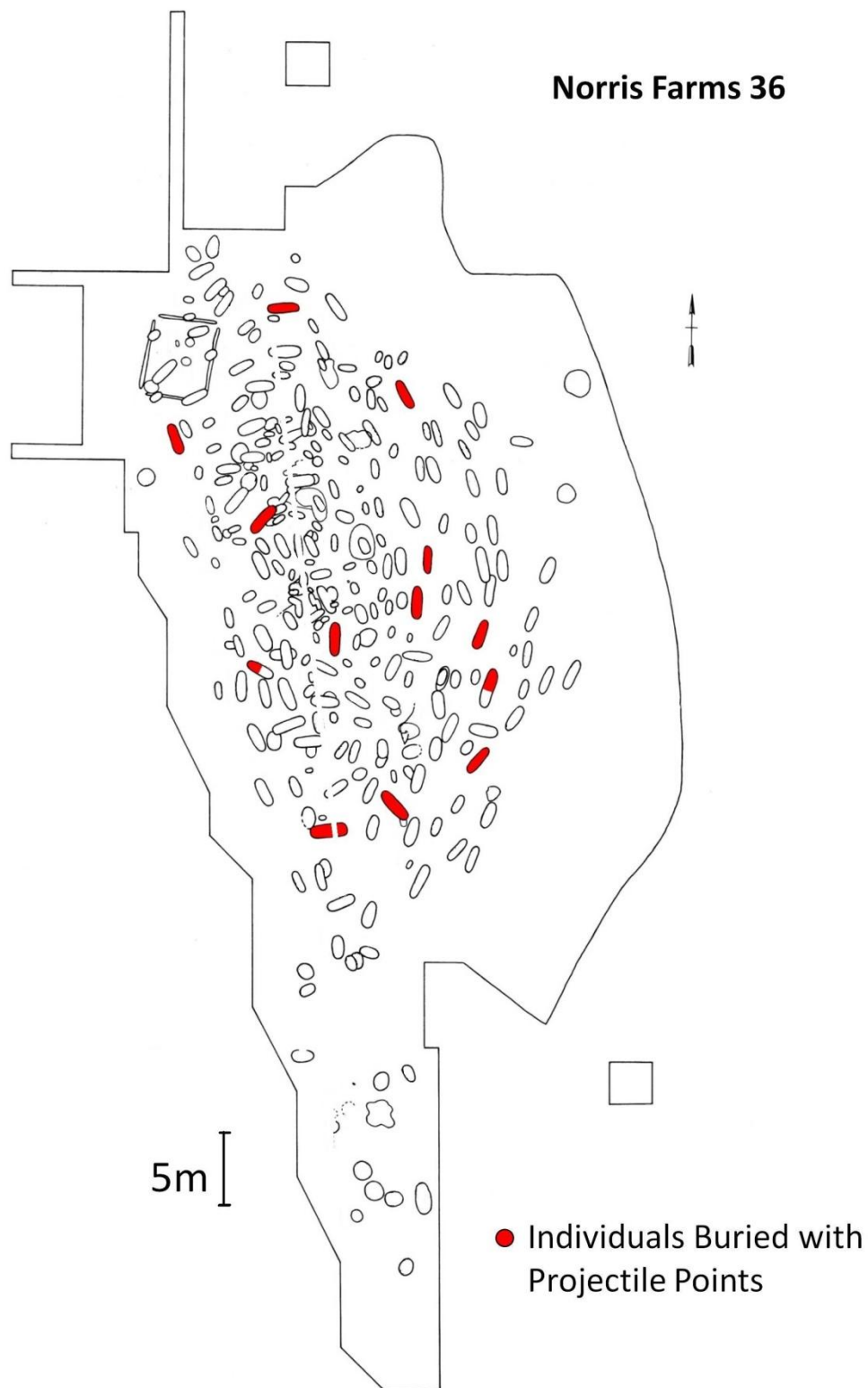
Santure and Esarey (1990) stated that projectile points were found in a nonrandom distribution, with more arrowpoints included with graves in the outer row of the cemetery. They suggest their apparently association with later burials may indicate an increasing trend towards violence through time. This pattern was not picked up by the ArcGIS analysis performed for this project, which may be a result of sampling bias. Figure 7.12 shows the distribution of projectile points in the Norris Farms 36 sample for this project.

Figure 7.11 Spatial Distribution of Beads at Norris Farms 36



Adapted from Santure et al. 1990, Fig. 9.6. Please refer to the original for additional map detail.

Figure 7.12 Spatial Distribution of Projectile Points at Norris Farms 36

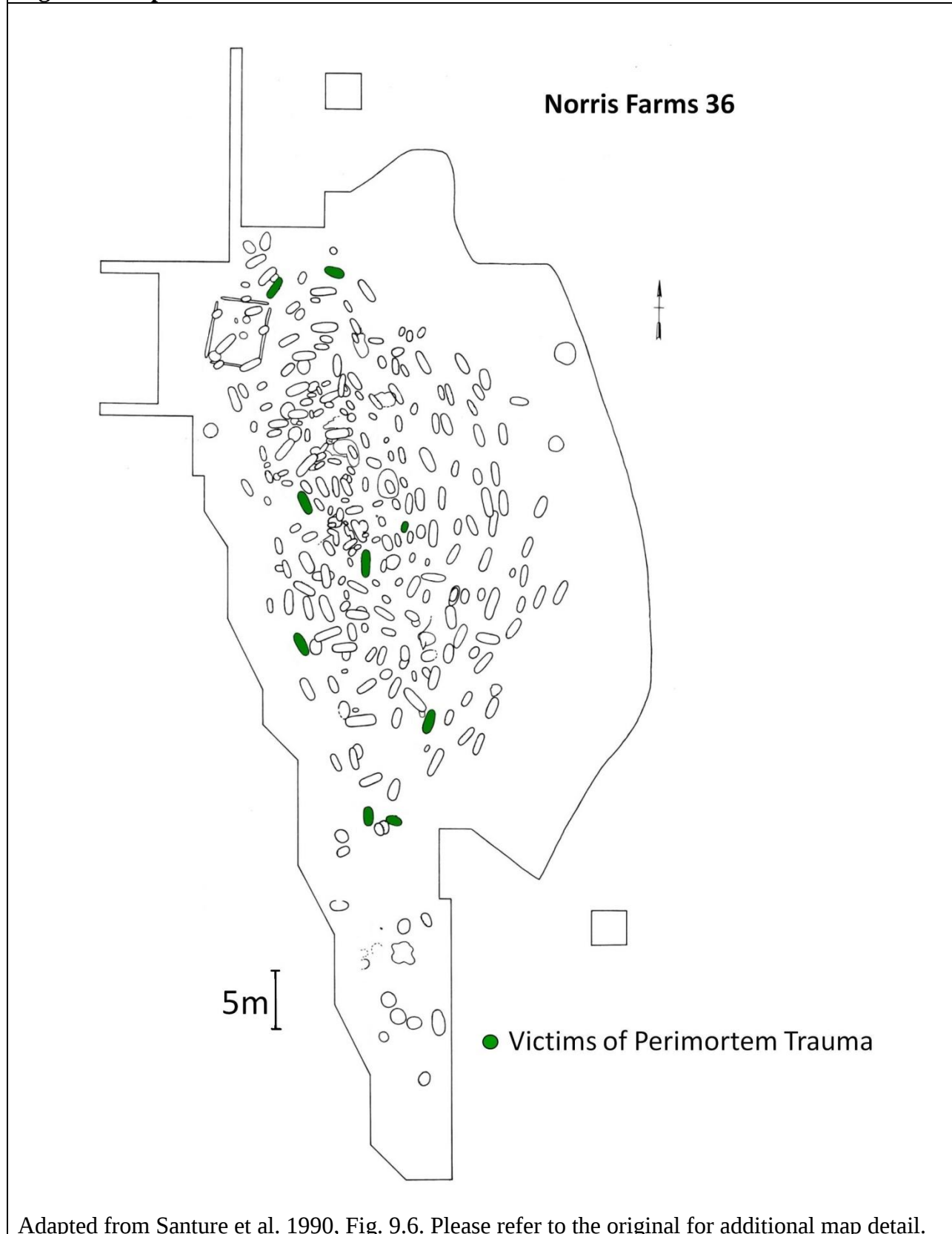


Adapted from Santure et al. 1990, Fig. 9.6. Please refer to the original for additional map detail.

In addition to the more peripheral location of arrowpoints in the cemetery, Santure (1990b) also noted that the victims of traumatic death tended to be interred on the periphery of the cemetery. She noted that only one grave containing victims of violent death was located in a central area of the cemetery. She also theorized that, if the cemetery expanded peripherally through time as supposed, the relationship of perimortem burials to the periphery might record an event late in the use of the cemetery (Santure 1990b: 174). She suggests this may even provide some insight into the eventual abandonment of the village.

Though a significant spatial relationship was identified by spatial autocorrelation analysis, this relationship was not significant at the 0.05 level in the High/Low Cluster analysis. In addition, a visual representation of the location of perimortem victims chosen for this project, as shown in Figure 7.13, does not appear to reflect the pattern suggested by Santure.

Figure 7.13 Spatial Distribution of Perimortem Trauma at Norris Farms 36



Adapted from Santure et al. 1990, Fig. 9.6. Please refer to the original for additional map detail.

Section 7.3 Osteobiographical Analysis of Select Norris Farms 36 Individuals

At this point, statistical analyses had been performed on subsamples of the population based on age, sex, trauma status, interment type, disease status, and grave good categories. The very small sample size that these tests utilized resulted in a weakening of the power of the statistical tests. This increased the possibility of Type II errors and revealed little about the individual experiences of Morton Village inhabitants. In order to further the investigation of social identity within the group, osteobiographical analyses were performed on a select number of Norris Farms 36 burials.

The osteobiographical analysis was first recommended by Frank Saul in 1961 based upon the understanding that skeletons record the life history of their occupants in various ways (Saul and Saul 1989). By extracting the life history from their bones, information about the experiences of individuals can be revealed. To illustrate the diversity in life experiences of the individuals at Morton Village, some males, females, and subadults were selected to present a variety of life histories. The sampling strategy for the osteobiographical analyses is presented in Chapter Four.

These life histories are limited by the data available on an individual basis in the report written by Milner and Smith (1990), as a complete reexamination of the skeletal sample was outside the scope of this project. Unfortunately, information about common indicators of physiological stress, such as linear enamel hypoplasias and porotic hyperostosis, were reported as percentages on the population level only and could not be included in this discussion. What follows is a review of the information that is available in the published report about interment style, grave goods, antemortem trauma, perimortem trauma, and postmortem modifications. When combined with the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values, these data reveal much about the individual

experiences of people living at Morton Village, revealing information about other categories of social identity, such as those based on age and gender, which may have had a stronger influence on diet than did ethnic identity.

Burial 19

Burial 19 was an older male, fifty-years or older, according to Milner and Smith (1990). He was buried in a supine, extended position with his head oriented toward the northwest, which is typical of the cemetery as a whole (Santure 1990b; Santure et al. 1990). He was interred in the southern half of the cemetery with four arrowpoints near his left hand (Santure and Esarey 1990; Santure et al. 1990). His grave also contained an orange colored, Oneota style jar near his torso (Santure and Esarey 1990; Santure et al. 1990). The jar was decorated at its shoulder with nested chevrons formed by punctated and trailed lines (Santure et al. 1990). Found in association with this Oneota style jar was a freshwater shell spoon made from a pocketbook mussel (*Lampsilis ovate* f. *ventricosa*) (Santure and Esarey 1990; Santure et al. 1990). The shell hinge was ground down and all edges of the spoon were worn. Shell spoons are relatively rare in Oneota burials outside of this region (Foley Winkler 2011). They are usually associated with pottery, as the shell spoon interred with Burial 19 is, and their association with pottery may represent a final meal for the departed soul (Berres 2001; Hall 1997).

Despite the deliberate inclusion of grave goods and articulated nature of the interment, the skeleton of this male revealed evidence of gnawing. This evidence of scavenging may suggest that the body was not interred before carnivores gained access to it. Thirty of the 264 skeletons recovered from Norris Farms 36 exhibited gnaw marks and it is possible that this number actually underrepresents the amount of scavenging, since some damage was likely

limited to the soft tissue (Milner, Anderson, and Smith 1991; Milner and Smith 1990). The bone destruction consisted of splintered and punctured cortices and deeply gouged cancellous bone. Its appearance and location indicate that canids were scavenging on the remains of Norris Farms 36 individuals prior to burial (Milner and Smith 1990; Milner, Anderson, and Smith 1991; Milner 1999). Milner (1999) suggests that at least some of this scavenging happened away from home, theorizing that people who died as a result of an attack by an outside group “were left exposed where they fell until the remaining parts were found and buried in the village cemetery” (Milner 1999:115). It is also important to note that the presence in some graves of wooden roofs may indicate that interment in open graves was typical for the cemetery and that this practice may have resulted in scavenging of the remains.

His left humerus and scapula revealed evidence of a non-resolved anterior dislocation which resulted in the formation of a secondary joint (Milner and Smith 1990). Shoulder dislocations generally occur after the sudden application of direct force to the shoulder joint, such as during a fall on an outstretched hand or from a direct blow. Anterior dislocations, such as Burial 19 had, comprise about 95% of all shoulder dislocations and can endanger the axillary nerve and artery (Moore, Dalley, and Agur 2010). Anterior dislocations typically cause considerable pain and modern medical practice involves sedating patients prior to resolving the dislocation (Moore, Dalley, and Agur 2010). In cases like Burial 19, where the dislocation is not resolved, damage to the axillary nerve would be likely. As a result, Burial 19 may have suffered from a weakened or paralyzed deltoid muscle and resultant limited abduction of the arm.

His fifth lumbar vertebra has bilateral defects through the pars interarticularis, a condition called spondylolysis (Milner and Smith 1990). Spondylolysis was relatively common in the Norris Farms 36 population and also occurs in modern populations. The etiology of

spondyloysis is somewhat unclear but it is believed to have a genetic component (Fredrickson et al. 1984). Some studies have shown that repetitive microtrauma on the developing vertebrae can lead to spondylolysis, though the nature of the microtrauma is debated in the literature (Green et al. 1994; Mays 2006; Morita 1995). In modern populations, spondylolysis is often seen in young athletes and Mays (2006) suggests that prehistoric populations from whom strenuous physical labor was an aspect of daily life also have high rates of spondyloysis. Spondylolysis can result in spondylolisthesis, the anterior displacement of a vertebra in relation to the vertebral column. If severe, spondyloisthesis can be very painful and often involves the body of L5 slipping anteriorly in relation to the sacrum. However, the presence and severity of spondylolisthesis can be very difficult to identify in dry bones (Mays 2006; Moore, Dalley, and Agur 2010; Milner and Smith 1990).

This individual's $\delta^{13}\text{C}$ was -8.9. This is noticeably higher than the average male value of -12.3 and the average older adult value of -12.2. This individual's $\delta^{13}\text{C}$ value was also higher than those individuals with similar burial treatments; higher than the adult single burial value of -12.0, higher than the supine articulated value of -12.1, higher than the $\delta^{13}\text{C}$ value of other adults buried with grave goods of -12.2, and even higher than other individuals buried with freshwater shell, who had an average $\delta^{13}\text{C}$ value of -11.5. Finally, this individual also had a much higher $\delta^{13}\text{C}$ value than other adults who did not show evidence of warfare (-11.9) and adults suffered antemortem trauma (-11.8).

Burial 19 had a $\delta^{15}\text{N}$ value of 11.9. This value is noticeably higher than the average male value and the average older adult value, both 10.6. His $\delta^{15}\text{N}$ value was also higher than other

adults who did not show evidence of warfare (10.4) and adults who had evidence of antemortem trauma (10.4). He also had a higher $\delta^{15}\text{N}$ value than adult single burials (10.3), articulated supine burials (10.4), and adults with grave goods (10.6). However, this individual's $\delta^{15}\text{N}$ value was within one standard deviation of the average value for adults with freshwater shell grave goods (11.7).

Given the noticeably high $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ of Burial 19, it can be said that this individual had an atypical diet for the site. This difference can be explained by an increase in maize and meat, a decrease in low $\delta^{15}\text{N}$, low $\delta^{13}\text{C}$ food sources like beans, or a combination of the two.

Burial 31

Burial 31 was a female who was fifty years or older (Milner and Smith 1990). She was buried articulated, in a supine position on the periphery of the cemetery with her head towards the southeast (Santure et al. 1990). The supine, articulated, single nature of the grave is consistent with the overall site pattern (Santure and Esarey 1990; Santure et al. 1990). The orientation of Burial 31's head away from the northern hemisphere is somewhat atypical, though some nearby burials (28 and 34) also had a similar orientation. Santure (1990b:71) suggests this could be the result of social persona, the cause of death, or the timing of the interment.

A hoe made from the right side of a mussel (*Amblema plicata*) shell was found adjacent to Burial 31 (Santure and Esarey 1990). The shell of this hoe was perforated to attach to a handle and was worn from use. The shell hoe may be a reflection of the importance of gardening on this individual's social identity in life.

Despite the relatively advanced age of this woman, she demonstrated no remarkable

skeletal pathologies (Milner and Smith 1990). Both of her 5th toes (right and left) had their medial and distal phalanges fused (Milner and Smith 1990). However, the ossification pattern of toe phalanges varies considerably and it is not uncommon for the medial and distal phalanges to not fully segment, essentially reducing the number of phalanges in the 5th toe to two (Venning 1956). As such, this is considered a minor skeleton anomaly with a possible genetic influence.

Burial 31 had a $\delta^{13}\text{C}$ value of -12.4. This is lower than the average adult female value of -11.7 and somewhat lower than the average older adult value of -12.2. This is also slightly lower than the average value of -12.2 for adults with grave goods. In addition, this is lower than the average value of -12.0 for those adults found without shell hoes.

This woman had a $\delta^{15}\text{N}$ value of 12.4. This is much higher than the average female value of 10.1 and even higher than the average value for males, 10.6. In addition, this is higher than the value for older adults of 10.6, and higher than the value of 10.6 for those adults found with grave goods. Adults who were buried without a shell hoe average 10.3‰ N.

If the shell hoe is presumed to indicate Burial 31's prowess in the agricultural sphere, I would argue that the high $\delta^{15}\text{N}$ value, coupled with the slightly lower than average $\delta^{13}\text{C}$ value would be best explained by the consumption of fish at a level higher than others at Norris Farms 36.

Burial 37

Burial 37 was located on the east side of the cemetery and was a single grave containing an 18-21 year old female (Milner and Smith 1990; Santure et al. 1990). Her head was oriented north like the majority of Norris Farm 36 burials (Santure et al. 1990). Unlike other burials in the

cemetery, however, Burial 37 was interred in a prone position (Santure et al. 1990). This individual did not have any nonperishable grave goods (Santure and Esarey 1990).

Burial 37 exhibited a supraclavicular foramen, an anatomical variation with some genetic influence (Douglas et al. 1997; Milner and Smith 1990; Pietrusewsky and Douglas 2002). A supraclavicular foramen is formed by the supraclavicular nerve piercing the superior border of the clavicle during development (Murlinmaju et al. 2011; Pietrusewsky and Douglas 2002). Supraclavicular foramina are typically asymptomatic, though in some cases nerve entrapment can occur (Lippitt et al. 2009).

She also exhibited another postcranial anomaly, a sternal perforation, which is also genetically influenced (Crubézy 1992; Milner and Smith 1990). Sternal perforations are found in different rates in different populations, typically falling between 1% and 10% of a given population (Fily et al. 2001). Normal variation exists in the number and configuration of the ossification centers of the sternum and congenital abnormalities may result from asynchronous or incomplete ossification (Ridout et al. 2009). These abnormalities can range in severity and appearance. A small defect, like that present on Burial 37, is likely to have been asymptomatic (Ridout et al. 2009).

This individual had a wedge-shaped 11th thoracic vertebra, likely the result of a compression fracture (Milner and Smith 1990). Compression fractures can occur as the result of trauma, particularly vertical trauma such as landing feet-first following a vertical fall (Aufderheide and Rodriguez-Martin 1998). Alternatively, compression fractures can be primarily due to a weakening of the vertebra due to a disease process like osteoporosis or tuberculosis (Old and Calvert 2004). Compression fractures are not pathognomic and the identification of a compression fracture does not reveal the case-specific etiology. However,

Burial 37's young age would tend to rule out osteoporosis as a cause of her compression fracture. A single compression fracture, such as that experienced by Burial 37, is likely to cause moderate pain (Old and Calvert 2004).

The right and left sacroiliac joints of Burial 37 were undergoing a pathological process at the time of her death. The right sacral and iliac auricular surfaces demonstrated irregular, deep pits interspersed with bone spicules (Milner and Smith 1990:137). The superior portion of left sacral auricular surface showed an irregular, depressed defect, surrounded by a thin, compact and porous margin (Milner and Smith 1990:137). The joint surface around this defect was porous.

