Maya Farming Communities and the Long View of Sustainability at Tzacauil

by

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Acknowledgments

This work is not only mine – it belongs to the many people who have helped me bring it into existence. I have thought often over the last years of what it would be like to sit down and write these acknowledgments. Yet now faced with the task, it feels impossible to capture my gratitude with words. There have been many who have helped me since I started at Michigan in 2011, and I will do my best to express – more accurately, to ramble – my appreciation for them here.

I'll start with the archaeological support I had in Mexico. I've learned so much from the co-directors of the *Proyecto de Interacción Política del Centro de Yucatán* (PIPCY). Travis Stanton gave me independence and support during my time working at Yaxuná and Tzacauil. I'll always be grateful to him for creating these opportunities for me, even when I was just starting out. Traci Ardren has been a beacon of the kind of archaeologist and person I aspire to be. I admire Aline Magnoni's enthusiasm for fieldwork and her patience as a teacher. These three individuals have been so generous with their time and resources, and I thank them sincerely for that.

Getting to be a part of PIPCY also meant joining a tightknit community of truly wonderful archaeologists. It's amazing how much of a difference that kind of community can make for your work.

With that in mind, I want to thank first the PIPCY archaeologists who helped me directly with my fieldwork. Dan Griffin and Stephanie Miller helped me with surface collection at Yaxuná in 2014. That will always be one of my favorite seasons, ever. In 2015 I directed excavations of house groups at Yaxuná, where I was helped by Augustín Calderón, Kadwin Pérez López, Juan Pablo Sanchez-Williams, Anna Bishop, Stephanie Miller, and Patrick Rohrer. Later that season we transitioned to work at Tzacauil for the first time, excavating the Chamal Group and a few test pits elsewhere around the site. I was helped by Nelda Marengo Camacho, Tanya Cariño Anaya, and

Agustín Calderón. Above all, though, the chance to work with Gustavo Novelo Rincón (Siki) at Tzacauil that season was a major turning point for me. Siki changed my entire approach to excavation, and I can't imagine how I could have directed excavations at Tzacauil in subsequent seasons without Siki's help at the first house group. In 2016, I was assisted by Harper Dine and Roger Sierra of the University of Miami during excavations of the Pool Group. César Torres Ochoa directed excavations of the test pit in the Tzacauil Acropolis. Ashuni Romero Buitrón began the meticulous work of launching excavations of the Jach Group. In the final season of work at Tzacauil, I was joined again by Harper Dine, who went on to direct excavations of Structures 3C and 8C. Harper proved herself to be a godsend to me in the field – she was reliable, eager to learn, and able to anticipate the needs of the project on a day-to day-basis. I'm so grateful for the help that all of these archaeologists gave me in the field.

Some of these wonderful people I met through PIPCY I count now among my dearest friends. The friendships I made with PIPCY archaeologists through long nights of sitting around the *comedor*, and traveling together everywhere from Pisté to Calakmul to San Cristóbal, have become some of the most meaningful of my life. My gratitude goes to each and every person who made that community during the 2013-2017 field seasons. I want to thank especially Ryan Collins, Dan Griffin, Nelda Marengo Camacho, Stephanie Miller, César Torres Ochoa, and Julie Wesp. These brilliant souls were the reason I was able to approach this work *con corazón abierto, ganas de aprender, y actitud*.

I lived in Yucatán from February 2017 to February 2018, with time in Mérida bookending either end of my five month final field season. That time was transformative, but also difficult. I am grateful for the friendships that sustained me while I was there. Carolina Bendaña, who is a member of PIPCY, I include here because it was her eventual move to Mérida that helped make it feel like home in the fall of 2017. Carolina became an important friend and it was through her that I met many of the wonderful people that made me feel a part of life in Mérida. I'm so grateful to Fernando, Diego, Geral, Deborha "La Prima", Erick, Mariana, Saul, and Ricardo for offering me their friendship. I want to thank especially Alejandra Campos, Ayla Transon, and Sindi Tejera

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Turning now to Michigan, I want first to thank the University of Michigan Department of Anthropology and Museum of Anthropological Archaeology faculty for their support over the past seven years. I am especially grateful to the mentors who have offered not only their guidance, but more importantly offered me their challenges. These challenges, perhaps more than anything, made me grow as a scholar. For this I want to express my deep thanks to Jason De León, Lisa Young, and Henry Wright, as well as to my committee members Robin Beck, Kent Flannery, and Rebecca Scott.