Although neither the erosive process affecting the sacroiliac joint nor the compression fracture of T-11 can be considered definitively diagnostic of tuberculosis, it is possible that they are a result of systemic tuberculosis affecting the skeletal system. Ramlakan and Govender (2007) stated that tuberculosis affecting the sacroiliac joint can result in joint space widening, sclerosis of the joint margin, sequestra, and periarticular osteopenia. The depression of the left auricular surface, the compact bony margin surrounding the defect, the bony spicules, and porous nature of the joint surface around the defect all are consistent with tuberculosis (Tuli 2004).

Milner and Smith (1990) argue that, given the skeletal evidence for destructive lesions in 12.1% of the population which may be attributable to the disease, tuberculosis may have been present at Morton Village. However, the lesions affecting Burial 37 differ from the lytic lesions of the sacroiliac joints of two other individuals which Milner and Smith (1990) consider to be possibly diagnostic of tuberculosis and the diagnosis of tuberculosis in Burial 37 is, at best, equivocal. Regardless of the specific pathogen, it is likely that this woman suffered from some sort of systemic infection at the time of her death.

Burial 37 had a $\delta^{13}\text{C}$ value of -10.0. This is quite high for the Norris Farms 36 sample. It

is higher than the average adult female value of -11.7 and the average younger adult value of -11.7. In general, individuals who exhibited signs of chronic disease, like Burial 37, had a higher $\delta^{13}\text{C}$ value (average -11.7) than those adults without evidence of chronic disease and Burial 37 is consistent with this pattern, with a higher than average $\delta^{13}\text{C}$ value. Her $\delta^{13}\text{C}$ value is also higher than other individuals who were articulated but interred in a prone position (average -12.1).

Burial 37 had a $\delta^{15}\text{N}$ value of 10.1. This is consistent with the average for females at Norris Farms 36 and slightly higher than other young adults. It is consistent with individuals with chronic disease, as well as adults without grave goods. This value is somewhat higher than other articulated, prone burials.

In general, Burial 37 did not have many markers of social identity, with the possible exception of her prone position in her grave. Despite any other overt signs of difference between Burial 37 and her female cohort at Norris Farms 36, there is evidence that she was consuming much more corn than others.

Burial 40

Burial 40 was a female of at least fifty years of age who was interred in the supine position in a single grave on the eastern periphery of the cemetery (Milner and Smith 1990; Santure et al. 1990). Her head was oriented towards the southern hemisphere, somewhat unusual for the cemetery (Santure 1990b; Santure et al. 1990). She was interred with a bowl, which was decorated with regularly spaced lip stamping and which was classified as a Bold Counselor Phase form. Bowls are rare at Oneota sites outside of the central Illinois River valley (Santure

and Esarey 1990).

Burial 40's skeleton exhibited several non-pathological anomalies. Her frontal bone exhibited a visible metopic suture (Milner and Smith 1990). All individuals have a metopic suture as newborns, with most experiencing physiological closure within the first year of age (Vu et al. 2001). Some individuals have a genetic predisposition to a persistent metopic suture, and in some cases the metopic suture may extend from nasion to bregma (Ajmani et al. 1983; Torgersen 1951). The rate of metopism is population dependent, with ranges from 1% to 10% in different populations (Ajmani et al 1983). The persistence of a metopic suture is not associated with any pathological processes and is primarily considered an indicator of genetic variation when encountered in skeletal populations.

On Burial 40's right foot, the proximal phalanx of her first and second toes were deformed, terminated in a flattened knob and pointed edge respectively (Milner and Smith 1990). The cause of this deformity is unknown.

Burial 40's anterior proximal femur had a small, well-delineated growth of smooth-surfaced bone (Milner and Smith 1990). Its location, size, and well-defined border suggest this growth can be classified as an osteoid osteoma, though these are more common in younger people and males (Kransdorf et al. 1991). The etiology of such small osteomas is unknown and there is some debate about whether osteoid osteomas should be classified with other bone tumors (Aufderheide and Rodriguez-Martin 1998; Kransdorf et al. 1991). Osteoid osteomas are benign, with the principle symptom being local pain – often severe (Kransdorf et al. 1991; Wheelless 2013). Osteoid osteomas in the lower extremity, like that exhibited by Burial 40, may result in a limp and/or muscle atrophy (Kransdorf et al. 1991). Osteoid osteomas may resolve spontaneously with time, though modern patients typically undergo surgery to remove the

osteoma (Kransdorf et al. 1991; Wheelless 2013).

Burial 40's right parietal bone exhibited signs of a healed depression fracture (Milner and Smith 1990). A depression fracture is typically the result of low velocity blunt force trauma and forces the bone inward towards the brain, though in some cases only the outer table is affected (Lovell 1997). Depressed skull fractures carry a risk of brain damage due to direct trauma to the brain or as a result of increased pressure on the brain as a result of hemorrhage (Braakman 1972). In most cases, those individuals who survive the initial traumatic episode will recover completely (Braakman 1972). Healed depression fractures were common in the Norris Farms 36 skeletal population, though the location of Burial 40's depression fracture, the parietal, is relatively rare when compared to the percentage of depression fractures which affected the frontal bone (76%). According to Steadman (2008a), depression fractures are common in the midcontinent during the late prehistoric period. Their high frequency and relatively consistent position on the skull in the Norris Farms 36 population are more likely the result of interpersonal violence than accidental falls. Steadman (2008a) and Milner and colleagues (Milner 1999; Milner, Anderson, and Smith 1991; Milner, Smith, and Anderson 1991; Milner and Smith 1990) suggest the depression fractures in the central Illinois River valley – both Orendorf and Norris Farms 36- when viewed in the larger context, reflect warfare-related violence rather than ritual violence.

Burial 40 had a $\delta^{13}\text{C}$ value of -10.1, which is higher than most other subcategories at Norris Farms 36. It is higher than the average adult female value of -11.7 and noticeably higher than the average older adult value of -12.2. It is higher than other adults who suffered from antemortem trauma (average -11.8), other single interments (-12.0), other supine burials (-12.1), and other adults with grave goods (-12.2).

Her $\delta^{15}\text{N}$ value of 10.5 is closer to the averages for Norris Farms 36. It is slightly higher

than the adult female value of 10.1 and slightly lower than the older adult value of 10.6. It is slightly higher than other adults who suffered from antemortem trauma (average 10.4), other single interments (10.3), and other supine burials (10.4). It is slightly lower than other adults with grave goods (10.6).

Burial 40 lived a relatively long life, despite the evidence for a traumatic assault resulting in a depression fracture. She was likely in significant pain from an osteoid osteoma and may have had limited mobility in the last months or years of her life. Her interment with a Bold Counselor phase bowl suggests the signaling of an Oneota ethnic identity unique to the central Illinois River valley, despite an isotopic level consistent with a higher rate of maize consumption than others at the site.

Burial 41

Burial 41 was a female aged by Milner and Smith (1990) to between thirty and thirty-five years of age. Her grave was a single interment located on the southeast periphery of the cemetery (Santure et al. 1990). She was interred in a supine position with her head directed toward the southwest (Santure et al. 1990). No non-perishable grave goods were included (Santure and Esarey 1990; Santure et al. 1990).

Burial 41's skeletal anomalies included a bifid rib on her right side (5th rib) (Milner and Smith 1990). Bifid ribs are typically considered a marker of nonmetric variation, under genetic influence (Fily et al. 2001). On both her right and left foot, the medial and distal phalanges of her 5th toe were fused. As mentioned earlier, this ossification pattern is considered a minor skeleton anomaly with a possible genetic influence (Venning 1956).

She suffered antemortem trauma, which included a fracture of her right clavicle (Milner

and Smith 1990). Her right scapula had exostoses along the inferior margin of the acromion process and her right humerus showed anterior-posterior flattening of the capitulum, accompanied by arthritic development. The skeletal changes of the scapula and humerus may be trauma related; falls on an outstretched hand can fracture the distal humerus where the radius articulates, can damage the tendons associated with the glenohumeral joint, and can result in clavicular fractures (Alder and Yochum 2006). However, mechanical stressors are a major cause of degenerative changes in the elbow and shoulder joints and it is possible that the pathologies of the shoulder and elbow result from overuse as opposed to a discrete trauma.

Burial 41 had a $\delta^{13}\text{C}$ value of -11.1, which is fairly average for Norris Farms 36. This is higher than the average for adult females (-11.7), for middle-aged adults (-11.9), and for adults with evidence of antemortem trauma (-11.8). This is also somewhat higher than for single burials (-12.0), supine burials (-12.1), and adults without grave goods (-11.8). Her $\delta^{15}\text{N}$ value of 10.2 was also near average for Norris Farms 36. It was slightly higher than the 10.1 average of adult females and equal to the 10.2 average for middle-age adults. It was slightly lower than the 10.4 average of those with evidence of antemortem trauma, the 10.3 average of adult single burials, and the 10.4 average of supine burials. It was just slightly over than the 10.1 average $\delta^{15}\text{N}$ value of adults without grave goods.

Other than the orientation of her grave, Burial 41 had no characteristics which set her apart from other interments at Norris Farms 36. Likewise, her diet is typical for the site.

Burial 43

Burial 43 was a young male, aged 16-18 (Milner and Smith 1990). He was buried in a single grave, supine (Santure et al. 1990). His grave was located on the southern, more peripheral portion of the cemetery with his head directed towards the north and a knife included in his burial (Santure et al. 1990).

His right first premolar exhibited a dental anomaly where the cusps and roots were both divided, resulting in two separate, peg-shaped teeth (Milner and Smith 1990). Though this is atypical, this is not associated with a specific disease process. His fifth lumbar vertebra showed evidence of spondylolysis with defects through both right and left pars interarticularis (Milner and Smith 1990). As discussed in relation to Burial 19, spondylolysis was relatively common in the Norris Farms 36 population. Spondylolysis may cause mild back pain and may progress to spondylolisthesis, which may be very painful (Moore, Dalley, and Agur 2010).

His $\delta^{13}\text{C}$ value was -10.9, higher than the adult male average of -12.3. This value was also high when compared to other young adults (-11.7), adult single burials (average -12.0), supine burials (-12.1), and adults without grave goods (-11.8). His $\delta^{15}\text{N}$ value was 11.2, higher than the average values of adult males (10.6), young adults (10.0), adult single burials (10.3), supine burials (10.4), and adults without grave goods (10.1). The relatively high $\delta^{13}\text{C}$ value combined with the relatively high $\delta^{15}\text{N}$ value may indicate that Burial 43 was consuming more maize and less resource with low $\delta^{15}\text{N}$, such as beans.

Burial 45

Burial 45 was that of a thirty-five to forty year old male who was interred in a single grave (Milner and Smith 1990; Santure et al. 1990). He was interred near the southern end of the cemetery in a supine position with his head oriented westward (Santure 1990b; Santure et al. 1990). A carbonized section of a wooden pole, interpreted as evidence of a wooden roof, was located in the grave (Santure 1990b). This suggests that this burial was interred in an open grave which was temporarily covered with a wooden roof, at least during the period of soft-tissue decomposition, before being filled in later. Evidence for wooden roofs was found in several other graves and, as noted earlier, it is possible that all individuals were interred in open graves.

Burial 45's first coccygeal vertebra was fused to his sacrum, a common and nonpathological variation (Milner and Smith 1990). A proximal phalanx on one of his right toes had a healed fracture. His distal left humerus had a bone spur on its medial surface, which may have caused moderate pain (Milner and Smith 1990). His left orbit was the site of a small, undiagnostic resorptive lesion partially filled with granular bone and covered over by a thin sheet of cortex. Bony orbital lesions can be a result of infection, benign tumors, or malignant tumors and can cause a variety of symptoms from pain to loss of vision (Karcioglu 2005).

An arrowpoint was found by Burial 45's left knee. He was interred with a copper pendant which consisted of 7 rounded zig-zags and which had a single perforation at one end (Santure and Esarey 1990). This pendant may represent either a stylized feather, a motif that is common in both Oneota and Mississippian designs, or a snake (Santure and Esarey 1990). This pendant was located near his lower right ribs touching his mid-forearm (Santure and Esarey 1990). Burial 45 was also buried with a deep-rimmed plate. These deep-rimmed plates are unique to the Bold Counselor Oneota and are considered to result from Spoon River Mississippian and Oneota

interaction (Lieto and O’Gorman 2012; Santure and Esarey 1990). The exterior of the vessel looks like a bowl, but the interior is broad and more plate-like. The brown deep-rimmed plate interred with Burial 45 had interior decoration that was atypical for Oneota, consisting of line-filled triangles without punctated or trailed elements. In addition, it should be noted that a bald eagle was interred near Burial 45, though it is also located near to a Woodland burial and therefore cannot be confidently associated with 45.

Burial 45 had a $\delta^{13}\text{C}$ value of -12.2. This is consistent with the average adult male value of -12.3. It is slightly lower than the value of -11.9 for middle age adults and slightly higher than that of -12.0 for adult single burials. It is consistent with that of supine burials (-12.1), those with undiagnostic lytic lesions (-12.3), adults with grave goods (-12.2), and is just slightly higher than adults with lithics (-12.4). His $\delta^{15}\text{N}$ value was 10.3. This is lower than other adult males (10.6) but is higher than middle age adults as a whole (10.2). It is consistent with adult single burials (10.3), supine burials (10.4), and adults with undiagnostic lytic lesions (10.2). It is slightly lower than the averages for adults with grave goods and adults with lithics (both 10.6).

The deep-rimmed plate interred with Burial 45 is unique Bold Counselor Oneota and emphasizes his membership in this group. His isotope values are typical for adult males interred at Norris Farms 36 and suggests he was a full member of the ethnic group.

Burial 49

Burial 49 contained the remains of a young male, aged twenty to twenty-five years of age (Milner and Smith 1990). He was buried in an oversized grave with Burial 50, a slightly older man, near the eastern portion of the cemetery (Milner and Smith 1990; Santure 1990b; Santure et al. 1990). He was interred extended, supine, with his head towards the north (Santure et al.

1990). His head was missing, the result of a decapitation, and the remains of Burial 50 were lying across his legs (Milner and Smith 1990; Santure 1990b). Burial 50 was also decapitated but additionally was dismembered. The postcranial remains of Burial 49 did not exhibit perimortem trauma, though his left tibia did have a trauma-induced exostosis along its interosseous crest at midshaft (Milner and Smith 1990). Three arrowpoints, made from nonlocal chert, were recovered near Burial 49's right knee (Santure and Esarey 1990).

His $\delta^{13}\text{C}$ value was -12.2, near the adult male average of -12.3. This value was slightly higher than other young adults (-11.7), adult multiple burials (average -12.1), and supine burials (-12.1). His $\delta^{13}\text{C}$ value was equal to the average for adults buried with grave goods (-12.2). His $\delta^{15}\text{N}$ value was 10.6, equal to the average value of adult males (10.6). This value was higher than the averages for young adults (10.0), adult multiple burials (10.4), and supine burials (10.4). His $\delta^{15}\text{N}$ value was equal to the average for adults buried with grave goods (10.6).

Burial 61

Burial 61 was a forty-five to fifty year old male (Milner and Smith 1990). He was buried on the eastern side of the cemetery, supine in a single grave, with his head oriented towards the southern hemisphere (Santure et al. 1990).

His skeleton was relatively free of pathologies or anomalies with the exception of bilateral defects through the pars interarticularis of his fifth lumbar vertebra (Milner and Smith). As previously discussed, spondylolysis is a fairly common finding in both modern and premodern populations.

Burial 61 was buried with an elaborate tool kit located at his right foot (Santure and

Esarey 1990). This tool kit was associated with the partial skeleton of a mink which is believed to have formed a bag of some sort (Santure and Esarey 1990). The toolkit included over 80 flake knives, many of which were stained with hematite. In addition to the hematite staining on the flake knives, nearly thirty small pieces of hematite were found with the tool kit and may have been used to generate paint (Santure and Esarey 1990). In addition, the presence of scarifiers in the tool kit may imply that the hematite was used as a tattooing pigment (Santure and Esarey 1990). Other grave goods, most of which were likely part of the toolkit, found with Burial 61 include two unusual biface knives, two scrapers, a complete greenstone celt, two sandstone abraders, two plummets, arrowpoints (including one made from the 3rd phalanx of a deer), a bird bone fishhook, two snapping turtle pleurals, three beaver incisors, a muskrat mandible, six deer 3rd phalanges (possibly previously included within a deer hoof rattle), a deer antler tine handle, and various stains and sediment compounds indicating the presence of both organic and copper materials (Santure and Esarey 1990).

Burial 61 has the most elaborate grave goods of any individuals sampled for this project. Santure and Esarey (1990) note that Mill Creek chert is typically found at Mississippian site and that the presence of a Mill Creek biface knife is atypical in an Oneota context. In addition to tools which could be tied to more mundane aspects of daily life, such as fishhooks and arrowpoints, many of these artifacts have an apparent ritual meaning. Santure and Esarey (1990) note that most sacred medicine bags belong to a specific social “office” rather than to individuals and therefore they suggest that the mink bag is unlikely to represent a traditional “medicine bag” but still acknowledge that the bag likely serves an important ritual function.

Burial 61 had a $\delta^{13}\text{C}$ value of -11.5. This is higher than the average of -12.3 for adult males at Norris Farms 36 and higher than the older adult value of -12.2. It is higher than the

average for single burials (-12.0), supine burials (12.1), adults with grave goods (-12.2), adults with lithics (-12.4) and adults with projectile points (-12.5). He had a $\delta^{15}\text{N}$ value of 11.0. This is higher than the average of 10.6 for adult males and older adults at Norris Farms 36. It is higher than the average for single burials (10.3) and supine burials (10.4). Finally, it is also higher than the 10.6 average values for adults with grave goods, adults with lithics, and adults with projectile points.

Given the elaborate grave goods interred with this individual, it is likely that Burial 61 held a special role at Morton Village. His isotope values suggest that he may have been eating both more corn and more meat than other males at the village. Maize has been shown ethnographically to be incorporated into many rituals and it is possible that his role performing ritual activities, as suggested by the toolkit, may have involved the ritual consumption of maize and meat.

Burial 71

Burial 71 was a middle-age male, aged to between thirty-five and forty years of age (Milner and Smith 1990). He was interred in a single grave in a supine position (Santure et al. 1990). His grave was located towards the center of the cemetery and oriented so that his head was towards the north (Santure et al. 1990).

Burial 71 was interred with many grave goods. Near his head, two arrowpoints made of local chert were found, along with one scarifier made from a channel catfish pectoral spine (Santure and Esarey 1990). Four additional scarifiers were found by his right forearm, along with a piece of unmodified hematite, and a chert flake knife. Two modified turtle pleurals (one snapping turtle, one softshell turtle – both locally available) were found by his right hand. A

sandstone slot abrader and chert flake knife were located by his femur. This toolkit was arranged along his right side from mid-humerus to mid-femur (Santure and Esarey 1990). The staining on the scarifiers and their association with hematite, suggest they were used for tattooing. Finally, a diffuse green stain was found in the grave under his ribs and pelvis (Santure and Esarey 1990).

Burial 71 had lumbar ribs associated with his first lumbar vertebra (Milner and Smith 1990). Lumbar ribs are relatively uncommon but nonpathological (Aufderheide and Rodriguez-Martin 1998). He also had a supernumerary lumbar vertebra, L6, which had a midline arch defect and was partially sacralized (Milner and Smith 1990). Sacralization of lumbar vertebrae is a defect in which a vertebra is incorporated into the sacrum and though usually considered nonpathological, unilateral sacralization can cause progressive scoliosis (Aufderheide and Rodriguez-Martin 1998).

He had an undiagnostic lytic lesion on the lateral aspect of his distal right ulna (Milner and Smith 1990). His eleventh left rib had signs of a healed fracture, and his right second rib had a trauma-induced exostosis (Milner and Smith 1990). Rib fractures can be caused by a variety of traumas, such as blows or falls, and are a common finding in skeletal populations. (Matos 2009; Lovell 1997).

Burial 71's $\delta^{13}\text{C}$ value was -12.7, which was noticeably low for this site. It was lower than the averages for adult males (-12.3), middle-age adults (-11.9), adult single burials (-12.0), supine burials (-12.1), and adults buried with grave goods (-12.2). His $\delta^{15}\text{N}$ value was 9.7, also somewhat low for the site. It was lower than the average value of adult males (10.6), middle age adults (10.1), adult single burials (10.3), supine burials (10.4), and adults buried with grave goods (10.6).

Given the elaborate grave goods interred with Burial 71, it is likely the he also held a

special role at Morton Village. Like Burial 61, his isotope values are somewhat atypical for the population, but unlike Burial 71 both his $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values are lower than the average for males at Norris Farms 36. Several factors could result in these isotope values, such as high consumption of beans or a heavy reliance on red meat fauna coupled with an avoidance of aquatic faunal resources.

Burial 91

Burial 91 was that of a thirty-five to forty year old female (Milner and Smith 1990). She was interred in a prone position with Burial 90, another woman in her 30s (Santure et al. 1990; Milner and Smith 1990). Burial 91 and 90 were interred on the northern edge of the cemetery.

Her twelfth ribs were atypical: the left rib was absent and the right was very small (Milner and Smith 1990). She had a healed fracture of her distal left radius and right cuboid (Milner and Smith 1990). The spine of her right scapula had a single, deep defect. Milner and Smith (1990) theorize that the damage was most likely from a blow to the shoulder. This is supported by the fact that her right proximal humerus was also damaged and an impression in the humeral head was consistent with the end of a celt.

Burial 91 had been decapitated at the first cervical vertebra and her skull was not recovered (Milner and Smith 1990). Her right leg had been detached at the pelvis and placed along the left side of her torso (Milner and Smith 1990). Her skeleton showed evidence of gnawing by scavenging canids, as indicated by puncture marks on her right humerus (Milner and Smith 1990). As noted earlier, carnivore gnaw marks are not uncommon at Norris Farms 36, suggesting that canids often had access to remains prior to burial. Milner and colleagues (Milner 1999; Milner and Smith 1990) suggest that this was a result of a delay in retrieving the body.

Though 91 does show evidence of a deliberate attack, it is also important to note that the practice of interring in open or roofed graves may have also presented an opportunity for scavenging canids to gain access to the body.

Her $\delta^{13}\text{C}$ value was -12.2, slightly lower than the average of -11.7 for adult females at Morton Village and the middle age adult average of -11.9. In general, multiple burials at Norris Farms 36 tend to have lower $\delta^{13}\text{C}$ values and Burial 91 conforms to this pattern. Her $\delta^{15}\text{N}$ value was 9.9, lower than the adult female average of 10.1 and the middle age adult average of 10.2. Burial 91's $\delta^{15}\text{N}$ level was lower than the average of multiple or single burials.

The interment style and isotope values for Burial 91 are somewhat atypical for this population. She appears to have consumed a diet that would have been noticeably different than her cohort, possibly consisting of less corn. Both her interment style and dietary choices suggest she may not have operated somewhat as an outsider at Morton Village.

Burial 113

Burial 113 was that of an eight to ten year old child (Milner and Smith 1990). Given the skeletal immaturity, sex is indeterminate. This child was buried supine in a single grave near the center of the cemetery with its head directed towards the northeast (Santure et al. 1990).

Assymetrical crowns of the permanent lateral incisors were noted as a dental anomaly (Milner and Smith 1990). This child also had complete sacralization of L5, considered a skeletal anomaly as discussed earlier. Burial 113 was interred with marine shell beads; three individual flat disc beads were located by the child's right ear and seven additional isolated beads were found around the head (Santure and Esarey 1990).

Given that Burial 113 was past the age of breastfeeding, the stable isotope values are interpreted as reflective of a non-nursing diet. This child had a low $\delta^{13}\text{C}$ value of -13.3, which is suggestive of low consumption of corn. Burial 113 had a $\delta^{15}\text{N}$ value of 9.7, which is low when compared to the rest of the site population but which is consistent with other subadults in the same age range.

Burial 150

Burial 150 was that of twelve to twenty-four month child (Milner and Smith 1990). Given the skeletal immaturity, sex is indeterminate. This child was buried supine. A bundle burial of a woman over fifty years of age, Burial 139, was buried 26 cm above Burial 150 (Santure 1990b; Santure et al. 1990; Milner and Smith 1990). As such, the bundle burial is believed to represent a post-interment addition. Burial 150 was near the center of the cemetery with its head directed south (Santure et al. 1990). No burial goods were recovered (Santure et al. 1990).

Given Burial 150's age, it is anticipated that its isotope values reflect that of a nursing diet. As such, it would be expected that both the $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values would be enriched (Dupras, Schwarcz, and Fairgrieve 2001; Fuller et al. 2006; Richards et al. 2002). Burial 150 had $\delta^{13}\text{C}$ value of -8.2 and a $\delta^{15}\text{N}$ value of 13.1. Though the high $\delta^{13}\text{C}$ value may be indicative of supplementation with cornmeal, the $\delta^{15}\text{N}$ value is also high which suggests it is likely that Burial 150 nursing up to the time of death.

Burial 174

Burial 174 was that of a young female, determined to be between nineteen and twenty-one years old by Milner and Smith (1990). She was buried supine in a grave with Burial 175, near the center of the cemetery (Santure et al. 1990). Her head was oriented north, as is typical for Norris Farms 36 (Santure 1990b; Santure et al. 1990). No grave goods were recovered with her (Santure and Esarey 1990). Burial 174 was interred with Burial 175, a newborn found lying prone on her torso (Milner and Smith 1990). Given the age of the woman, she may or may not have been the mother of the infant.

Burial 174 had some skeletal and dental anomalies, including a perforated sternum and a bifid root on her left mandibular canine. These are both considered to be nonpathological variation. She also had a bone spur on the medial surface of her left distal humerus which may be the result of trauma or overuse (Milner and Smith 1990). In addition, Burial 174 had a healed fracture of her left 2nd rib (Milner and Smith 1990). As discussed early, rib fractures have many causes and are common in all populations.

Her $\delta^{13}\text{C}$ value was -13.7, very low for Norris Farms 36 population. This is lower than the average for adult females (-11.7), young adults (-11.7), adult multiple burials (-12.1), supine graves (-12.1), and adults without grave goods (-11.8). Burial 174's $\delta^{15}\text{N}$ value was 10.5. This is higher than the average for adult females (10.1), young adults (10.0), adult multiple burials (10.4), supine burials (10.4), and adults without grave goods (10.1). Her isotope values, combined with her location in the center of the cemetery, may indicate the maintenance of a "traditional" Oneota diet.

Burial 185

Burial 185 was that of a forty-five to fifty year old male buried supine in a single grave (Milner and Smith 1990; Santure et al. 1990). He was buried towards the northern end of the cemetery, with his head oriented south, which is somewhat atypical for the Norris Farms 36 cemetery (Santure 1990b; Santure et al. 1990). No grave goods were recovered with Burial 185 (Santure and Esarey 1990).

Burial 185 had six sacral vertebrae, while having a typical number of both lumbar and coccygeal vertebra (Milner and Smith 1990). As noted earlier, supernumerary vertebrae are considered nonpathological variation. He had an unusual defect on his left fourth rib which consisted of an irregular opening and loss of trabecular bone (Milner and Smith 1990). This is likely the result of a non-pathognomonic disease process. It should be noted that this rib was avoided when choosing a bone sample for this project.

In addition, Burial 185 had a unilateral flattening of his femoral head and a noticeably shortened femoral neck (Milner and Smith 1990). His acetabulum was also visibly shallow, with an elevated bony cuff at the margin. Milner and Smith (1990) suggest this deformation could be the result of developmental hip dysplasia, which results in a complete but malformed joint (Aronsson et al. 1994; Robertson et al. 1996). Developmental hip dysplasia is considered to be influenced by both genetic and environmental factors. Hip dysplasia can result in difficulty walking.

Burial 185 had a $\delta^{13}\text{C}$ value of -13.3, which is low for Norris Farms 36 population. This is lower than the average for adult males (-12.3), older adults (-12.2), adult single burials (-12.0), supine graves (-12.1), and adults without grave goods (-11.8). Burial 185's $\delta^{15}\text{N}$ value of 10.9 was higher than the average for adult males (10.6), older adults (10.6), adult single burials (10.4),

supine burials (10.4), and adults without grave goods (10.3). Given the isotopic values of food resources in the area, these isotopic values may be the result of a focus on the consumption of fish.

Burial 188

Burial 188 was that of a young female, determined by Milner and Smith (1990) to be between eighteen and twenty-one years old. She was buried supine in a single grave with her skull oriented towards the north in the northern portion of the cemetery (Santure et al. 1990). No grave goods were recovered with Burial 188.

Burial 188 had a cervical rib associated with her right seventh cervical vertebra and lumbarization of her twelfth thoracic vertebra (Milner and Smith 1990). Cervical ribs are the most common type of supernumerary ribs (Aufderheide and Rodriguez-Martin 1998). Both of her fifth toes only had two phalanges due to the fusion of the medial and distal phalanges. Both of these characteristics are considered nonpathological skeletal anomalies.

A portion of periostitis was identified on the posterior aspect of her skull, primarily affecting the occipital bone, though it extended anteriorly in thin bands along the temporal lines (Milner and Smith 1990). Her left radius suggested she had possibly broken the distal aspect in the past, with uncomplicated healing (Milner and Smith 1990).

Her $\delta^{13}\text{C}$ value was -10.0. This is higher than the average value for females and the average value for young adults, both -11.7. Her $\delta^{13}\text{C}$ value was also higher than the averages for single burials (-12.0), supine burials (-12.10), adults without grave goods (-11.8), and adults with periostitis (-11.1). Her $\delta^{15}\text{N}$ value was 9.0. This was lower than the average values for adult females (10.1), young adults (10.0), adult single burials (10.3), supine burials (10.4), and adults

without grave goods (10.1). It was, however, close to the value for adults with periostitis (9.2). Though her interment is typical for the cemetery, her relatively low isotope values suggest a higher consumption of maize than her cohort.

Burial 191

Burial 191 was that of an older female, at least 50 years of age (Milner and Smith 1990). She was buried, supine, in a single grave located near the center of the cemetery (Santure et al. 1990). Her head was oriented towards the northwest and a complete bone pin, formed from the long bone of a medium or large mammal, was found in a disturbed context by the left side of her head (Santure et al. 1990; Santure and Esarey 1990).

Burial 191 has a couple nonpathological skeletal anomalies, including a perforated sternum and the fusion of the medial and distal phalanges in her 5th toes (Milner and Smith 1990). Her fifth lumbar vertebra exhibited spondylolysis through a unilateral defect through her left pars interarticularis and a defect through her right lamina near the midline. Merbs (2002) suggests that unilateral development of a defect in the pars interarticularis is the stage in the progression of spondylolysis, with bilateral spondylolysis being the end result.

Her body showed a number of healed trauma and other pathologies. These include a healed depression fracture of her frontal bone, which may indicate interpersonal violence as discussed earlier (Milner and Smith 1990). She also had a healed fracture of her distal left radius which shortened the length of her radius and resulted in the formation of a new distal joint at the ulna (Milner and Smith 1990). This fracture was likely very painful and limited use of her left arm either temporarily or permanently. Finally, both her eighth thoracic and first lumbar vertebrae had wedged-shaped bodies, likely as a result of compression fractures (Milner and

Smith 1990).

Burial 191 had a $\delta^{13}\text{C}$ value of -12.5, which is lower than other adult females (-11.7) and somewhat lower than other older adults (average -12.2). It is lower than adult single burials (average -12.0) and supine burials (average -12.1). Adults with grave goods tend to have lower $\delta^{13}\text{C}$ values and Burial 191 is consistent with this pattern. Burial 191 had a $\delta^{15}\text{N}$ value of 10.5. This is higher than the average adult female value of 10.1 but slightly lower than average for adult adults of 10.6. This is somewhat higher than both the averages for adult single burials (10.3) and supine burials (10.4). Her $\delta^{15}\text{N}$ value was just slightly lower than the average $\delta^{15}\text{N}$ for adults with grave goods of 10.6. Her isotope values may indicate a higher consumption of fish than other female at the site.

Burial 254

Burial 254 was that of a thirty-five to forty year old male (Milner and Smith 1990). He was buried in a single, supine grave on the western periphery of the site (Santure et al. 1990). His head was directed towards the northwest and he was interred with both an arrowpoint and a jar (Santure et al. 1990; Santure and Esarey 1990).

He had a supernumerary sacral vertebra and the medial and distal phalanges were fused in his fifth toes (Milner and Smith 1990). As discussed earlier, these are viewed as nonpathological variation. His fifth lumbar vertebra exhibited spondylolysis, with bilateral defects of the pars interarticularis (Milner and Smith 1990). As noted, spondylolysis is common in this population. His frontal bone had a healed depression fracture, likely the result of interpersonal violence. His left radius had a healed fracture of the proximal shaft and would

likely have limited the use of this arm (Milner and Smith 1990). An exostosis, possibly trauma-induced, was located at the deltoid tuberosity of his right humerus.

His $\delta^{13}\text{C}$ value was -13.2, which was noticeably lower than most individuals this site. It was lower than the averages for adult males (-12.3), middle-age adults (-11.9), adult single burials (-12.0), supine burials (-12.1), and adults buried with grave goods (-12.2). His $\delta^{15}\text{N}$ value was 10.4, which was slightly lower than the average value of adult males (10.6) at Norris Farms 36. However, it was higher than the average for middle age adults (10.1) and adult single burials (10.3). It was equal to the average for supine burials at the site (10.4) and lower than the average for adults buried with grave goods (10.6).

Given this individual's age, relative good health, sex, and the inclusion of arrowpoints in his grave, it is feasible that he may have spent significant time away from the village, possibly in a hunting group. This could have resulted in a higher consumption of meat, fish, and gathered plants and reduced his reliance on corn.

Section 7.3.1 Summary of Information Obtained Through Osteobiographical Analysis

The life histories presented above reveal the range of variation present within the Norris Farms 36 cemetery. In addition to the physical anomalies which impacted the experiences of individuals living at Morton Village, the variation in interment style, grave goods, and isotopic signatures indicate that there were many social personas available to individuals at Norris Farms 36. It seems likely that gender had a strong influence on the social personas available to individuals, but that gender alone was not the only factor determining social persona. Finally, the range of variation highlighted by these osteobiographical analyses indicate that intragroup social identities may have had a stronger influence on food consumption than did ethnic identity.

Section 7.4 Summary of Norris Farms 36 Intrasite Analysis

Overall, few significant intrasite differences at Norris Farms 36 were revealed through the statistical analysis. Significant differences in $\delta^{15}\text{N}$ values were found between sexes, perhaps reflecting the participation of males and females in different subsistence activities. A significant difference in $\delta^{15}\text{N}$ values were also found between age groups. Differences in $\delta^{15}\text{N}$ values in subadults may be explained by biological life stages, such as nursing and weaning. However, there were also significant differences in $\delta^{15}\text{N}$ values seen between adult age categories. This change in $\delta^{15}\text{N}$ values with age is most pronounced in males.

There were no significant differences seen between adult categories of warfare or antemortem trauma. This indicates that the victims of warfare interred at Norris Farms 36 were likely members of the local Oneota group. Several of the victims of warfare were interred in mass graves. However, no differences in $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values were seen between interment types. This lack of significant differences was also present between skeletal positions.

No differences were seen in $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values between in the broad categories of adults with and without chronic disease. The exception to this was between adults with periostitis and those without periostitis, with lower $\delta^{15}\text{N}$ values found in individuals with periostitis.

Analysis of adult $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values in relation to grave good categories also revealed few significant differences. Freshwater shell inclusions were significantly associated with higher $\delta^{15}\text{N}$ values. Freshwater shell spoons were also associated with significantly higher $\delta^{13}\text{C}$ values in adults and adult males. Analysis of all adults showed significant $\delta^{15}\text{N}$ differences between

individuals with and without bone fishhooks, lithics, and projectile points. In all cases, individuals with grave goods had higher $\delta^{15}\text{N}$. Analysis of all subadults showed significant $\delta^{15}\text{N}$ differences between individuals with and without lithics; subadults with lithics had lower $\delta^{15}\text{N}$ levels. Adult females with freshwater shell hoes showed significantly higher $\delta^{15}\text{N}$ levels than those without. Adult males had no significant differences in most of the grave good categories, with the exception of one male who was buried with a freshwater shell spoon and had significantly lower $\delta^{13}\text{C}$ and significantly higher $\delta^{15}\text{N}$ values.

High/Low cluster analysis of adult $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values revealed no spatial patterning of $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values. However, Spatial Autocorrelation testing showed a near-significant spatial patterning of $\delta^{13}\text{C}$ values, with adults buried in the outer rows of the cemetery having higher $\delta^{13}\text{C}$ values. This may represent a trend in increased corn consumption over time.

Further spatial analysis confirmed the patterns noted by Santure: subadults tended to be buried in the center of the cemetery and females on the periphery of the cemetery, with males most likely to be in the area between the two (Santure 1990b). Victims of perimortem trauma were also shown to have some spatial patterning, with affected individuals more likely to be buried on the periphery of the cemetery, which Santure and Esarey (1990b) theorize could represent an increase in violence through time.

Overall these statistical tests revealed few significant differences beyond those of sex and age but did reveal large intrapopulation standard deviations and nonsignificant trends. This suggests that there was substantial variation within the population, despite the inability of statistical tests to recognize these patterns. Osteobiographical analysis of fourteen selected

individuals revealed the diversity of life experiences at Norris Farms 36. This analysis suggested that there were many social personas available to individuals at Norris Farms 36 and that these social identities may have had a stronger influence on food consumption than did ethnic identity.

Chapter 8: Discussion and Conclusion

Section 8.1 Introduction

Anthropology as a discipline is interested in human diversity across time and space. Differences are brought into relief by the process of migration when two disparate groups come into contact for the first time. There is a range of potential outcomes of this cultural contact, dependent on the goals of both the local and migrant groups. The end result of a migration may be complete assimilation of the migrant group into the local culture or strict maintenance of the original culture and a hostile relationship between the two groups. More than likely, the reality will be somewhere in between these two extremes. The ways in which migrants signal their ethnic identity, as well as the frequency, yield valuable information about how the social environment influences the interaction of migrant and local population.

Ethnic identity is signaled through the use of symbols in both ritual and routine arena. This principle holds that if ethnic identity was an important identity to a given group in the past, it must have then been manipulated and/or reified frequently in order to maintain its meaning. Variability and/or changes in the amount of ethnic identity signaling would be directly related to the importance of ethnicity as a role to the members of the community; changes in how these symbols are produced, reproduced, and/or transformed over time can shed light on how ethnic identity has been manipulated in the past (Baumann 2004:14). Therefore, by examining the nature of ethnic identity markers in prehistoric groups, archaeologists can gather information regarding the impact of migration on ethnic identity. Because ethnic identity is situational, the interaction between local and migrant populations will vary considerably depending on the sociopolitical structure of the two groups and the history of past interaction between the two groups (though not necessarily the individuals).

The recognition of the power of food as a symbol of ethnic identity is well-established in cultural anthropology (Appadurai 1981; Belasco 1999; Farnsworth 2001; Fischler 1988; Fox 2013; Gabaccia 1998; Gumerman 1997; Hastorf and Johannessen 1994; Narayan 1995; Smith 2006; Twiss 2012; Vizcarra Bordi 2006; White et al. 2009). Critical to survival, procurement, preparation, and consumption of food often happens several times a day. These activities typically involve multiple people, instilling diet with intrinsic social meanings (Twiss 2012). Maize seems to be an especially powerful cultural vehicle, therefore having a particularly great potential for contributing to the study of ethnic identity (Hastorf 1994:396). Corn is included in the mythology of many cultures and in many mortuary rituals (Berres 2001; Bohrer 1994; Ford 1994; Gumerman 1994; Ortiz 1994). The relatively sudden shift to maize as a dietary staple is associated with the process of Mississippianization in eastern North America. Evidence suggests that maize is often imbued with strong symbolic power and by manipulating and reifying these symbols, groups were able to effect cultural change, leading Hastorf and Johannessen (1994) to view maize as an agent of transformation in terms of ethnic identity.

Therefore, investigating diet, particularly maize consumption, can yield valuable information about ethnic identity. Applying this framework to an archaeological problem is complex but offers the opportunity to move from the goal of assigning a site to one ethnic category or another to the goal of understanding the relationship of individuals at a site with an appreciation of ethnic identity as fluid, dynamic, and context-specific. This dissertation demonstrates the rewards of utilizing this framework.

The case study used in this project examines food choice as a deliberate cultural symbol used to manipulate ethnic identity following the prehistoric migration of an Oneota group to west-central Illinois (ca. A.D. 1300). As migrants to the central Illinois River valley, the Oneota

people at Morton Village had access to optimal agricultural lands capable of supporting intensive maize agriculture and were in regular contact with maize-reliant Middle Mississippians, with recent evidence suggesting cohabitation at Morton Village of both Oneota migrants and local Middle Mississippians. This project seeks to reveal how the Oneota migrants maintained or altered their traditionally diverse diet as a result of this interaction. Two main research questions – focusing on whether food was used to draw ethnic boundaries between the Oneota and Middle Mississippians within the central Illinois River valley and whether ethnic identity is the primary influence on dietary choice at Morton Village - provide a framework upon which this research is situated.

To address this goal, this dissertation first uses stable isotope analysis to investigate the diet of the Bold Counselor Oneota population living at Morton Village and interred at Norris Farms 36 in comparison with the diet of an Orendorf Phase Middle Mississippian population interred in the burial mound at Orendorf. The results of the intersite analysis are presented in Chapter Six. Next, homogeneity of the diet at Norris Farms 36 was investigated. The results of this intrasite analysis can be found in Chapter Seven. The current chapter focuses on integrating the results of this study into a discussion of dietary choice and ethnic identity in west-central Illinois during the late prehistoric period.

Section 8.2 Intersite Comparison

This section summarizes and interprets the results from the comparison of the two sites presented in Chapter Six. Section 8.2.1 focuses on the carbon isotope values, while Section 8.2.2 reviews the results of nitrogen isotope ratios. Finally, Section 8.2.3 presents a summary of the intersite differences and discusses their implications.