A major part of the Michigan archaeology experience is working on a variety of different projects before "settling down" in one place. I thank the University of Michigan projects that took me on in Texas and Romania. Especially formative for me were the experiences I had working in Mesoamerica, particularly in Belize with Geoffrey Braswell and in Oaxaca with Chuck Spencer, Elsa Redmond, and Lacey Carpenter. I learned so much about the logistics of fieldwork and also about the kind of archaeologist I want to be from these early experiences. In this vein, I would also like to thank E. Christian Wells, who directed my first field school back in 2009 in Roatán. Christian later taught me soil chemistry and has been an important mentor in environmental anthropology during my time in graduate school.

I can't imagine a more supportive community than the students of the museum. From the time I started, I had as my role models some of the people I now consider to be among the rising best in our field, and the chance to overlap if only for a bit with older students like Amanda Logan, Alice Wright, Casey Barrier, and Colin Quinn was particularly influential for me. Over the years, I've loved having the chance to develop not only intellectual ties but real friendships with students in the museum, in particular with Jess Beck, Ashley Schubert, Lacey Carpenter, Christina Sampson, Jordan Dalton, Elspeth Geiger, Jo Osborn, Timothy Everhart, Kimberly Swisher, Gyorgi Parditka, James Torpy, Yuchao Zhao, Martin Menz, Lauren Pratt, and Laura Bossio.

My cohort in Anthropology has also been an intrinsic part of this experience. I'm moved when I look back on our early days together and tie those memories to where we are now. These friendships have provided a constant source of support during my time here. I'm grateful to all of our cohort, and especially to Aleksandr Sklyar, Aaron Sandel, Laura Yakas, Allison Caine, Nikolas Sweet, and Drew Haxby for their friendship.

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I have met some of my closest friends through this program. I can't adequately put into words what these relationships have meant over the course of this effort – but these were the people who were there for me, who supported me, and who celebrated with me.

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Iride Tomažič and I crossed paths fairly late in my time at Michigan, but I'm so grateful that we did. Our interactions are just as likely to involve talking archaeology as diving into obscure spiritual topics, and I'm thankful to have befriended such an open-minded and inquisitive soul here.

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And finally among the friends I want to thank, there are certain individuals I have met that I wish I could have known for longer. These connections are spontaneous but

no less meaningful; they maintain a certain meaning in being unresolved. Of these, I'm most grateful to have known the brilliant Victoria Koski-Karell.

Now to transition, I have thought often over the years that when it came time to write these acknowledgments, I'd like to thank the non-person entities that were so foundationally important to me, along with the people that gave those entities their souls. I thank the Ruthven Museums Building and all its ghosts, the libraries, and the many coffee shops and other haunts I frequented in Ann Arbor, Mérida, Pisté, and Atlanta. I thank the Truly Living Well Center for Natural Urban Agriculture in Atlanta, and the inspiring people I met through my time there. I'm grateful to the podcasts and podcasters that kept me company during the lonely hours of this work, specifically the voices of Krista Tippett, Lindsay Hansen Park, John Larsen, Lillian DeVane, and Kelly Sullivan. I appreciate the novels, poetry, and songs that sustained me. I'm also just generally grateful for cumbia.

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Table of Contents

Acknowledgments ii
List of Figures xv
List of Tables xxxv
List of Appendices xxxvii
Abstract xxxviii

Chapter 1 Introduction 1
1.1 Prelude 1
1.2 The premise of this work 4
1.3 Historical ecology and the anthropological study of landscapes 11
1.4 Introducing Tzacauil and the Yaxunah *ejido* 17
1.5 Previous archaeological work in the Yaxunah *ejido* 23
1.5.1 The Carnegie Institution of Washington in Yaxuná 23
1.5.2 The Selz Foundation Yaxuná Archaeological Project 26
1.5.3 INAH research at Yaxuná 31
1.5.4 PIPCY 31
1.6 Organization of the chapters ahead 37

Chapter 2 Sustainable Agriculture in the Maya Area 40
2.1 Introduction 40
2.2 Defining agricultural sustainability 41
2.3 Efficiency and conservation in Maya agriculture 44
2.4 Rural livelihoods and Maya agriculture 50
2.5 Governance and Maya agriculture 53