Section 8.2.1 Comparison of Mississippian and Oneota Carbon Isotope Ratios Between Norris Farms 36 and Orendorf

When the subadults at Orendorf were compared to subadults at Norris Farms 36, a statistically significant difference was found in $\delta^{13}\text{C}$ values, with Orendorf having a more positive mean. Given that subadult life stages, both biological and cultural, likely have a powerful influence on diet, the subadult group was further divided into small age groups. The Orendorf samples consistently had a more positive $\delta^{13}\text{C}$ mean than Norris Farms 36, though the differences were not significant. It is likely that the small sample size is at least in part responsible for the lack of significance. It is concluded that subadults at Orendorf were likely consuming more maize than their counterparts at Morton Village/Norris Farms 36.

The lower consumption of maize by the Bold Counselor Oneota population interred at Norris Farms 36 in relation to the Middle Mississippians at Orendorf was also indicated by the $\delta^{13}\text{C}$ values of adults. However, the standard deviations at Norris Farms 36 (± 1.3) and at Orendorf (± 1.7) were outside of the 0.1-0.3‰ range that can be accounted for by physiological variation in carbon isotope fractionation during the production of collagen (Lovell et al. 1986). This indicates that there was dietary variation within each population, meaning that membership within the broad group at each site did not hold exclusive sway over dietary choice. Instead, social roles available within each group, including those based on age and gender, may have influenced maize consumption.

In order to attempt to reduce the impact of intra-community social personae which may have had an impact on diet, the adult populations were further broken down into subsamples. Significant differences in $\delta^{13}\text{C}$ were also present between the sites in the categories of young

adults, middle-age adults, and older adults, with Orendorf values consistently higher. Both adult males and adult females also show the same pattern of intersite differences. However, when groups based on both age and sex were tested, fewer significant differences appeared. For example, no significant differences in $\delta^{13}\text{C}$ values were found when older adult females interred at Norris Farms 36 were compared with older adult females interred in the Orendorf burial mound and no significant differences in $\delta^{13}\text{C}$ values were found when young adult males at Norris Farms 36 were compared with young adult males from Orendorf. In both cases, the Norris Farms 36 mean $\delta^{13}\text{C}$ values were still lower than those from Orendorf but no significant differences were found.

From the information gained by an intersite comparison of the different age and sex groups, it can be concluded that all demographic categories at Norris Farms 36 were getting less of their dietary protein from maize than the Middle Mississippians at Orendorf. This indicates that individuals at Norris Farms 36 were not routinely or exclusively attempting to signal a Middle Mississippian ethnic identity through an emphasis of maize in their foodway. However, the amount of dietary variation at both sites had the potential to be a reflection of multiple ethnic identities existing within each burial sample. As a result, an attempt to separate out any nonlocal individuals from the intersite comparison was made. First, adults from the two sites with and without skeletal evidence of injuries from warfare were compared. Both categories had the same significant difference in $\delta^{13}\text{C}$ mean values, with Orendorf having more positive $\delta^{13}\text{C}$ values. When divided into male and female categories, no significant differences appeared between either male or female victims of warfare between the two sites, though both male and female victims of warfare still exhibited higher $\delta^{13}\text{C}$ values at Orendorf and the lack of significant

differences could be a Type II error based on small sample size. Males and females without evidence of warfare exhibited significant differences in $\delta^{13}\text{C}$ values between the two sites. This indicates that the entire burial population at Orendorf (including apparent victims of warfare) regularly consumed more maize than the individuals interred at Norris Farms 36. Likewise, the comparison of victims of warfare from one site with non-victims at the other site would be unlikely to result in significant differences if the victims were nonlocals interred in either cemetery for the sake of disposal, but significant differences were found in both permutations. This supports the conclusion that there was a true difference in maize consumption at the two sites and that victims of warfare interred at each cemetery are likely to represent members of the local community.

When categories based on interment types were examined the overall pattern of higher carbon values at Orendorf remained. Adults interred in a single grave showed a significant difference in $\delta^{13}\text{C}$ mean values between the two sites. Subadult single interments did not show significant differences in $\delta^{13}\text{C}$ values between the two sites. Graves which held multiple individuals showed the same pattern, with all adult multiple graves revealing significantly different $\delta^{13}\text{C}$ values between the two sites, but with subadult multiple graves showing no significant differences. The nonsignificant differences in the subadult grave categories could be a Type II error resulting from small sample sizes with high standard deviations which could be attributed to age-related differences within the broad subadult category. Overall, the same pattern exists, with the Middle Mississippians at Orendorf demonstrating higher carbon isotope values, therefore consuming more maize than their counterparts at Morton Village.

However, it is critical to the interpretation of these results to recognize the concept of typical and atypical interments. At Norris Farms 36, single burials are typical, while at Orendorf multiple interments are typical. For subadult single burials at Orendorf, an “atypical” mortuary treatment, the $\delta^{13}\text{C}$ mean values is -11.7, much lower than the overall site mean value of -9.6. For the sole subadult multiple burial at Norris Farms 36, an “atypical” mortuary treatment, the $\delta^{13}\text{C}$ value is -8.3, much higher than the overall site mean value of -11.9. In both of these examples, subadults with atypical mortuary treatments have mean $\delta^{13}\text{C}$ values more in line with the other site. This suggests that atypical mortuary treatment of subadults at either site may have been one method of signaling an identity that was also signaled through atypical maize consumption.

The results of the subadult interments were very intriguing and lead to the comparison of “typical” and “atypical” mortuary treatments of adults between the sites. First, the “typical” interment types at the two sites (single graves at Norris Farms 36 and multiple graves at Orendorf) were compared. As expected based on the assumption that individuals who receive a “typical” burial treatment represent members of the local community, a significant difference in $\delta^{13}\text{C}$ values was revealed. When “atypical” mortuary treatments (multiple graves at Norris Farms 36 and single graves at Orendorf) were compared, significant differences were again revealed. Though individuals in multiple graves at Norris Farms 36 did have somewhat higher $\delta^{13}\text{C}$ values than those in “typical” single graves, the difference is within the 0.0-0.3‰ range that can be accounted for by carbon isotope fractionation (Lovell et al. 1986). Further, a significant correlation ($p=0.019$) exists at Norris Farms 36 between warfare and multiple grave interment. Given this information, it seems likely that the adults interred in multiple graves at

Norris Farms 36 are likely to represent the local population. However, single adult burials at Orendorf have a mean $\delta^{13}\text{C}$ value that is more negative than the multiple burials by 0.5‰. This difference cannot be explained by isotope fractionation alone and suggests that interment type at Orendorf was influenced by a number of factors which also affected diet.

Overall, statistical analysis showed a pattern of significant differences in $\delta^{13}\text{C}$ values between the two sites, with Orendorf burials having more positive values. This indicates that individuals at Norris Farms 36 were getting less of their dietary protein from maize than the Middle Mississippians at Orendorf. This is consistent with the broad pattern seen in late prehistoric eastern North America of maize being utilized to reify a Middle Mississippian identity.

Section 8.2.2 Comparison of Oneota and Mississippian Nitrogen Isotope Ratios Between Norris Farms 36 and Orendorf

When all subadults were compared between the two sites, no significant differences in $\delta^{15}\text{N}$ mean values between Norris Farms 36 and Orendorf were revealed. This is consistent within the subadult population and no significant differences were revealed between specific subadult populations at the two sites, either.

When only adults were tested, the same pattern of no significant differences in $\delta^{15}\text{N}$ mean values between Norris Farms 36 and Orendorf was seen. To reduce the influence of potential confounding factors, such as culturally dictated diets associated with particular age or gender roles, the adult category was broken down into several subsamples. First, the adult category was broken down into young, middle, and older adults and compared between sites. No

significant differences in $\delta^{15}\text{N}$ mean values between sites were revealed in young adults or middle adults. Older adults were significantly different between sites, with higher $\delta^{15}\text{N}$ values found at Norris Farms 36. However, the difference in mean values (10.6 for Norris Farms 36 and 10.0 at Orendorf) was within the 0.1-1.0‰ range that can be accounted for by normal physiological variations in nitrogen isotopic fractionation during the production of collagen (DeNiro and Schoeninger 1983), making it more difficult to assess the importance of this difference. When only adult females were tested, there were no significant differences in $\delta^{15}\text{N}$ mean values between sites. This was still true when adult females were broken down into young, middle, and older categories.

When only adult males were examined, a significant difference in $\delta^{15}\text{N}$ values became apparent, with a higher mean value at Norris Farms 36. Though the $\delta^{15}\text{N}$ mean values were higher at Norris Farms 36 for young adult males and middle-age adult males, no significant differences between sites were present. However, the $\delta^{15}\text{N}$ mean value was significantly higher at Norris Farms 36. Once again, though, the difference in mean values (10.6 for Norris Farms 36 and 10.0 at Orendorf) was within the 0.1-1.0‰ range that can be accounted for by normal variation in nitrogen isotope fractionation (DeNiro and Schoeninger 1983).

In addition to the comparisons between demographic categories, an attempt to separate out any nonlocal individuals from the intersite comparison was made. First, adults from the two sites with and without evidence of warfare were compared. Neither category had significant differences in $\delta^{15}\text{N}$ mean values. Then females with and without evidence of warfare and males with and without evidence of warfare were compared between sites. Only males without

evidence of warfare exhibited significant differences in $\delta^{15}\text{N}$ mean values, with the male non-victims having higher $\delta^{15}\text{N}$ levels at Norris Farms 36. When categories based on interment types were examined, no significant differences in $\delta^{15}\text{N}$ mean values were found between the two sites.

Overall, there are few differences in mean $\delta^{15}\text{N}$ values between the two sites, though they tend to be somewhat higher at Norris Farms 36, particularly in males and older adults. Nitrogen isotope ratios are difficult to interpret, as discussed in Chapter Five. The overlapping distribution of nitrogen isotope values at both sites indicates that collagen $\delta^{15}\text{N}$ values cannot be used to distinguish between the Norris Farms 36 diet and the Orendorf diet. This is particularly true in terms of the contributions of terrestrial fauna, aquatic fauna, mussels, and beans because different relative contributions of each of these foods would produce similar $\delta^{15}\text{N}$ values. The lack of a statistically significant difference between the two sites reveals relatively little regarding differences in consumed diet. In this case, with regard to nitrogen isotopes, we cannot say the diets are similar; we simply cannot prove they are dissimilar.

Section 8.2.3 Summary and Implications of Intersite Differences

In general, Oneota groups exploited diverse floral and faunal resources, while also growing local domesticates, maize, beans, and squash. The diversity of available resources at Morton Village is consistent with Oneota sites but unlike other Oneota groups, early floral and faunal analyses suggested a relatively restricted subsistence base, with an emphasis on maize

cultivation and white-tailed deer. These early studies suggested that the Oneota at Morton Village had a diet very similar to their Middle Mississippian neighbors. However, recent investigations have revealed much more diversity in food resources utilized at the site, more in line with a “traditional” Oneota diet. In contrast to this new information regarding the Oneota diet at Morton Village, investigations of the floral and faunal assemblages at Orendorf indicated that the inhabitants were consuming a characteristic Middle Mississippian diet, with a focus on maize cultivation, white-tailed deer, and marsh resources.

If the Oneota in the central Illinois River valley were emphasizing their traditional Oneota ethnic identity it would be expected that their food choice would focus on maintaining a traditional Oneota diet (Bell 2003). This strategy would result in a diet at Morton Village that was significantly different than the Middle Mississippians at Orendorf. This is particularly true if ethnic identity was the most important social identity operating at Morton Village, overruling other common identity categories, such as age and gender.

The analysis of stable isotopes from remains at Norris Farms 36 and Orendorf demonstrated a consistent difference in mean $\delta^{13}\text{C}$ values between the two sites. This supports the conclusion that the population living at Morton Village and interred at Norris Farms 36 focused less actively on maize than did the neighboring Middle Mississippians at Orendorf. Though the $\delta^{15}\text{N}$ values yield little information regarding the differences in diet between the two sites, the significant difference found in carbon isotope values indicates that the inhabitants at Norris Farms 36 chose to get less of their dietary protein from maize than did their Middle Mississippian counterparts. However, the average carbon isotope values from Norris Farms 36 were more positive than the majority of the limited isotope values available for other Upper Mississippian sites and the consumption of maize was surely a notable component of the diet.

The increased maize consumption at Morton Village relative to other Upper Mississippian groups may be a response to cultural contact with Middle Mississippians, with the inhabitants at Norris Farms 36 utilizing maize situationally to make statements about their ethnic identity as migrants.

The inclusion of corn into a subsistence strategy without an exclusive focus is not unique to the individuals at Morton Village, nor is it even unique to Upper Mississippians. It is widely accepted that maize arrived in the eastern woodlands by 800 B.C., though evidence for cultivation does not appear until nearly 1,000 years later – long after the establishment of the Eastern Agricultural Complex (Wymer 1994). This process often happened very abruptly, with a dramatic increase in the ubiquity of corn around A.D. 800 (Hastorf and Johannessen 1994).

Hastorf and Johannessen (1994) noted that the radical increase in corn took place in association with the process of Mississippianization. In addition to the change in diet, Mississippianization is associated with shifts in social, political, and ideological organization. They note that the adoption of maize as a staple in the eastern woodlands is not synonymous with the adoption of agriculture, since agriculture was already well developed. They suggest, instead, that the shift in the importance of maize is best viewed as a cultural change.

It is well accepted that food can serve as vehicle for cultural change, particularly in terms of social identity. Maize seems particularly adept at serving as a bearer of cultural messages (Hastorf and Johannessen 1994). As discussed in *Corn and Culture in the Prehistoric New World* (Hastorf and Johannessen 1994), there is a wealth of archaeological and ethnographic evidence for a symbolic network associated with maize (e.x. Bohrer 1994; Ford 1994; Fowler 1994; Gumerman 1994; Ortiz 1994). While this symbolic network was likely adopted to some

degree by Upper Mississippian groups, it was not adopted with the same significance as by Middle Mississippians.

Given high rates of perimortem trauma and other evidence of warfare, it is clear that the Oneota did not blend seamlessly into the landscape. Despite very interesting evidence of interaction, cooperative and adversarial, the data in this study do not support an obvious attempt to assimilate. The difference in diet between the inhabitants of Morton Village and Orendorf indicated by the stable isotope analysis indicates a true cultural difference between the Oneota and Middle Mississippian groups in west-central Illinois. A discussion of the intrasite analysis will shed more light on the experience of being an Oneota migrant in the central Illinois River valley.

Section 8.3 Intrasite Analysis of Norris Farms 36

Continually reifying a traditional ethnic identity would likely involve routine consumption of traditional food. This would prioritize ethnic identity at Morton Village over other social categories, resulting in a homogenous diet within the site. The mean $\delta^{13}\text{C}$ value for all of the Norris Farms 36 adults sampled for this project was $-12.0 (\pm 1.3)$. The mean $\delta^{15}\text{N}$ value of the adult burials from Norris Farms 36 was $10.3 (\pm 0.7)$. Overall, the individuals at Norris Farms 36 seem more similar to their Upper Mississippian counterparts than they do to the individuals at the nearby site of Orendorf, but there is a noticeable amount of variation within the population. The varied use of maize at Morton Village likely is representative of the variation within the population, both in terms of how individuals signaled their ethnic identity as migrants and in terms of dietary choices available to other social roles within the population.

Sex-related differences are present in the isotope values at Norris Farms 36. There is a general trend for females to have higher $\delta^{13}\text{C}$, suggesting higher maize consumption by females. There is also a statistically significant difference in the levels of $\delta^{15}\text{N}$ between the sexes, with males having higher values, suggesting they were consuming less protein from maize than their female counterparts. This could likely represent additional fish and/or terrestrial fauna. This indicates the social roles associated with biological sex influenced dietary choice. Ethnohistorically, males from many indigenous groups in eastern North America went on hunting expeditions while females performed subsistence activities within and near the village. The pattern of lower $\delta^{13}\text{C}$ and higher $\delta^{15}\text{N}$ values found in males suggests that males were hunting and consuming fauna and non-maize flora away from the village.

One of the most confounding differences seen at Norris Farms 36 was between adult age groups, where the general pattern is decreasing $\delta^{13}\text{C}$ values and increasing $\delta^{15}\text{N}$ values with increased age. Differences in $\delta^{15}\text{N}$ values in subadults may be explained by biological life stages, such as nursing and weaning, but the pattern in adults is harder to interpret. If the individuals had all died on one day, conclusions could be drawn regarding a changing diet (for example, differences between a 25 year old and an individual in their 50s may be related to a change in diet over time, since collagen is known to turn over slowly enough that they would be recording different time periods [Hedges et al. 2007]). This is obviously not the case in an archaeological setting, and a 50 year old may represent a temporal period much later than a 25 year old interred in the same cemetery. As such, the difference in these values cannot easily be explained without a clear understanding of the temporality of the cemetery.

Analysis of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values in relation to grave good categories revealed few significant differences. Freshwater shell inclusions were significantly associated with higher $\delta^{15}\text{N}$ values and tended to be associated with higher $\delta^{13}\text{C}$ values. Artifacts related to the procurement of faunal resources (including bone fishhooks and projectile points) were associated with significantly higher $\delta^{15}\text{N}$ values in adult males. This suggests that there may have been social roles associated with subsistence responsibilities which perhaps afforded greater access to meat.

Santure and Esarey (1990) suggested a temporal organization to the Norris Farms 36 cemetery, with the cemetery expanding on its periphery. Spatial Autocorrelation testing indicated that adult burials in the outer rows of the cemetery tended to have higher $\delta^{13}\text{C}$ values, though this was not significant at the 0.05 level. This may suggest increasing corn consumption through time, if the cemetery organization is primarily temporal. However, spatial patterns were also evident related to age, sex, and warfare status, complicating the interpretation of the spatial distribution of $\delta^{13}\text{C}$ values.

Osteobiographical analyses of a select subsample of burials were presented in order to explore the diversity of life experiences at Morton Village. Various mortuary treatments were available, though the majority of burials were single burials of individuals interred in a supine position with their head directed toward the north. Grave good inclusions were not found with all individuals and varied considerably in their nature and number. The osteobiographies demonstrated the presence of several skeletal anomalies under genetic influence, such as perforated sterna and fused toe phalanges. In addition, spondylolysis was prevalent in the population, likely a combination of both mechanical and genetic influences. Several individuals

chosen for the osteobiographical analyses have evidence of trauma and/or chronic infections. The osteobiographies also emphasized the individual variation present in dietary choices, as represented by isotope values.

Section 8.4 Summary of Intersite and Intrasite Analyses

The intersite analysis was performed to address the first research question - Was food used to draw ethnic boundaries between the Oneota and Middle Mississippians within the central Illinois River valley? The statistical analysis demonstrated differences between diets at the two sites, with significantly lower $\delta^{13}\text{C}$ values and generally higher $\delta^{15}\text{N}$ at Norris Farms 36. This indicates that there were significant differences in diet between the two sites. Since similar food resources were available at both sites, the dietary differences were deliberate choices made by the two populations. Thus, it can be concluded that the differences in diet may have been used by the inhabitants at Morton Village to signal their ethnic identity to local populations.

The next step in this project was to investigate whether ethnic identity was the primary influence on dietary choice at Morton Village or whether other social identities exerted the most influence on dietary choice. The Oneota are typically viewed as having a tribal level of sociopolitical organization (Berres 2001; Benn 1989; Berres 2001; Milner, Anderson, and Smith 1991; O’Gorman 2010; Schroeder 2004; Stevenson 1985). This suggests a basically egalitarian society, where membership of the ethnic group (or tribe) is more central to social identity than membership in different groups within the tribe. Likewise, ethnic identity tends to be emphasized following a migration, resulting in a more homogenous diet. Therefore, a homogenous diet would have been expected if a single ethnic identity was the primary influence on diet.

Instead, the isotope values at Norris Farms 36 had relatively large standard deviations, suggesting the diet at Norris Farms 36 was not homogenous. The osteobiographical analyses also revealed a variety of experiences at Norris Farms 36. The grave good inclusions, interment style, and isotope values suggest there were a variety of social identities, and possibly ethnic identities, available to individuals at Norris Farms 36. The lack of homogeneity at Norris Farms 36, even within groups based on sex and age, indicates that there was not a homogenous ethnic identity that was prioritized over other available social identities.

The results of this project show that Bold Counselor Oneota diets at Morton Village were different than those of the Middle Mississippians living at Orendorf. However, their isotope values were more positive than many of the other Upper Mississippian values, suggesting some degree of change following their move to the central Illinois River valley.

The intrasite analysis of Norris Farms 36 demonstrated heterogeneity within the site. This suggests that various social identities at Norris Farms 36, as represented in grave good inclusions and isotope values, may have had an influence on food choice. Individuals buried on the periphery of the cemetery tended to have higher $\delta^{13}\text{C}$ values. Santure (1990b) stated that the cemetery seemed to have expanded from a central location, suggesting that the graves in the outer rows were interred later than those in inner rows. However the majority of individuals, even those interred in the outer rows of the cemetery, did not regularly utilize maize at the levels of previous Middle Mississippian groups in the regions, such as that at Orendorf. This may be explained by the situational and symbolic consumption of maize in addition to a more traditional Oneota-level of use of maize in the regular diet.

When interpreted together, the intersite and intrasite analyses indicate that social interactions at this time in west-central Illinois were very complex and likely were very fluid.

When placed into the broader archaeological context, the evidence for cohabitation and cooperation between Oneota and Middle Mississippian groups at Morton Village indicates the coexistence of both ethnic identities at the site. Rather than biologically-defined associations, the results of this study suggest that both ethnic identities were available to inhabitants at Morton Village. Villagers likely would have been able to invoke ties to either their Oneota or Middle Mississippian roots dependent on the situation.

Stone (2003) notes that when social constructs are important, such as ethnic identity, they tend to be signaled through the use of multiple symbolic vehicles. Previous research has shown that the hybrid and unique styles of ceramics found at Bold Counselor sites, coupled with the presence of “traditional” Oneota and Middle Mississippian artifacts at the same sites, support the presence of at least three ethnic identities at Bold Counselor sites - both Oneota and Middle Mississippian identities, as well as a new ethnic identity unique to the Bold Counselor. Ongoing research on architectural styles and site use also suggest the coexistence of multiple ethnic identities at Morton Village. Therefore, the conclusions reached in this project are supported by other avenues of investigation, all of which suggest the existence, and importance, of multiple ethnic identities at Bold Counselor sites.

Section 8.5 Contributions of This Study

This study makes several contributions to the field of anthropology, on a broad and specific level. By demonstrating that the population at Norris Farms 36 chose a diet unique from both “traditional” Oneota groups, as represented by published isotope values, and previous Middle Mississippian groups in the region, this study serves as a prehistoric example of the utility of the “interaction plus” framework.

This framework is based on the principle that individuals both are aware of their habitus and actively negotiate their positions within the specific cultural contexts of their habitus. This framework maintains that actors utilize identity markers to negotiate their individual ethnic identity to influence interactions between themselves and members both within and outside the group. By recognizing the symbols of ethnic identity, archaeologists can begin to understand the nature of interaction between indigenous groups and migrant populations in specific cases (Stone 2003).

This study suggests that food consumption at Morton Village was complex and situational, possibly changing through time. These results demonstrate how food can be used to negotiate the ethnic identity of a migrant population. By investigating food choice within a broader archaeological context, this study demonstrates how the “interaction plus” framework offers the opportunity to move from the goal of assigning a site to one ethnic category or another to the goal of understanding the relationship of individuals at a site with an appreciation of ethnic identity as fluid, dynamic, and context-specific.

Additionally, this study reaffirms the ability of carbon and nitrogen stable isotope analysis to yield valuable information about food choice, thus demonstrating the utility of bone chemistry to allow the study of agency in past populations. This study also contributes by being one of the first large studies of Oneota stable isotopes, thereby contributing to the understanding of Oneota diet on a broad level. On a more immediate level, this study has implications by yielding information about food choice in west-central Illinois during the late prehistoric period. By doing so, it provides information about the social context of life after a migration into the central Illinois River valley. This study demonstrated that the Oneota at Morton Village had a significantly different diet than the Middle Mississippians living at Orendorf. This indicates that

despite moving out of their traditional region and into an area populated primarily by Middle Mississippian groups, the Oneota inhabitants at Morton Village were not simply attempting to assimilate.

Analysis of the sample from Norris Farms 36 revealed age- and sex-related differences in isotope ratios, as well as possible dietary changes through time. Given the lack of evidence for social complexity, it is not believed that this variation is linked to institutionalized differential access. Given the current understanding of how individuals invoke and manipulate identity through diet, the heterogeneity within the community suggests that other social identities, such as those based on age and gender, had more of an influence on diet than did ethnic identity.

Section 8.6 Future Research

This study is likely to benefit from the ongoing field school excavations at Morton Village, led by Dr. Jodie O’Gorman from Michigan State University and Dr. Michael Conner from the Illinois State Museum. For example, floral and faunal analyses being performed on samples from Morton Village will provide additional data regarding resource utilization at the village, which can help inform the interpretation of the isotope analysis.

The stable isotope analysis on the Oneota remains at Morton Village/Norris Farms 36 would also be aided by additional isotopic studies on other Oneota populations. The limited isotopic information available for the Oneota leaves many questions unanswered, particularly in light of the understanding of the Oneota diet as variable and locally distinct.

Finally, the conclusions drawn from the results of this specific project would be strengthened by the analysis of stable isotopes in enamel apatite. Bone collagen, used in this project, is formed principally by the protein component of the diet. Enamel apatite is formed from circulating

carbonate in the blood and therefore is influenced by all components of the diet. The combination of analysis of stable isotopes in collagen and enamel apatite therefore would provide a more complete picture of the diet at Morton Village.

Section 8.7 Conclusions

As anthropologists seek to better understand the late prehistoric period in the Eastern Woodlands, the understanding of food choice plays a central role. The practice of selecting and consuming food serves as a cultural vehicle for cultural concepts. Food can be used to recreate or reaffirm social identity and by extension, studies which focus on food choice can reveal valuable information into past cultural dynamics (Fischler 1988; Hastorf and Johannessen 1994). In particular, the relationship between maize and Mississippianization is often emphasized.

Following a migration, particularly a diaspora, cultural identity is redefined. A key component of this is the development of “cultural taste” (Forero and Smith 2011). According to Forero and Smith (2011:78), “All societies create, transform and reproduce the cultural representations of foods that make them distinctive from other societies.” In diasporic communities, the consumption of “authentic” “traditional” foods serves an important role in negotiating social identity (Fishkin 2005). As such, the examination of food choice following a migration has a particularly strong potential to reveal valuable information about cultural identity.

The goal of this dissertation is to explore Oneota dietary choice in west-central Illinois to gain insight into Oneota ethnic identity and their interactions with local Middle Mississippian groups. The results of a comparison between the Oneota population interred at Norris Farms 36

with the Middle Mississippian population interred in the Orendorf burial mound revealed a significant difference in the amount of corn consumed.

The fact that the Oneota diet stays distinct from the Middle Mississippian diet suggests the Oneota were not trying to assimilate into the existing culture in the region. However, the heterogeneity of the diet at Morton Village, the presence of items belonging to the Southeastern Ceremonial Complex at Norris Farms 36, the evidence for cohabitation at several sites in the area, and the extremely high rate of violence in the region all suggest that social interactions at this time in west-central Illinois were very complex and likely were very fluid.

I argue that the evidence for cohabitation and cooperation between Oneota and Middle Mississippian groups at Morton Village indicates the coexistence of both ethnic identities, as well the development of a unique ethnic identity, at the site. I believe the varying levels of maize use revealed by this study suggest that the three ethnic identities were available to all inhabitants at Morton Village, regardless of biologically-defined associations, and that villagers would have been able to situationally invoke ties to either their Oneota or Middle Mississippian identities.

Evidence supporting this conclusion includes evidence for positive interactions between the Oneota and Middle Mississippians at Morton Village as evidenced, for example, by the hybrid and unique styles of ceramics found at the site, coupled with the presence of “traditional” Oneota and Middle Mississippian artifacts at the site. In addition to the evidence for some positive interactions between the Oneota and Middle Mississippians at Morton Village, the archaeological record also provides information about negative interactions, evidenced in the high rate of violence at sites in the area during the late prehistoric period. This evidence of negative interaction and the evidence of dietary change through time suggest that the maintenance of these two ethnic identities, and likely the development of a unique ethnic identity

at the site, may have developed in response to social stress. Ethnic identities create we/they distinctions that influence social interactions. Individuals and groups can invoke or deemphasize ethnic identities and move from one ethnic identity to another as needed to advance personal interests through processes of interaction, exclusion, or inclusion (Cohen 1978). The maintenance of ethnic identities based on both Oneota and Middle Mississippian affiliations, as well as the development of a unique identity as inhabitants of Morton Village, would have afforded the population at Morton Village an advantage when negotiating for power in the region and when attempting to offset social tensions.

APPENDICES

Appendix A: Published Values for Faunal Stable Isotopes from Collagen

Faunal Category	Comments/ Additional Info	Species	I.D. Number	Collagen $\delta^{13}\text{C}$ (‰)	Collagen $\delta^{15}\text{N}$ (‰)	Source
Fish	<i>Stizostedion</i> sp.	Walleye	10-3	-17.8	9.9	Katzenberg 1989
Fish	Moatfield site- <i>Stizosteidon</i> sp.	Walleye or Sauger	1	-17.4	11.7	van der Merwe et al. 2003
Fish	<i>Esox</i> sp.	Pickeral	10-1	-20.8	8.8	Katzenberg 1989
Fish	Parsons site – <i>Esox americanus</i>	Grass pickerel	Mean of 2	-23.4	7.7	van der Merwe et al. 2003
Fish	Moatfield site- <i>Esox lucius</i>	Northern Pike	Mean of 4	-19.0	9.1	van der Merwe et al. 2003
Fish	<i>Catostomus</i> sp.	Sucker	10-2	-23.1	3.6	Katzenberg 1989
Fish	Moatfield site- <i>Catostomus commersoni</i>	White sucker	Mean of 4	-18.9	5.1	van der Merwe et al. 2003
Fish	Parsons site – <i>Catsostomus catostomus</i>	Longnose Sucker	1	-17.5	5.8	van der Merwe et al. 2003
Fish	Moatfield site – <i>Amia calva</i>	Bowfin	Mean of 2	-23.6	7.8	van der Merwe et al. 2003
Fish	Grandview site – <i>Salmo salar</i>	Atlantic Salmon	Mean of 4	-19.3	10.1	van der Merwe et al. 2003
Fish	Moatfield site- <i>Salmo salar</i>	Atlantic salmon	Mean of 3	-19.5	10.5	van der Merwe et al. 2003
Fish	Grandview site – <i>Salvenius namaycush</i>	Lake Trout	1	-21.0	11.8	van der Merwe et al. 2003
Fish	Moatfield site- <i>Salvelinus namaycush</i>	Lake Trout	Mean of 3	-20.2	11.0	van der Merwe et al. 2003
Fish	Grandview site – <i>Coregonus clupeaformis</i>	Lake Whitefish	1	-20.7	8.8	van der Merwe et al. 2003
Fish	Moatfield site- <i>Coregonus clupeaformis</i>	Lake whitefish	Mean of 4	-21.2	8.3	van der Merwe et al. 2003
Fish	Moatfield site- <i>Ameiurus nebulosus</i>	Brown bullhead	Mean of 6	-20.2	6.5	van der Merwe et al. 2003

Table A.1 (cont'd)						
Faunal Category	Comments/ Additional Info	Species	I.D. Number	Collagen $\delta^{13}\text{C}$ (‰)	Collagen $\delta^{15}\text{N}$ (‰)	Source
Fish	Moatfield site- <i>Perca flavescens</i>	Yellow Perch	Mean of 5	-19.6	9.0	van der Merwe et al. 2003
Fish	Moatfield site- <i>Micropterus dolomeiu</i>	Smallmouth Bass	Mean of 2	-17.4	9.0	van der Merwe et al. 2003
Fish	Moatfield site- <i>Lepomis gibbosus</i>	Pumpkinseed	Mean of 4	-19.2	6.3	van der Merwe et al. 2003
Fish	Parsons site – <i>Ambloplites rupestris</i>	Rock Bass	1	-24.9	8.0	van der Merwe et al. 2003
Fish	Moatfield site- <i>Ambloplites rupestris</i>	Rock Bass	Mean of 4	-21.5	8.4	van der Merwe et al. 2003
Fish	Moatfield site- <i>Pomoxis</i> cf. <i>nigromaculatus</i>	Crappy	Mean of 2	-20.8	8.0	van der Merwe et al. 2003
Fish	Parsons site – <i>Ictalurus punctatus</i>	Channel Catfish	Mean of 2	-17.4	8.6	van der Merwe et al. 2003
Fish	Parsons site – <i>Lota lota</i>	Burbot	1	-21.0	12.0	van der Merwe et al. 2003
Fish	Parsons site – <i>Aplodinotus grunniens</i>	Freshwater drum	1	-11.5	6.1	van der Merwe et al. 2003
Fish	Moatfield site- <i>Anguilla rostrata</i>	American eel	Mean of 3	-17.0	10.1	van der Merwe et al. 2003
Fish	Grandview site – <i>Anguilla rostrata</i>	American Eel	1	-16.2	8.1	van der Merwe et al. 2003
Faunal	Moundville site – Aquatic Fauna		Mean of 5	-23.5	7.8	Schoeninger and Schurr 1998
Faunal	Moundville site- Terrestrial Fauna		Mean of 16	-20.2	3.8	Schoeninger and Schurr 1998
Bird	<i>Branta</i> sp.	Goose	Er36-86	-20.6	9.4	Katzenberg 1989
Bird	<i>Branta</i> sp.	Goose	Er35-66	-21.3	7.2	Katzenberg 1989
Bird	<i>Meleagris gallopavo</i>	Turkey	55Ee15	-19.2	6.9	Katzenberg 1989

Table A.1 (cont'd)						
Faunal Category	Comments/ Additional Info	Species	I.D. Number	Collagen $\delta^{13}\text{C}$ (‰)	Collagen $\delta^{15}\text{N}$ (‰)	Source
Mammal	<i>Marmota</i> sp.	Woodchuck	-	-24.0	3.7	Katzenberg 1989
Mammal	<i>Marmota</i> sp.	Woodchuck	60Er1	-24.9	3.7	Katzenberg 1989
Mammal	<i>Castor canadensis</i>	Beaver	55Eg9	-22.3	4.8	Katzenberg 1989
Mammal	<i>Castor canadensis</i>	Beaver	55Ed43	-23.6	6.0	Katzenberg 1989
Mammal	<i>Castor canadensis</i>	Beaver	60Eg66	-22.6	4.6	Katzenberg 1989
Mammal	<i>Castor canadensis</i>	Beaver	50El33	-22.6	6.7	Katzenberg 1989
Mammal	<i>Castor Canadensis</i>	Beaver	45Ec84	-21.9	4.0	Katzenberg 1989
Mammal	<i>Canis</i> sp.	Dog	55Ez13	-11.5	10.0	Katzenberg 1989
Mammal	<i>Canis</i> sp.	Dog	50Eh16	-11.0	9.6	Katzenberg 1989
Mammal	<i>Canis</i> sp.	Dog	60Em4	-10.6	9.5	Katzenberg 1989
Mammal	<i>Canis</i> sp.	Dog	50Ee54	-12.4	9.6	Katzenberg 1989
Mammal	<i>Canis</i> sp.	Dog	50Eg13	-10.7	9.3	Katzenberg 1989
Mammal	<i>Canis</i> sp.	Dog	Em8	-10.1	9.7	Katzenberg 1989
Mammal	<i>Canis</i> sp.	Dog	55E2	-12.2	9.5	Katzenberg 1989
Mammal	<i>Canis</i> sp.	Dog	Ed69	-10.3	9.7	Katzenberg 1989
Mammal	<i>Canis</i> sp.	Dog	33Ha400	-10.97	7.15	Tankersley and Koster 2009
Mammal	<i>Canis</i> sp.	Dog	33Ha58	-13.68	7.37	Tankersley and Koster 2009
Mammal	<i>Canis</i> sp.	Dog	33Ha419	-20.60	6.52	Tankersley and Koster 2009
Mammal	<i>Canis</i> sp.	Dog	33Ha11	-13.82	10.08	Tankersley and Koster 2009
Mammal	<i>Canis</i> sp.	Dog	33Ct29	-14.87	11.58	Tankersley and Koster 2009

Table A.1 (cont'd)						
Faunal Category	Comments/ Additional Info	Species	I.D. Number	Collagen $\delta^{13}\text{C}$ (‰)	Collagen $\delta^{15}\text{N}$ (‰)	Source
Mammal	<i>Bos</i> sp.	Modern Cattle	Chicago	-13.9	7.4	Schoeller et al. 1986
Mammal	Pecos Pueblo – <i>Canis</i> sp.	Dog	1	-8.6*	-	Spielmann et al. 1990
Mammal	<i>Ursus</i> sp.	Bear	55Ez31	-21.4	4.8	Katzenberg 1989
Mammal	<i>Ursus</i> sp.	Bear	45Ed65	-19.7	4.9	Katzenberg 1989
Mammal	<i>Ursus</i> sp.	Bear	60Ek57	-21.4	5.2	Katzenberg 1989
Mammal	<i>Ursus</i> sp.	Bear	60Ek57	-21.8		Katzenberg 1989
Mammal	<i>Ursus</i> sp.	Bear	55Ee3	-20.0	4.8	Katzenberg 1989
Mammal	<i>Ursus</i> sp.	Bear	Ec79	-21.1	5.0	Katzenberg 1989
Mammal	<i>Ursus</i> sp.	Bear	Ec76	-21.4	4.9	Katzenberg 1989
Mammal	<i>Procyon lotor</i>	Raccoon	45Eb60	-21.1	10.1	Katzenberg 1989
Mammal	<i>Procyon lotor</i>	Raccoon	45Ec85	-24.5	11.9	Katzenberg 1989
Mammal	<i>Odocoileus</i> sp.	Deer	55Ez14	-22.8	5.4	Katzenberg 1989
Mammal	<i>Odocoileus</i> sp.	Deer	55Ez14	-22.3		Katzenberg 1989
Mammal	<i>Odocoileus</i> sp.	Deer	55Eg11	-21.7	6.4	Katzenberg 1989
Mammal	<i>Odocoileus</i> sp.	Deer	55Ec81	-22.2	6.2	Katzenberg 1989
Mammal	<i>Odocoileus</i> sp.	Deer	55Ef151	-22.2	5.4	Katzenberg 1989
Mammal	<i>Odocoileus</i> sp.	Deer	55Ec2	-22.3	4.5	Katzenberg 1989
Mammal	<i>Odocoileus</i> sp.	Deer	Eg16	-22.2	5.5	Katzenberg 1989
Mammal	<i>Odocoileus</i> sp.	Deer	Eg16	-22.1	5.6	Katzenberg 1989
Mammal	<i>Odocoileus</i> sp.	Deer	Eg105	-22.3	5.2	Katzenberg 1989

Table A.1 (cont'd)						
Faunal Category	Comments/ Additional Info	Species	I.D. Number	Collagen $\delta^{13}\text{C}$ (‰)	Collagen $\delta^{15}\text{N}$ (‰)	Source
Mammal	<i>Odocoileus</i> sp.	Deer	Eg105	-22.2	5.1	Katzenberg 1989
Mammal	Granada, FL- <i>Odocoileus virginianus</i>	White-tailed deer	-	-20.3	3.2	DeNiro 1985
Mammal	Palmer, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-20.4	3.3	DeNiro 1985
Mammal	Palmer, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-20.6	3.3	DeNiro 1985
Mammal	Palmer, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-20.5	3.3	DeNiro 1985
Mammal	Wightman, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-18.5	3.3	DeNiro 1985
Mammal	Wightman, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-19.2	3.2	DeNiro 1985
Mammal	Wightman, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-18.6	3.2	DeNiro 1985
Mammal	Wightman, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-18.0	3.4	DeNiro 1985
Mammal	McLarty, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-20.0	3.2	DeNiro 1985
Mammal	McLarty, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-20.5	3.3	DeNiro 1985
Mammal	McLarty, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-20.4	3.4	DeNiro 1985
Mammal	McLarty, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-20.6	3.3	DeNiro 1985
Mammal	McLarty, FL - <i>Odocoileus virginianus</i>	White-tailed deer	-	-20.0	3.3	DeNiro 1985
Mammal	Pacbitum, Belize- <i>Odocoileus virginianus</i>	White-tailed Deer	-	-23.74	15.80	White et al. 1993

Table A.1 (cont'd)						
Faunal Category	Comments/ Additional Info	Species	I.D. Number	Collagen $\delta^{13}\text{C}$ (‰)	Collagen $\delta^{15}\text{N}$ (‰)	Source
Mammal	Pacbitum, Belize - <i>Odocoileus virginianus</i>	White-tailed Deer	-	-21.55	7.03	White et al. 1993
Mammal	Pacbitum, Belize - <i>Odocoileus virginianus</i>	White-tailed Deer	-	-19.54	5.05	White et al. 1993
Mammal	Pacbitum, Belize - <i>Odocoileus virginianus</i>	White-tailed Deer	-	-17.54	10.76	White et al. 1993
Mammal	Pacbitum, Belize - <i>Odocoileus virginianus</i>	White-tailed Deer	-	-13.47	9.42	White et al. 1993
Mammal	Pecos Pueblo- <i>Odocoileus hemionus</i>	Mule Deer	1	-18.7*	8.0	Spielmann et al. 1990
Mammal	Pecos Pueblo – <i>Bison bison</i>	Bison	1	-9.5*	6.4	Spielmann et al. 1990
Mammal	Sierra Blanca– <i>Bison bison</i>	Bison	-	-12.8 to -8.0	-	Katzenberg and Kelley 1991, as reported in Hard et al. 1996
Mammal	Sierra Blanca – <i>Lepus</i> sp.	Jackrabbit	-	-15.3 to -12.8	-	Katzenberg and Kelley 1991, as reported in Hard et al. 1996
Mammal	S. Jornada – <i>Lepus</i> sp.	Jackrabbit	12	-21.3 to -13.3	-	Mauldin 1993, as reported in Hard et al. 1996
Mammal	Sierra Blanca – <i>Sylvilagus</i> sp.	Cottontail	-	-19.9 to -17.8	-	Katzenberg and Kelley 1991, as reported in Hard et al. 1996
Mammal	Pecos Pueblo – <i>Felis</i> sp.	Cat	1	-17.7*	6.0	Spielmann et al. 1990
Mammal	Cedar Mesa – <i>Ovis</i> sp.	Mountain Sheep	Mean of 7 for carbon, 3 for nitrogen	-17.0	4.5	Chrisholm and Matson 1994

Table A.1 (cont'd)						
Faunal Category	Comments/ Additional Info	Species	I.D. Number	Collagen $\delta^{13}\text{C}$ (‰)	Collagen $\delta^{15}\text{N}$ (‰)	Source
Mammal	Pecos Pueblo – <i>Antilocapra Americana</i>	Pronghorn Antelope	Mean of 2	-18.2*	6.8	Spielmann et al. 1990
Mammal	Sierra Blanca – <i>Antilocapra Americana</i>	Pronghorn Antelope	-	-19.8 to -15.6	-	Katzenberg and Kelley 1991, as reported in Hard et al. 1996
Turtle	Cuello, Belize – <i>Kinoster</i> sp.	Mud Turtle	-	-22.2 to -19.4	-	Tykot et al. 1996
*For Spielmann et al. 1990, faunal $\delta^{13}\text{C}$ “flesh” values were recalculated to represent bone collagen values.						

Appendix B: Full List of Usable Human Samples from Norris Farms 36 and Orendorf

Table B.1 Full List of Usable Human Samples from Norris Farms 36 and Orendorf						
Burial Number	Age	Sex	Interment	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	C:N
NF-1	2-4 year old	undetermined	Single	10.0	-12.4	3.3
NF-11	young adult female	female	Single	8.8	-12.0	3.3
NF-12	neonate	undetermined	Single	9.8	-10.5	3.3
NF-16	0-1 year old	undetermined	Single	11.7	-10.4	3.3
NF-19	older adult male	male	Single	11.9	-8.9	3.3
NF-24	older adult female	female	Multiple	10.5	-12.3	3.1
NF-31	older adult female	female	Single	12.4	-12.6	3.3
NF-33	middle age adult female	female	Single	9.4	-13.4	3.4
NF-34	older adult female	female	Single	9.7	-12.5	3.3
NF-35	older adult female	female	Single	10.0	-11.6	3.3
NF-36	older adult female	female	Single	10.3	-12.1	3.3
NF-37	young adult female	female	Single	10.1	-10.0	3.1
NF-40	older adult female	female	Single	10.5	-10.1	3.3
NF-41	middle age adult female	female	Single	10.2	-11.1	3.3
NF-43	young adult male	male	Single	11.2	-10.9	3.3
NF-45	middle age adult male	male	Single	10.3	-12.2	3.3
NF-49	young adult male	male	Multiple	10.6	-12.2	3.3
NF-50	middle age adult male	male	Multiple	9.7	-12.7	3.2
NF-51	older adult female	female	Single	10.1	-11.5	3.0
NF-53	5-15 year old	undetermined	Single	10.1	-12.0	3.3
NF-55	older adult male	male	Single	10.7	-12.4	3.1
NF-57	0-1 year old	undetermined	Single	12.7	-8.3	3.2
NF-60	older adult male	male	Single	10.7	-12.0	3.3
NF-61	older adult male	male	Single	11.0	-11.5	3.3
NF-63	middle age adult male	male	Single	9.9	-11.2	3.3
NF-65	2-4 year old	undetermined	Single	12.1	-10.0	3.3

Table B.1 (cont'd)						
Burial Number	Age	Sex	Interment	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	C:N
NF-67	older adult male	male	Single	10.6	-13.2	3.3
NF-70	older adult male	male	Single	10.7	-13.1	3.2
NF-71	middle age adult male	male	Single	9.7	-12.7	3.2
NF-79	1-2 year old	undetermined	Single	12.1	-9.3	3.0
NF-86	older adult female	female	Single	10.4	-10.9	3.1
NF-89	5-15 year old	undetermined	Single	9.6	-12.0	3.3
NF-90	middle age adult female	female	Multiple	10.3	-11.6	3.2
NF-91	middle age adult female	female	Multiple	9.9	-12.2	3.3
NF-101	1-2 year old	undetermined	Single	10.9	-20.2	3.2
NF-113	5-15 year old	undetermined	Single	9.7	-13.3	3.2
NF-128	2-4 year old	undetermined	Single	12.0	-10.3	3.0
NF-129	older adult male	male	Single	10.9	-14.5	3.4
NF-133	0-1 year old	undetermined	Single	11.2	-9.0	3.2
NF-135	1-2 year old	undetermined	Single	13.9	-11.4	3.5
NF-139	older adult female	female	Multiple	10.4	-12.0	3.3
NF-144	neonate	undetermined	Single	10.1	-15.2	3.3
NF-150	1-2 year old	undetermined	Multiple	13.1	-8.2	3.2
NF-152	neonate	undetermined	Single	9.2	-8.1	3.4
NF-154	5-15 year old	undetermined	Single	9.5	-13.2	3.4
NF-162	1-2 year old	undetermined	Single	11.0	-11.3	3.2
NF-173	0-1 year old	undetermined	Single	12.2	-10.7	3.3
NF-174	young adult female	female	Multiple	10.5	-13.7	3.5
NF-181	2-4 year old	undetermined	Single	11.2	-16.0	3.1
NF-183	2-4 year old	undetermined	Single	9.1	-13.7	3.3
NF-185	older adult male	male	Single	10.9	-13.3	3.3
NF-186	neonate	undetermined	Single	9.6	-9.8	3.4
NF-188	young adult female	female	Single	9.0	-10.0	3.3

Table B.1 (cont'd)						
Burial Number	Age	Sex	Interment	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	C:N
NF-190	young adult male	male?	Single	9.8	-14.3	3.1
NF-191	older adult female	female	Single	10.5	-12.5	3.3
NF-200	middle age adult female	female	Single	9.5	-12.1	3.2
NF-201	0-1 year old	undetermined	Single	11.8	-19.2	3.0
NF-203	young adult female	female	Single	9.7	-10.8	3.3
NF-209	5-15 year old	undetermined	Single	8.7	-9.3	3.3
NF-216	middle age adult male	male	Single	10.9	-11.7	3.1
NF-225	older adult male	male	Single	11.4	-16.6	3.2
NF-234	older adult female	female	Single	9.7	-11.0	3.3
NF-236	middle age adult male	male	Single	10.7	-11.1	3.1
NF-243a	middle age adult male	male	Multiple	10.9	-11.2	3.1
NF-251	middle age adult female	female	Single	9.6	-11.1	3.3
NF-254	middle age adult male	male	Single	10.4	-13.2	3.3
NF-258	5-15 year old	undetermined	Single	10.4	-11.4	3.2
NF-265	middle age adult male	male	Multiple	11.1	-11.0	3.3
NF-281	older adult male	male	Single	9.7	-12.3	3.3
NF-288	older adult male	male	Single	10.3	-10.7	3.4
O-1	older adult male	male	Multiple	10.6	-10.8	3.1
O-10	young adult male	male?	Multiple	10.8	-9.4	3.4
O-12	young adult male	male	Multiple	9.8	-8.9	3.3
O-13A	neonate	undetermined	Multiple	11.6	-10.5	3.3
O-14	5-15 year old	undetermined	Multiple	10.4	-8.6	3.2
O-16	young adult male	male	Single	11.1	-9.9	3.4
O-28	0-1 year old	undetermined	Multiple	13.3	-8.5	3.3
O-30	young adult female	female?	No Association	9.8	-9.0	3.3
O-31	0-1 year old	undetermined	Multiple	11.8	-5.9	3.0
O-36	older adult male	male	No Association	10.2	-8.9	3.5

Table B.1 (cont'd)						
Burial Number	Age	Sex	Interment	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	C:N
O-39	5-15 year old	undetermined	Multiple	10.0	-8.7	3.2
O-40	older adult male	male	Multiple	10.6	-9.4	3.2
O-44	2-4 year old	undetermined	Multiple?	13.3	-8.7	3.4
O-50	older adult female	female	Multiple	9.1	-8.8	3.3
O-55	young adult female	female	Single	10.2	-9.6	3.2
O-58	young adult female	female	Single	10.5	-9.4	3.3
O-59	0-1 year old	undetermined	Single	12.8	-6.5	3.2
O-60	young adult female	female	Multiple	10.0	-8.3	3.3
O-60A	0-1 year old	undetermined	Multiple	11.7	-6.9	3.3
O-63	2-4 year old	undetermined	Single	10.4	-10.9	3.4
O-66	older adult female	female	Multiple	10.2	-8.8	3.3
O-67	5-15 year old	undetermined	Multiple	8.5	-11.6	3.4
O-71	middle age adult male	male	Multiple	10.2	-11.9	3.4
O-72	older adult male	male	Multiple	10.8	-10.2	3.2
O-75	older adult male	male	Multiple	10.2	-8.2	3.2
O-76	young adult female	female	Multiple	10.4	-8.9	3.3
O-77	middle age adult male	male	Multiple	10.1	-9.0	3.2
O-79	1-2 year old	undetermined	Multiple	12.4	-7.2	3.3
O-80	2-4 year old	undetermined	No Association	11.6	-9.1	3.4
O-83	middle age adult male	male	Multiple?	10.2	-10.6	3.6
O-84	older adult male	male	Single	9.9	-9.2	3.4
O-87	middle age adult male	male	Single	10.4	-9.1	3.3
O-88	young adult female	female	Single	9.9	-9.1	3.1
O-100	2-4 year old	undetermined	Multiple	10.1	-8.9	3.3
O-106b	1-2 year old	undetermined	Multiple	11.9	-8.3	3.0
O-107	older adult female	female	Multiple	9.4	-9.0	3.2
O-109	middle age adult male	male	Single	9.6	-8.5	3.3

Table B.1 (cont'd)						
Burial Number	Age	Sex	Interment	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	C:N
O-110A	middle age adult female	female	Multiple	9.7	-9.9	3.3
O-112	older adult male	male	Multiple	10.1	-13.1	3.3
O-113	middle age adult male	male	Multiple	11.2	-10.5	3.5
O-117	2-4 year old	undetermined	Single	10.3	-14.9	3.2
O-118	5-15 year old	undetermined	Single	9.3	-13.1	3.2
O-120	young adult female	female	Multiple	10.6	-9.0	3.3
O-121	middle age adult male	male	Single	10.0	-11.1	3.1
O-123	middle age adult male	male	Single	10.3	-9.6	3.1
O-127	older adult female	female	Single	8.6	-12.8	3.3
O-132	young adult female	female	Multiple	10.4	-7.8	3.1
O-134	middle age adult female	female	Multiple	10.6	-8.3	3.4
O-138	1-2 year old	undetermined	Single	11.6	-14.3	3.2
O-139	older adult female	female	Multiple	9.6	-10.0	3.2
O-140	young adult female	female	Multiple	8.9	-8.6	3.3
O-141	5-15 year old	undetermined	Single	10.8	-10.2	3.4
O-142	1-2 year old	undetermined	Multiple	12.3	-8.0	3.2
O-143	middle age adult female	female?	Single?	10.4	-8.7	3.2
O-146	older adult female	female	Single	11.0	-12.5	3.3
O-152	older adult male	male	Multiple	9.4	-11.6	3.2
O-157	adult	male?	Multiple	10.2	-11.0	3.3
O-159	adult	female	Single	9.6	-3.5	3.3
O-161	adult	female	Single	10.4	-11.5	3.6
O-163	adult	male	Single	10.0	-11.5	3.3
O-1970-148	0-1 year old	undetermined	Multiple	9.7	-10.0	3.3
O-1970-23-25	neonate	undetermined	Multiple	11.7	-8.1	3.3

Appendix C: Published Values for Human Stable Isotopes from Collagen

Table C.1. Published Values for Human Stable Isotopes from Collagen							
Archaeological Tradition	Site	Burial	Sex	Age	Collagen $\delta^{13}\text{C}$	Collagen $\delta^{15}\text{N}$	Source
Archaic	Reigh	6C	F?	Young Adult	-21.4	-	Bender et al. 1981
Archaic		7	-	Adult	-21.7	-	
Archaic		26A	M	Adult	-22.1		
Archaic		14A	-	Adult	-23.1	-	
Archaic		23A	-	Adult	-21.8	-	
Archaic	Scatters	1	-	-	-21.1	-	Lynott et al. 1986
Archaic	Lepold	-	-	-	-21.7	-	
Archaic	Billy Moore	1	-	-	-20.5	-	
Archaic	Frontenac	41270	-	-	-21.3	-	Vogel and Van Der Merwe 1977
Archaic Average					-21.63	-	
Early Woodland	McCarty	-	-	-	-21.7	-	Lynott et al. 1986
Early Woodland	Vine Valley	38447	-	-	-18.9	-	Vogel and Van Der Merwe 1977
Early Woodland		38465	-	-	-19.8	-	
Early Woodland Average					-20.13	-	

Table C.1. (cont'd)							
Archaeological Tradition	Site	Burial	Sex	Age	Collagen $\delta^{13}\text{C}$	Collagen $\delta^{15}\text{N}$	Source
Hopewell	Millville	2	F	40+	-22.6	-	Bender et al. 1981
Hopewell		3A	F	40+	-22.5	-	
Hopewell		3B	F	40+	-22.7	-	
Hopewell	Trempealeau	Mound 4, B-16	-	-	-21.5	-	
Hopewell		Mound 26, B-B	-	-	-22.7	-	
Hopewell	Gibson	Mound 3, B-9	M	45-55	-20.6	-	
Hopewell		Mound 3, B-8	M	50+	-21.0	-	
Hopewell		Mound 5, B-30	M	45-50	-21.3	-	
Hopewell		Mound 5, B-10	M	50+	-21.6	-	
Hopewell		Mound 5, B-27	M	18-20	-20.7	-	
Hopewell		Mound 5, B-26	M	50+	-20.7	-	
Hopewell	Edwin Harness Mound	Feature 56	F	30	-24.1	-	
Hopewell		Feature 60	F	Early/mid yrs.	-22.7	-	
Hopewell		Feature 75	F	40-45	-21.2	-	
Hopewell	Seip Mound	3	M	28	-21.1	-	
Hopewell		52	F	29	-21.0	-	
Hopewell		90	M	43	-23.4	-	
Hopewell		37	M	Adult	-22.7	-	
Hopewell		72	M	Adult	-22.1	-	
Hopewell Average					-21.91	-	
Woodland	Christensen	-	-	-	-19.9	-	Lynott et al. 1986
Woodland	Nevins Cairn	2	-	-	-20.1	-	
Woodland Average					-20.0	-	

Table C.1. (cont'd)							
Archaeological Tradition	Site	Burial	Sex	Age	Collagen $\delta^{13}\text{C}$	Collagen $\delta^{15}\text{N}$	Source
Late Woodland	Ledders	63	F	-	-19.8	-	Bender et al. 1981
Late Woodland		69	F	-	-17.5	-	
Late Woodland		79	F	-	-17.0	-	
Late Woodland		54	M	-	-16.5	-	
Late Woodland		56	M	-	-15.0	-	
Late Woodland		96	M	-	-14.7	-	
Late Woodland	Rock Island, Site II	6	F	-	-19.4	-	
Late Woodland		8	M		-19.9	-	
Late Woodland	Round Spring	1	-	-	-20.7	-	Lynott et al. 1986
Late Woodland	Snell	4	-	-	-14.0	-	Vogel and Van Der Merwe 1977
Late Woodland		5	-	-	-16.6	-	
Late Woodland	Ledders	Average of 17	-	-	-17.4	-	Buikstra, Rose, and Milner 1994
Late Woodland	Dickson Mounds	Average of 9	-	-	-13.4	-	
<i>Late Woodland Average</i>					-17.07	-	
Early Mississippian	Zebree	3F	-	-	-21.2	-	Lynott et al. 1986
Early Mississippian		6	-	-	-20.5	-	
Early Mississippian		3G	-	-	-21.2	-	
Early Mississippian	Moundville I	Average of 4	-	-	-15.0	7.0	Schoeninger and Schurr 1994
Early Mississippian	Helton	Average of 22	-	-	-17.5	-	Buikstra, Rose, and Milner 1994
Early Mississippian	Dickson Mounds	Average of 10	-	-	-12.6	-	
<i>Early Mississippian Average</i>					-18.00	7.0	

Table C.1. (cont'd)							
Archaeological Tradition	Site	Burial	Sex	Age	Collagen $\delta^{13}\text{C}$	Collagen $\delta^{15}\text{N}$	Source
Middle Mississippian	Cahokia, Mound 72	12 (high status)	?	Adult	-18.8	11.9	Ambrose et al. 2003
Middle Mississippian		120 (high status)	?	Adult	-14.3	7.9	
Middle Mississippian		162 (high status)	?	25-30	-17.8	10.2	
Middle Mississippian		201 (high status)	F?	Adult	-18.4	9.7	
Middle Mississippian		53 (low status)	?	?	-16.0	8.7	
Middle Mississippian		142 (low status)	F?	20-25	-16.6	8.7	
Middle Mississippian		146 (low status)	F	20-25	-18.4	8.0	
Middle Mississippian		186 (low status)	F	20-25	-17.2	7.9	
Middle Mississippian		14 (high status)	M	Adult	-16.5	-	Bender et al. 1981
Middle Mississippian		16	-	Young Adult	-18.7	-	
Middle Mississippian	Aztalan	66	F	Adult	-20.0	-	
Middle Mississippian		72	F	Adult	-15.0	-	
Middle Mississippian		9 (high status)	-	-	-17.0	-	
Middle Mississippian		10 (high status)	-	-	-19.2	-	
Middle Mississippian		11	-	-	-17.1	-	
Middle Mississippian		Feature 202	F	Young Adult	-12.0	-	
Middle Mississippian		Feature 37	-	-	-18.5	-	
Middle Mississippian		Feature 73	-	-	-16.4	-	
Middle Mississippian		Feature 77	-	-	-14.5	-	
Middle Mississippian		Feature 82	-	-	-14.4	-	
Middle Mississippian	Fingerhut	42	-	-	-15.9	-	
Middle Mississippian		27	-	-	-15.2	-	

Table C.1. (cont'd)							
Archaeological Tradition	Site	Burial	Sex	Age	Collagen $\delta^{13}\text{C}$	Collagen $\delta^{15}\text{N}$	Source
Middle Mississippian	Round Spring	2	-	-	-15.6	-	Lynott et al. 1986
Middle Mississippian	Lilbourn	16D	-	-	-14.9	-	
Middle Mississippian	Zebree	4	-	-	-13.0	-	
Middle Mississippian	Turner	21A	-	-	-15.8	-	
Middle Mississippian		28	-	-	-13.2	-	
Middle Mississippian		36B	-	-	-14.1	-	
Middle Mississippian	Orendorf	10	M?	14-16	-8.99*	12.22*	Strange 2006
Middle Mississippian		12	M	20-25	-9.22*	12.72*	
Middle Mississippian		30	F?	15-20	-8.28*	11.55*	
Middle Mississippian		40	M	40-50	-8.32*	11.14*	
Middle Mississippian		83	M	30-40	-8.88*	12.05*	
Middle Mississippian		2	F	40-50	-11.09*	18.63*	
Middle Mississippian		85	F	30-40	-7.62*	8.92*	
Middle Mississippian		105	M	15-20	-8.96*	12.42*	
Middle Mississippian		116	F	45+	-10.88*	9.22*	
Middle Mississippian		153	M	40-50	-8.65*	14.16*	
Middle Mississippian		Average of 4	-	-	-9.2	-	Buikstra, Rose, and Milner 1994
Middle Mississippian	Cahokia, Mound 72	Average of 12	-	-	-14.6	-	
Middle Mississippian	Schild	Average of 19	-	-	-12.3	-	
Middle Mississippian	Dickson Mounds	Average of 11	-	-	-10.4	-	
Middle Mississippian		Average of 11	-	-	-11.2	-	
Middle Mississippian	Moundville II	Average of 3	-	-	-10.4	8.0	Schoeninger and Schurr 1993
Middle Mississippian	Moundville III	Average of 30	-	-	-10.3	8.3	
Middle Mississippian	Angel	Average of 41	-	-	-8.9	-	Schurr 1992
<i>Middle Mississippian Average</i>					-13.75	10.89	

Table C.1. (cont'd)							
Archaeological Tradition	Site	Burial	Sex	Age	Collagen $\delta^{13}\text{C}$	Collagen $\delta^{15}\text{N}$	Source
Late Mississippian	East St. Louis Stone Quarry	17	F	-	-11.11	9.11	Hedman et al. 2002
Late Mississippian		27	F	-	-10.20	9.03	
Late Mississippian		42	F	-	-11.28	8.96	
Late Mississippian		56	F	-	-11.63	9.35	
Late Mississippian		9	F	-	-11.93	7.91	
Late Mississippian		39	F	-	-11.53	8.08	
Late Mississippian		77	F	-	-11.36	9.84	
Late Mississippian		25	F	-	-13.27	8.46	
Late Mississippian		45	I	-	-10.32	8.58	
Late Mississippian		5	I	-	-12.10	9.05	
Late Mississippian		80	I	-	-10.98	10.23	
Late Mississippian		misc	I	-	-12.61	10.20	
Late Mississippian		4	M	-	-11.40	9.31	
Late Mississippian		38	M	-	-8.52	9.21	
Late Mississippian		68	M	-	-10.21	8.18	
Late Mississippian		48	M	-	-11.13	8.47	
Late Mississippian		52	M	-	-11.06	9.25	
Late Mississippian		67	M	-	-9.97	8.68	
Late Mississippian		76	M	-	-10.32	9.06	
Late Mississippian		78	M	-	-9.82	9.48	
Late Mississippian		14	M	-	-9.42	9.68	
Late Mississippian	Florence St.	15	I	-	-10.47	10.06	
Late Mississippian		12	I	-	-13.11	10.33	
Late Mississippian		21	I	-	-11.10	10.20	
Late Mississippian		29	I	-	-10.51	10.07	
Late Mississippian		30	I	-	-12.40	9.32	
Late Mississippian		31	I	-	-10.12	9.74	
Late Mississippian		34	I	-	-11.26	9.88	
Late Mississippian		14	M	-	-10.94	9.02	

Table C.1. (cont'd)							
Archaeological Tradition	Site	Burial	Sex	Age	Collagen $\delta^{13}\text{C}$	Collagen $\delta^{15}\text{N}$	Source
Late Mississippian		29/9	M	-	-11.24	10.19	Hedman et al. 2002
Late Mississippian	Range	18	F	-	-10.30	9.21	
Late Mississippian		19	F	-	-11.06	8.32	
Late Mississippian		20	I	-	-11.16	9.55	
Late Mississippian		16	I	-	-10.33	9.28	
Late Mississippian		13	I	-	-11.02	9.34	
Late Mississippian		14	M	-	-14.34	10.88	
Late Mississippian	Corbin Md.	PC 4	F	-	-11.97	9.12	
Late Mississippian		PC 10	F	-	-13.41	8.79	
Late Mississippian		PC 25	F	-	-12.16	9.50	
Late Mississippian		PC18	F	-	-12.42	8.70	
Late Mississippian		PC 3	F	-	-11.00	8.85	
Late Mississippian		?	I	-	-14.91	9.44	
Late Mississippian		Unassociated	I	-	-10.75	8.79	
Late Mississippian		?	M	-	-12.06	9.53	
Late Mississippian		PC 24	M	-	-14.99	9.09	
Late Mississippian		PC 9	M	-	-11.76	9.59	
Late Mississippian		PC 5	M	-	-9.87	8.75	
Late Mississippian		PC 6	M	-	-10.18	8.85	
Late Mississippian		PC 7	M	-	-11.62	9.56	
Late Mississippian	Hill Prairie	1	F	-	-12.53	9.79	
Late Mississippian		5	F	-	-10.97	9.79	
Late Mississippian		6	F	-	-10.20	10.65	
Late Mississippian		28	I	-	-16.38	9.15	
Late Mississippian		2	M	-	-17.65	9.14	
Late Mississippian		3	M	-	-19.70	9.36	
Late Mississippian	Schild A	Feature 62	F	-	-12.70	9.60	Hedman et al. 2002 (Schober 1998)
Late Mississippian	Schild A	Feature 66	F	-	-13.20	8.30	
Late Mississippian	Schild A	Feature 66a	F	-	-14.80	8.90	

Table C.1. (cont'd)							
Archaeological Tradition	Site	Burial	Sex	Age	Collagen $\delta^{13}\text{C}$	Collagen $\delta^{15}\text{N}$	Source
Late Mississippian	Schild A	Feature 69a	F	-	-12.30	7.90	Hedman et al. 2002 (Schober 1998)
Late Mississippian	Schild A	Feature 85	F	-	-10.40	8.80	
Late Mississippian	Schild A	Feature 157	F	-	-15.30	8.80	
Late Mississippian		Feature 101a	M	-	-12.80	9.90	
Late Mississippian		Feature 149	M	-	-15.30	8.90	
Late Mississippian		Feature 153	M	-	-20.40	7.60	
Late Mississippian	Berry	22	-	-	-13.5	-	Lynott et al. 1986
Late Mississippian	Campbell	52	-	-	-10.4	-	
Late Mississippian	Hazel	56	-	-	-12.9	-	
Late Mississippian	Moundville IV	Average of 24	-	-	-11.1	8.3	Schoeninger and Schurr 1993
Late Mississippian	Kane Mounds	Average of 10	-	-	-11.2	-	Buikstra, Rose, and Milner 1994
Late Mississippian	East St. Louis Stone Quarry	Average of 11	-	-	-11.8	-	
Late Mississippian Average					-12.03	9.23	
Brice Prairie Oneota	OT		-	-	-13.2	10.6	Vradenburg 1993
Brice Prairie Oneota			-	-	-13.4	10.7	
Brice Prairie Oneota			-	-	-13.3	-	
Brice Prairie Oneota			-	-	-12.1	-	
Brice Prairie Oneota			-	-	-11.9	-	
Oneota	King Hill	1A	M	22-24	-11.9	10.9	Vradenburg and Hollinger 1994
Oneota		2	F?	Adult	-12.5	11.0	
Oneota	Norris Farms 36	Average of 10	-	-	-12.6	-	Buikstra, Rose, and Milner 1994
Langford	Material Services	Mean of 10	-	-	-12.5	-	Emerson et al. 2005
Langford	Gentleman Farm	Mean of 26	-	-	-11.7	-	
Upper Mississippian Average					-12.51	10.8	
* Average of two tests on same Orendorf individual performed by Strange 2006							

Appendix D: Grave Good Associated Variation in Adult $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values

Table D.1. Grave Good Associated Variation in Adult $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adults with Grave Good(s)	-12.2 (± 1.6)	10.6 (± 0.7)
Adults without Grave Good(s)	-11.8 (± 1.0)	10.1 (± 0.6)
Significance	0.480	0.018
Adults with Faunal Remain(s)	-12.3 (± 0.7)	10.4 (± 0.6)
Adults without Faunal Remain(s)	-12.0 (± 1.4)	10.3 (± 0.7)
Significance	0.384	0.792
Adults with Freshwater Shell	-11.5 (± 2.3)	11.7 (± 0.9)
Adults without Freshwater Shell	-12.0 (± 1.3)	10.3 (± 0.6)
Significance	0.915	0.007
Adults with a Shell Rattle(s)	-13.1 ($\pm n/a$)	10.7 ($\pm n/a$)
Adults without a Shell Rattle(s)	-12.0 (± 1.3)	10.3 (± 0.7)
Significance	0.400	0.577
Adults with a Shell Hoe(s)	-12.6 ($\pm n/a$)	12.4 ($\pm n/a$)
Adults without a Shell Hoe(s)	-12.0 (± 1.4)	10.3 (± 0.6)
Significance	0.533	0.002
Adults with a Freshwater Shell Spoon(s)	-8.9 ($\pm n/a$)	11.9 ($\pm n/a$)
Adults without a Freshwater Shell Spoon(s)	-12.1 (± 1.3)	10.3 (± 0.7)
Significance	0.044	0.023
Adults with Bone Tool(s)	-13.5 (± 2.2)	10.7 (± 0.7)
Adults without Bone Tool(s)	-11.9 (± 1.2)	10.3 (± 0.7)
Significance	0.108	0.363
Adults with Bone Fishhook(s)	-14.0 (± 3.7)	11.2 (± 0.3)
Adults without Bone Fishhook(s)	-11.9 (± 1.7)	10.3 (± 0.7)
Significance	0.455	0.068
Adults with Bone Projectile Point(s)	-11.5 ($\pm n/a$)	11.0 ($\pm n/a$)
Adults without Bone Projectile Point(s)	-12.0 (± 1.4)	10.3 (± 0.7)
Significance	0.711	0.348
Adults with Scarifier(s)	-12.1 (± 0.9)	10.4 (± 0.9)
Adults without Scarifier(s)	-12.0 (± 1.4)	10.3 (± 0.9)
Significance	0.808	0.996
Adults with Misc. Bone Tool(s)	-12.3 (± 1.1)	10.9 (± 0.2)
Adults without Misc. Bone Tool(s)	-12.0 (± 1.4)	10.3 (± 0.7)
Significance	0.729	0.056
Adults with Antler	-12.3 (± 1.1)	10.9 (± 0.2)
Adults without Antler	-12.0 (± 1.4)	10.3 (± 0.7)
Significance	0.729	0.145

Table D.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adults with Antler Flaker(s)	-13.1 ($\pm$ n/a)	10.7 ($\pm$ n/a)
Adults without Antler Flaker(s)	-12.0 ($\pm$ 1.3)	10.3 ($\pm$ 0.7)
Significance	0.400	0.577
Adults with Antler Handle(s)	-11.5 ($\pm$ n/a)	11.0 ($\pm$ n/a)
Adults without Antler Handle(s)	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.711	0.267
Adults with Adornment(s)	-12.5 ($\pm$ 1.5)	10.7 ($\pm$ 0.2)
Adults without Adornment(s)	-12.0 ($\pm$ 1.3)	10.3 ($\pm$ 0.7)
Significance	0.475	0.118
Adults with Bone Pin(s)	-12.3 ($\pm$ 0.4)	10.6 ($\pm$ 0.2)
Adults without Bone Pin(s)	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.618	0.155
Adults with Bead(s)	-14.5 ($\pm$ n/a)	10.9 ($\pm$ n/a)
Adults without Bead(s)	-11.9 ($\pm$ 1.3)	10.3 ($\pm$ 0.7)
Significance	0.089	0.444
Adults with Pendant(s)	-12.6 ($\pm$ 1.8)	10.6 ($\pm$ 0.3)
Adults without Pendant(s)	-12.0 ($\pm$ 1.3)	10.3 ($\pm$ 0.7)
Significance	0.589	0.344
Adults with Shell Pendant(s)	-14.5 ($\pm$ n/a)	10.9 ($\pm$ n/a)
Adults without Shell Pendant(s)	-12.0 ($\pm$ 1.3)	10.3 ($\pm$ 0.7)
Significance	0.251	0.451
Adults with Metal/Stain(s)	-12.6 ($\pm$ 2.1)	10.7 ($\pm$ 0.6)
Adults without Metal/Stain(s)	-11.9 ($\pm$ 1.2)	10.3 ($\pm$ 0.7)
Significance	0.613	0.214
Adults with a Green Stain	-13.7 ($\pm$ 2.6)	10.7 ($\pm$ 0.9)
Adults without a Green Stain	-11.9 ($\pm$ 1.2)	10.3 ($\pm$ 0.7)
Significance	0.175	0.577
Adults with Lithic(s)	-12.4 ($\pm$ 1.8)	10.6 ($\pm$ 0.6)
Adults without Lithic(s)	-11.9 ($\pm$ 1.1)	10.2 ($\pm$ 0.7)
Significance	0.506	0.044
Adults with Toolkit(s)	-12.4 ($\pm$ 0.8)	10.5 ($\pm$ 0.7)
Adults without Toolkit(s)	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.418	0.759
Adults with Ground Stone Artifact(s)	-12.4 ($\pm$ 0.8)	10.5 ($\pm$ 0.7)
Adults without Ground Stone Artifact(s)	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.418	0.759
Adults with Hematite (Ground)	-12.3 ($\pm$ 1.1)	10.9 ($\pm$ 0.2)
Adults without Hematite (Ground)	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.729	0.145

Table D.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adults with Celt(s)	-11.5 ($\pm$ n/a)	11.0 ($\pm$ n/a)
Adults without Celt(s)	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.711	0.267
Adults with Plummet(s)	-12.1 ($\pm$ 0.9)	10.4 ($\pm$ 0.9)
Adults without Plummet(s)	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.808	0.996
Adults with Abrader(s)	-12.1 ($\pm$ 0.9)	10.4 ($\pm$ 0.9)
Adults without Abrader(s)	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.808	0.996
Adults with Chipped Stone Artifact(s)	-12.3 ($\pm$ 1.8)	10.6 ($\pm$ 0.6)
Adults without Chipped Stone Artifact(s)	-11.9 ($\pm$ 1.1)	10.2 ($\pm$ 0.7)
Significance	0.580	0.054
Adults with Scraper(s)	-11.5 ($\pm$ n/a)	11.0 ($\pm$ n/a)
Adults without Scraper(s)	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.711	0.348
Adults with Projectile Point(s)	-12.5 ($\pm$ 1.8)	10.6 ($\pm$ 0.6)
Adults without Projectile Point(s)	-11.8 ($\pm$ 1.1)	10.2 ($\pm$ 0.7)
Significance	0.161	0.049
Adults with Knife/Knives	-11.8 ($\pm$ 1.0)	10.5 ($\pm$ 0.7)
Adults without Knife/Knives	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.636	0.721
Adults with Pottery	-11.8 ($\pm$ 1.5)	10.3 ($\pm$ 0.7)
Adults without Pottery	-12.1 ($\pm$ 1.3)	10.3 ($\pm$ 0.7)
Significance	0.758	0.992
Adults with Hybrid Vessel(s)	-11.5 ($\pm$ 0.6)	10.2 ($\pm$ 0.6)
Adults without Hybrid Vessel(s)	-12.0 ($\pm$ 1.4)	10.4 ($\pm$ 0.7)
Significance	0.445	0.708
Adults with Oneota Vessel(s)	-12.0 ($\pm$ 1.8)	10.3 ($\pm$ 0.8)
Adults without Oneota Vessel(s)	-12.0 ($\pm$ 1.3)	10.4 ($\pm$ 0.7)
Significance	0.673	0.920
Adults with Bottle(s)	-12.0 ($\pm$ 1.8)	10.3 ($\pm$ 0.8)
Adults without Bottle(s)	-12.0 ($\pm$ 1.3)	10.4 ($\pm$ 0.7)
Significance	0.673	0.920
Adults with Deep-Rimmed Plate(s)	-12.2 ($\pm$ n/a)	10.3 ($\pm$ n/a)
Adults with Deep-Rimmed Plate(s)	-12.0 ($\pm$ 1.4)	10.3 ($\pm$ 0.7)
Significance	0.844	0.908
Adults with Bowl(s)	-10.1 ($\pm$ n/a)	10.5 ($\pm$ n/a)
Adults without Bowl(s)	-12.0 ($\pm$ 1.3)	10.3 ($\pm$ 0.7)
Significance	0.178	0.799

Table D.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adults with Jar(s)	-12.0 (± 1.6)	10.3 (± 0.8)
Adults without Jar(s)	-12.0 (± 1.3)	10.4 (± 0.7)
Significance	0.748	0.738
Adults with Pottery or Shell Spoon(s)	-11.9 (± 1.4)	10.3 (± 0.9)
Adults without Pottery or Shell Spoon(s)	-11.9 (± 2.4)	10.6 (± 1.1)
Significance	0.539	0.299
Adults with Ceremonial Item(s)	-12.4 (± 0.8)	10.5 (± 0.7)
Adults without Ceremonial Item(s)	-11.9 (± 2.2)	10.6 (± 1.0)
Significance	0.341	0.870
*Statistically significant at the 0.05 level; the Mann-Whitney U test was used to compare means of $\delta^{13}\text{C}$ values and independent samples the t-test was used to determine statistical significance of $\delta^{15}\text{N}$ values.		

Appendix E: Grave Good Associated Variation in Adult Female $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values

Table E.1 Grave Good Associated Variation in Adult Female $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adult Females with Grave Good(s)	-11.73	10.26
Adult Females without Grave Good(s)	-11.67	9.92
Significance	0.845	0.348
Adult Females with Faunal Remain(s)	-12.55	11.46
Adult Females without Faunal Remain(s)	-11.61	9.92
Significance	0.078	0.355
Adult Females with Freshwater Shell	-12.57 ($\pm n/a$)	12.44 ($\pm n/a$)
Adult Females without Freshwater Shell	-11.65 (± 1.00)	9.95 (± 0.50)
Significance	0.273	0.000*
Adult Females with a Shell Rattle(s)	-	-
Adult Females without a Shell Rattle(s)	-	-
Significance	-	-
Adult Females with a Shell Hoe(s)	-12.57 ($\pm n/a$)	12.44 ($\pm n/a$)
Adult Females without a Shell Hoe(s)	-11.65 (± 1.00)	9.95 (± 0.50)
Significance	0.273	0.000*
Adult Females with a Freshwater Shell Spoon(s)	-	-
Adult Females without a Freshwater Shell Spoon(s)	-	-
Significance	-	-
Adult Females with Bone Tool(s)	-	-
Adult Females without Bone Tool(s)	-	-
Significance	-	-
Adult Females with Bone Fishhook(s)	-	-
Adult Females without Bone Fishhook(s)	-	-
Significance	-	-
Adult Females with Bone Projectile Point(s)	-	-
Adult Females without Bone Projectile Point(s)	-	-
Significance	-	-
Adult Females with Scarifier(s)	-	-
Adult Females without Scarifier(s)	-	-
Significance	-	-
Adult Females with Misc. Bone Tool(s)	-	-
Adult Females without Misc. Bone Tool(s)	-	-
Significance	-	-
Adult Females with Antler	-	-
Adult Females without Antler	-	-
Significance	-	-

Table E.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adult Females with Antler Flaker(s)	-	-
Adult Females without Antler Flaker(s)	-	-
Significance	-	-
Adult Females with Antler Handle(s)	-	-
Adult Females without Antler Handle(s)	-	-
Significance	-	-
Adult Females with Adornment(s)	-12.54 ($\pm$ n/a)	10.49 ($\pm$ n/a)
Adult Females without Adornment(s)	-11.65 ($\pm$ 1.00)	10.04 ($\pm$ 0.73)
Significance	0.364	0.553
Adult Females with Bone Pin(s)	-12.54 ($\pm$ n/a)	10.49 ($\pm$ n/a)
Adult Females without Bone Pin(s)	-11.65 ($\pm$ 1.00)	10.04 ($\pm$ 0.73)
Significance	0.364	0.553
Adult Females with Bead(s)	-	-
Adult Females without Bead(s)	-	-
Significance	-	-
Adult Females with Pendant(s)	-	-
Adult Females without Pendant(s)	-	-
Significance	-	-
Adult Females with Shell Pendant(s)	-	-
Adult Females without Shell Pendant(s)	-	-
Significance	-	-
Adult Females with Metal/Stain(s)	-	-
Adult Females without Metal/Stain(s)	-	-
Significance	-	-
Adult Females with a Green Stain	-	-
Adult Females without a Green Stain	-	-
Significance	-	-
Adult Females with Lithic(s)	-10.81	9.65
Adult Females without Lithic(s)	-11.74	10.08
Significance	0.364	0.576
Adult Females with Toolkit(s)	-	-
Adult Females without Toolkit(s)	-	-
Significance	-	-
Adult Females with Ground Stone Artifact(s)	-	-
Adult Females without Ground Stone Artifact(s)	-	-
Significance	-	-
Adult Females with Hematite (Ground)	-	-
Adult Females without Hematite (Ground)	-	-
Significance	-	-

Table E.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adult Females with Celt(s)	-	-
Adult Females without Celt(s)	-	-
Significance	-	-
Adult Females with Plummet(s)	-	-
Adult Females without Plummet(s)	-	-
Significance	-	-
Adult Females with Abrader(s)	-	-
Adult Females without Abrader(s)	-	-
Significance	-	-
Adult Females with Chipped Stone Artifact(s)	-10.81 ($\pm$ n/a)	9.65 ($\pm$ n/a)
Adult Females without Chipped Stone Artifact(s)	-11.74 ($\pm$ 1.00)	10.08 ($\pm$ 0.73)
Significance	0.364	0.576
Adult Females with Scraper(s)	-	-
Adult Females without Scraper(s)	-	-
Significance	-	-
Adult Females with Projectile Point(s)	-	-
Adult Females without Projectile Point(s)	-	-
Significance	-	-
Adult Females with Knife/Knives	-10.81 ($\pm$ n/a)	9.65 ($\pm$ n/a)
Adult Females without Knife/Knives	-11.74 ($\pm$ 1.00)	10.08 ($\pm$ 0.73)
Significance	0.364	0.576
Adult Females with Pottery	-11.75 ($\pm$ 1.25)	9.86 ($\pm$ 0.44)
Adult Females without Pottery	-11.68 ($\pm$ 0.95)	10.12 ($\pm$ 0.78)
Significance	0.940	0.376
Adult Females with Hybrid Vessel(s)	-11.14 ($\pm$ n/a)	9.63 ($\pm$ n/a)
Adult Females without Hybrid Vessel(s)	-11.72 ($\pm$ 1.01)	10.08 ($\pm$ 0.73)
Significance	0.727	0.558
Adult Females with Oneota Vessel(s)	-11.90 ($\pm$ 1.39)	9.92 ($\pm$ 0.49)
Adult Females without Oneota Vessel(s)	-11.65 ($\pm$ 0.93)	10.09 ($\pm$ 0.77)
Significance	0.712	0.599
Adult Females with Bottle(s)	-11.90 ($\pm$ 1.39)	9.92 ($\pm$ 0.49)
Adult Females without Bottle(s)	-11.65 ($\pm$ 0.93)	10.09 ($\pm$ 0.77)
Significance	0.712	0.599
Adult Females with Deep-Rimmed Plate(s)	-	-
Adult Females with Deep-Rimmed Plate(s)	-	-
Significance	-	-
Adult Females with Bowl(s)	-10.14 ($\pm$ n/a)	10.52 ($\pm$ n/a)
Adult Females without Bowl(s)	-11.77 ($\pm$ 0.96)	10.04 ($\pm$ 0.73)
Significance	0.273	0.525

Table E.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adult Females with Jar(s)	-12.15 (± 1.01)	9.70 (± 0.29)
Adult Females without Jar(s)	-11.60 (± 0.99)	10.14 (± 0.77)
Significance	0.434	0.078
Adult Females with Pottery or Shell Spoon(s)	-11.75	9.86
Adult Females without Pottery or Shell Spoon(s)	-11.68	10.12
Significance	0.940	0.376
Adult Females with Ceremonial Item(s)	-	-
Adult Females without Ceremonial Item(s)	-	-
Significance	-	-
- indicates no adult females were buried with this artifact type *Statistically significant at the 0.05 level; the Mann-Whitney U test was used to compare means of $\delta^{13}\text{C}$ values and independent samples t-test was used for $\delta^{15}\text{N}$ values.		

Appendix F: Grave Good Associated Variation in Adult Male $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values

Table F.1 Grave Good Associated Variation in Adult Male $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adult Males with Grave Good(s)	-12.52	10.72
Adult Males without Grave Good(s)	-11.94	10.33
Significance	0.531	0.148
Adult Males with Faunal Remain(s)	-12.34	10.42
Adult Males without Faunal Remain(s)	-12.28	10.65
Significance	0.785	0.505
Adult Males with Freshwater Shell	-10.96	11.31
Adult Males without Freshwater Shell	-12.41	10.55
Significance	0.569	0.407
Adult Males with a Shell Rattle(s)	-13.06	10.73
Adult Males without a Shell Rattle(s)	-12.25	10.61
Significance	0.609	0.835
Adult Males with a Shell Hoe(s)	-	-
Adult Males without a Shell Hoe(s)	-	-
Significance	-	-
Adult Males with a Freshwater Shell Spoon(s)	-8.86	11.89
Adult Males without a Freshwater Shell Spoon(s)	-11.89	10.56
Significance	0.022	0.017*
Adult Males with Bone Tool(s)	-13.45	10.70
Adult Males without Bone Tool(s)	-12.04	10.60
Significance	0.250	0.802
Adult Males with Bone Fishhook(s)	-14.04	11.18
Adult Males without Bone Fishhook(s)	-12.12	10.56
Significance	0.506	0.105
Adult Males with Bone Projectile Point(s)	-11.45	11.00
Adult Males without Bone Projectile Point(s)	-12.33	10.60
Significance	0.696	0.500
Adult Males with Scarifier(s)	-12.05	10.35
Adult Males without Scarifier(s)	-12.31	10.64
Significance	1.000	0.731
Adult Males with Misc. Bone Tool(s)	-12.26	10.86
Adult Males without Misc. Bone Tool(s)	-12.29	10.59
Significance	0.957	0.216
Adult Males with Antler	-12.26	10.86
Adult Males without Antler	-12.29	10.59
Significance	0.957	0.216

Table F.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adult Males with Antler Flaker(s)	-13.06	10.73
Adult Males without Antler Flaker(s)	-12.25	10.61
Significance	0.609	0.835
Adult Males with Antler Handle(s)	-11.45	11.00
Adult Males without Antler Handle(s)	-12.33	10.60
Significance	0.696	0.500
Adult Males with Adornment(s)	-12.54	10.77
Adult Males without Adornment(s)	-12.25	10.59
Significance	0.966	0.220
Adult Males with Bone Pin(s)	-12.05	10.71
Adult Males without Bone Pin(s)	-12.30	10.61
Significance	0.870	0.870
Adult Males with Bead(s)	-14.50	10.87
Adult Males without Bead(s)	-12.19	10.60
Significance	0.174	0.649
Adult Males with Pendant(s)	-12.57	10.62
Adult Males without Pendant(s)	-12.24	10.61
Significance	0.830	0.962
Adult Males with Shell Pendant(s)	-14.50	10.87
Adult Males without Shell Pendant(s)	-12.25	10.61
Significance	0.257	0.675
Adult Males with Metal/Stain(s)	-12.60	10.66
Adult Males without Metal/Stain(s)	-12.18	10.60
Significance	1.000	0.834
Adult Males with a Green Stain	-13.65	10.65
Adult Males without a Green Stain	-12.08	10.61
Significance	0.355	0.763
Adult Males with Lithic(s)	-12.48	10.71
Adult Males without Lithic(s)	-12.13	10.44
Significance	0.593	0.269
Adult Males with Toolkit(s)	-12.39	10.47
Adult Males without Toolkit(s)	-12.27	10.63
Significance	0.763	0.733
Adult Males with Ground Stone Artifact(s)	-12.39	10.47
Adult Males without Ground Stone Artifact(s)	-12.27	10.63
Significance	0.763	0.733
Adult Males with Hematite (Ground)	-12.26	10.86
Adult Males without Hematite (Ground)	-12.29	10.59
Significance	0.957	0.216

Table F.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adult Males with Celt(s)	-11.45	11.00
Adult Males without Celt(s)	-12.33	10.60
Significance	0.696	0.500
Adult Males with Plummets(s)	-12.05	10.35
Adult Males without Plummets(s)	-12.31	10.64
Significance	1.000	0.731
Adult Males with Abrader(s)	-12.05	10.35
Adult Males without Abrader(s)	-12.31	10.64
Significance	1.000	0.731
Adult Males with Chipped Stone Artifact(s)	-12.35	10.68
Adult Males without Chipped Stone Artifact(s)	-12.19	10.50
Significance	0.975	0.454
Adult Males with Scraper(s)	-11.45	11.00
Adult Males without Scraper(s)	-12.33	10.60
Significance	0.696	0.5000
Adult Males with Projectile Point(s)	-12.46	10.64
Adult Males without Projectile Point(s)	-12.06	10.57
Significance	0.563	0.774
Adult Males with Knife/Knives	-12.02	10.66
Adult Males without Knife/Knives	-12.34	10.60
Significance	0.725	0.880
Adult Males with Pottery	-11.83	10.68
Adult Males without Pottery	-12.49	10.58
Significance	0.492	0.734
Adult Males with Hybrid Vessel(s)	-11.61	10.50
Adult Males without Hybrid Vessel(s)	-12.35	10.62
Significance	0.506	0.696
Adult Males with Oneota Vessel(s)	-12.10	10.71
Adult Males without Oneota Vessel(s)	-12.33	10.59
Significance	0.907	0.804
Adult Males with Bottle(s)	-12.10	10.71
Adult Males without Bottle(s)	-12.33	10.59
Significance	0.907	0.804
Adult Males with Deep-Rimmed Plate(s)	-12.17	10.26
Adult Males with Deep-Rimmed Plate(s)	-12.29	10.63
Significance	1.000	0.536
Adult Males with Bowl(s)	-	-
Adult Males without Bowl(s)	-	-
Significance	-	-

Table F.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Adult Males with Jar(s)	-11.89	10.72
Adult Males without Jar(s)	-12.40	10.58
Significance	0.745	0.725
Adult Males with Pottery or Shell Spoon(s)	-11.83	10.68
Adult Males without Pottery or Shell Spoon(s)	-12.49	10.58
Significance	0.492	0.734
Adult Males with Ceremonial Item(s)	-12.39	10.47
Adult Males without Ceremonial Item(s)	-12.27	10.63
Significance	0.763	0.733
- indicates no adult males were buried with this artifact type *Statistically significant at the 0.05 level; the Mann-Whitney U test was used to compare means of $\delta^{13}\text{C}$ values and independent samples t-test was used for $\delta^{15}\text{N}$ values.		

Appendix G: Grave Good Associated Variation in Subadult $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values

Table G.1. Grave Good Associated Variation in Subadult $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Subadults with Grave Good(s)	-12.64 (± 1.81)	10.44 (± 1.19)
Subadults without Grave Good(s)	-11.41 (± 3.57)	11.08 (± 1.42)
Significance	0.057	0.255
Subadults with Faunal Remain(s)	-12.49 (± 1.90)	10.63 (± 1.15)
Subadults without Faunal Remain(s)	-11.54 (± 3.51)	10.97 (± 1.45)
Significance	0.141	0.541
Subadults with Marine Shell	-12.85 (± 2.38)	10.58 (± 1.23)
Subadults without Marine Shell	-11.61 (± 3.26)	10.93 (± 1.40)
Significance	0.295	0.630
Subadults with Freshwater Shell	-10.70 ($\pm n/a$)	12.18 ($\pm n/a$)
Subadults without Freshwater Shell	-11.85 (± 3.19)	10.82 (± 1.36)
Significance	1.000	0.339
Subadults with a Shell Rattle(s)	-	-
Subadults without a Shell Rattle(s)	-	-
Significance	-	-
Subadults with a Shell Hoe(s)	-	-
Subadults without a Shell Hoe(s)	-	-
Significance	-	-
Subadults with a Freshwater Shell Spoon(s)	-10.70 ($\pm n/a$)	12.18 ($\pm n/a$)
Subadults without a Freshwater Shell Spoon(s)	-11.85 (± 3.19)	10.82 (± 1.36)
Significance	1.000	0.339
Subadults with Bone Tool(s)	-	-
Subadults without Bone Tool(s)	-	-
Significance	-	-
Subadults with Bone Fishhook(s)	-	-
Subadults without Bone Fishhook(s)	-	-
Significance	-	-
Subadults with Bone Projectile Point(s)	-	-
Subadults without Bone Projectile Point(s)	-	-
Significance	-	-
Subadults with Scarifier(s)	-	-
Subadults without Scarifier(s)	-	-
Significance	-	-
Subadults with Misc. Bone Tool(s)	-	-
Subadults without Misc. Bone Tool(s)	-	-
Significance	-	-

Table G.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Subadults with Antler	-	-
Subadults without Antler	-	-
Significance	-	-
Subadults with Antler Flaker(s)	-	-
Subadults without Antler Flaker(s)	-	-
Significance	-	-
Subadults with Antler Handle(s)	-	-
Subadults without Antler Handle(s)	-	-
Significance	-	-
Subadults with Adornment(s)	-12.49 (± 1.90)	10.63 (± 1.15)
Subadults without Adornment(s)	-11.54 (± 3.51)	10.97 (± 1.45)
Significance	0.141	0.541
Subadults with Bone Pin(s)	-12.89 (± 2.74)	11.16 (± 1.02)
Subadults without Bone Pin(s)	-11.66 (± 3.21)	10.84 (± 1.41)
Significance	0.311	0.652
Subadults with Bead(s)	-13.19 (± 2.31)	10.62 (± 1.18)
Subadults without Bead(s)	-11.54 (± 3.24)	10.92 (± 1.41)
Significance	0.177	0.670
Subadults with Pendant(s)	-12.75 (± 2.91)	10.92 (± 1.24)
Subadults without Pendant(s)	-11.68 (± 3.20)	10.87 (± 1.40)
Significance	0.497	0.951
Subadults with Shell Pendant(s)	-12.75 (± 2.91)	10.92 (± 1.24)
Subadults without Shell Pendant(s)	-11.68 (± 3.20)	10.87 (± 1.40)
Significance	0.497	0.951
Subadults with a Green Stain	-	-
Subadults without a Green Stain	-	-
Significance	-	-
Subadults with Lithic(s)	-12.45 (± 0.78)	9.82 (± 0.29)
Subadults without Lithic(s)	-11.72 (± 3.33)	11.02 (± 1.39)
Significance	0.273	0.003*
Subadults with Toolkit(s)	-	-
Subadults without Toolkit(s)	-	-
Significance	-	-
Subadults with Ground Stone Artifact(s)	-	-
Subadults without Ground Stone Artifact(s)	-	-
Significance	-	-
Subadults with Hematite (Ground)	-	-
Subadults without Hematite (Ground)	-	-
Significance	-	-

Table G.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Subadults with Celt(s)	-	-
Subadults without Celt(s)	-	-
Significance	-	-
Subadults with Plummet(s)	-	-
Subadults without Plummet(s)	-	-
Significance	-	-
Subadults with Abrader(s)	-	-
Subadults without Abrader(s)	-	-
Significance	-	-
Subadults with Chipped Stone Artifact(s)	-11.99 ($\pm$ n/a)	9.57 ($\pm$ n/a)
Subadults without Chipped Stone Artifact(s)	-11.80 ($\pm$ 3.20)	10.93 ($\pm$ 1.36)
Significance	0.800	0.338
Subadults with Scraper(s)	-11.99 ($\pm$ n/a)	9.57 ($\pm$ n/a)
Subadults without Scraper(s)	-11.80 ($\pm$ 3.20)	10.93 ($\pm$ 1.36)
Significance	0.800	0.338
Subadults with Projectile Point(s)	-	-
Subadults without Projectile Point(s)	-	-
Significance	-	-
Subadults with Knife/Knives	-	-
Subadults without Knife/Knives	-	-
Significance	-	-
Subadults with Pottery	-12.41 ($\pm$ 1.25)	10.03 ($\pm$ 1.03)
Subadults without Pottery	-11.62 ($\pm$ 3.53)	11.14 ($\pm$ 1.36)
Significance	0.138	0.057
Subadults with Mississippian Pottery	-13.66 ($\pm$ n/a)	9.14 ($\pm$ n/a)
Subadults without Mississippian Pottery	-11.73 ($\pm$ 3.17)	10.95 ($\pm$ 1.34)
Significance	0.400	0.198
Subadults with Oneota Vessel(s)	-11.86 ($\pm$ 1.18)	10.32 ($\pm$ 1.17)
Subadults without Oneota Vessel(s)	-11.80 ($\pm$ 3.40)	10.98 ($\pm$ 1.39)
Significance	0.543	0.369
Subadults with Bottle(s)	-12.22 ($\pm$ 1.30)	10.09 ($\pm$ 1.14)
Subadults without Bottle(s)	-11.70 ($\pm$ 3.46)	11.07 ($\pm$ 1.36)
Significance	0.272	0.140
Subadults with Deep-Rimmed Plate(s)	-	-
Subadults with Deep-Rimmed Plate(s)	-	-
Significance	-	-
Subadults with Bowl(s)	-	-
Subadults without Bowl(s)	-	-
Significance	-	-

Table G.1 (cont'd)		
Grave Good Category	$\delta^{13}\text{C}$ Mean Values	$\delta^{15}\text{N}$ Mean Values
Subadults with Jar(s)	-11.86 (± 1.18)	10.32 (± 1.17)
Subadults without Jar(s)	-11.80 (± 3.40)	10.98 (± 1.39)
Significance	0.543	0.366
Subadults with Pottery or Shell Spoon(s)	-12.16 (± 1.31)	10.34 (± 1.24)
Subadults without Pottery or Shell Spoon(s)	-11.67 (± 3.63)	11.09 (± 1.38)
Significance	0.178	0.214
Subadults with Ceremonial Item(s)	-	-
Subadults without Ceremonial Item(s)	-	-
Significance	-	-
- indicates no subadults were buried with this artifact type *Statistically significant at the 0.05 level; the Mann-Whitney U test was used to compare means of both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values.		

Appendix H: Spatial Analysis of Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values at Norris Farms 36

Table H.1 High/Low Clusters of Mortuary Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values		
	Z Score	P Value
Age	-2.535	0.011*
Sex	-2.117	0.034*
Individuals with Grave Good(s)	-0.914	0.361
Individuals with Faunal Remain(s)	0.260	0.795
Individuals with Marine Shell	0.447	0.655
Individuals with Freshwater Shell	0.496	0.620
Individuals with a Freshwater Shell Spoon(s)	-0.266	0.790
Individuals with Bone Tool(s)	-0.408	0.683
Individuals with Bone Fishhook(s)	-0.266	0.790
Individuals with Scarifier(s)	0.161	0.108
Individuals with Antler	-0.266	0.790
Individuals with Pottery	-0.828	0.408
Individuals with Hybrid Vessel(s)	-0.458	0.647
Individuals with Oneota Vessel(s)	0.401	0.688
Individuals with Bottle(s)	0.717	0.473
Individuals with Jar(s)	0.018	0.986
Individuals with Adornment(s)	0.477	0.633
Individuals with Bone Pin(s)	-0.176	0.861
Individuals with Bead(s)	3.426	0.001*
Individuals with Pendant(s)	-0.226	0.821
Individuals with a Green Stain	1.169	0.242
Individuals with Lithic(s)	-0.668	0.504
Individuals with Toolkit(s)	0.617	0.537
Individuals with Metal/Stain(s)	0.182	0.856
Individuals with Ground Stone Artifact(s)	0.617	0.537
Individuals with Hematite (Ground)	-0.266	0.790
Individuals with Plummet(s)	1.605	0.108
Individuals with Abrader(s)	1.605	0.108
Individuals with Chipped Stone Artifact(s)	-0.906	0.365
Individuals with Scraper(s)	-0.266	0.790
Individuals with Projectile point(s)	-0.912	0.362
Individuals with Knife/Knives	0.469	0.639
Single/Multiple Burials	0.265	0.791
Skeletal Position	0.162	0.871
Evidence of Warfare	0.264	0.792

Table H.1 (cont'd)		
Perimortem Trauma	1.907	0.056
Antemortem Trauma	-0.718	0.473
Evidence of Chronic Disease	0.836	0.403
Undiagnostic Lytic Lesions	-1.014	0.311
Periostitis	-0.266	0.790
* Statistically significant at the $p < 0.05$ level Demographic categories and grave good classes were not included in this table if the sample size was too small for analysis		

Table H.2 Spatial Autocorrelation of Mortuary Variation in $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$ Values		
	Index Value	P Value
Age	0.214	0.002*
Sex	0.117	0.083
Individuals with Grave Good(s)	0.043	0.451
Individuals with Faunal Remain(s)	0.061	0.313
Individuals with Marine Shell	0.009	0.724
Individuals with Freshwater Shell	0.040	0.456
Individuals with a Shell Rattle(s)	-0.010	0.778
Individuals with a Shell Hoe(s)	0.002	0.286
Individuals with a Freshwater Shell Spoon(s)	-0.035	0.710
Individuals with Bone Tool(s)	-0.008	0.926
Individuals with Bone Fishhook(s)	-0.024	0.868
Individuals with Bone Projectile point(s)	-0.007	0.635
Individuals with Misc. Bone Tool(s)	-0.018	0.952
Individuals with Scarifier(s)	0.071	0.126
Individuals with Antler	-0.018	0.952
Individuals with Antler Flaker(s)	-0.010	0.778
Individuals with Pottery	-0.008	0.935
Individuals with Mississippian Pottery	-0.045	0.044*
Individuals with Hybrid Vessel(s)	-0.001	0.835
Individuals with Oneota Vessel(s)	0.078	1.245
Individuals with Bottle(s)	0.073	0.242
Individuals with Deep-Rimmed Plate(s)	0.007	0.159
Individuals with Bowl(s)	-0.011	0.793
Individuals with Jar(s)	0.065	0.287
Individuals with Adornment(s)	0.039	0.472
Individuals with Bone Pin(s)	-0.008	0.922

Table H.2 (cont'd)		
Individuals with Bead(s)	0.179	0.006*
Individuals with Pendant(s)	0.036	0.474
Individuals with Shell Pendant(s)	0.024	0.573
Individuals with a Green Stain	0.045	0.351
Individuals with Lithic(s)	0.041	0.459
Individuals with Toolkit(s)	0.026	0.525
Individuals with Metal/Stain(s)	0.040	0.446
Individuals with Ground Stone Artifact(s)	0.026	0.525
Individuals with Hematite (Ground)	-0.018	0.952
Individuals with Celt(s)	-0.007	0.635
Individuals with Plummet(s)	0.071	0.126
Individuals with Abrader(s)	0.071	0.126
Individuals with Chipped Stone Artifact(s)	0.012	0.721
Individuals with Scraper(s)	-0.004	0.816
Individuals with Projectile point(s)	-0.031	0.827
Individuals with Knife/Knives	-0.004	0.522
Single/Multiple Burials	0.159	0.019*
Skeletal Position	0.118	0.054
Evidence of Warfare	0.068	0.261
Perimortem Trauma	0.202	0.004*
Evidence of Scalping	-0.061	0.465
Evidence of Decapitation	0.234	0.001
Antemortem Trauma	-0.006	0.911
Evidence of Chronic Disease	-0.005	0.894
Undiagnostic Lytic Lesions	-0.110	0.181
Periostitis	-0.071	0.314
* Statistically significant at the $p<0.05$ level. Demographic categories and grave good classes were not included in this table if the sample size was too small for analysis		

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April 3, 2013

Bonnie W. Styles,
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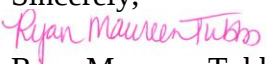
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