2.6 Resilience and Maya agriculture 56
2.7 Chapter summary 58

Chapter 3 The Yucatán Landscape 60
3.1 Introduction 60
3.2 Yucatán ecology 60
3.3 Defining households, houses, and houselots for Yucatán 69
3.4 Ethnographic accounts of households, houses, and houselots 70
3.4.1 The building site 74
3.4.2 Dwellings 74
3.4.3 Ancillary structures and miscellaneous features 75
3.4.4 Boundary markers 77
3.4.5 Houselot gardens 79
3.4.6 Milpas 80
3.5 Archaeological correlates of houselot activities 81
3.6 Chapter summary 84

Chapter 4 Tzacauil in Context: Yaxuná and the Northern Maya Lowlands 86
4.1 Introduction 86
4.2 History at Yaxuná, ca. 1000 BC – AD 1000 87
4.2.1 Pre-Formative origins 87
4.2.2 The Middle Formative 89
4.2.3 The Late Formative 98
4.2.4 The Terminal Formative 111
4.2.5 The Early Classic 113
4.2.6 The Late Classic 115
4.2.7 The Terminal Classic 118
4.2.8 The Postclassic 120
4.3 Comparative perspectives from Komchen, Yucatán 120
4.4 Chapter summary 126

Chapter 5 Assembling a Methodology of Landscape at Tzacauil 128
5.1 Introduction 128
5.2 Ethnographic methods 129
5.2.1 Xíimbal k'áax / Walking the forest 130
5.2.2 Houselot visits 138
5.3 Archaeological methods 138
5.3.1 House group excavations 142
5.3.2 Test excavation in the Tzacauil Acropolis 145
5.3.3 Intra-settlement excavations 146
5.4 Laboratory analysis of artifacts and soil samples 148
5.4.1 Artifact analysis 148
5.4.2 Soil chemistry analysis 152
5.5 Chapter summary 159

Chapter 6 Tzacauil in the Formative Period 164
6.1 Introduction 164
6.2 The Middle Formative presence at Tzacauil 164
6.3 Late Formative monumentality at Tzacauil 168
6.3.1 The Tzacauil Acropolis 169
6.3.2 The Tzacauil Sacbe 172
6.4 The Tzacauil settlement in the Formative period 178
6.5 The Jach Group 179
6.5.1 Overview of the Jach Group 179
6.5.2 Jach Group construction history and techniques 181
6.5.3 Jach Group location and intra-settlement features 195
6.5.2 Jach Group material culture 199
6.6 The P'aak Group 204
6.6.1 Overview of the P'aak Group 204
6.6.2 P'aak Group construction history and techniques 204

6.6.3 P'aak Group location and intra-settlement features 212
6.6.4 P'aak Group material culture 217
6.7 The Sáastun Group 218
6.7.1 Overview of the Sáastun Group 218
6.7.2 Sáastun Group construction history and techniques 218
6.7.3 Sáastun Group location and intra-settlement features 226
6.7.4 Sáastun Group material culture 229
6.8 The Chamal Group 230
6.8.1 Overview of the Chamal Group 230
6.8.2 Chamal Group construction history and techniques 234
6.8.3 Chamal Group location and intra-settlement features 241
6.8.4 Chamal Group material culture 248
6.9 Southwestern Tzacauil in the Formative period 249
6.9.1 Overview of southwestern Tzacauil in the Formative 249
6.9.2 Formative Kaan Group construction history 250
6.9.3 Formative Pool Group construction history 255
6.9.4 Intra-settlement features in southwestern Tzacauil 262
6.10 Chapter summary 265

Chapter 7 Tzacauil in the Classic Period 269
7.1 Introduction 269
7.2 Monumentality and life by the wayside 269
7.3 The Tzacauil settlement in the Classic 271
7.4 The Kaan Group 273
7.4.1 Overview of the Kaan Group in the Classic 273
7.4.2 Classic Kaan Group construction history 273
7.4.3 Kaan Group material culture 277
7.5 The Pool Group 281
7.5.1 Overview of the Pool Group in the Classic 281
7.5.2 Classic Pool Group construction history 281

7.5.3 Pool Group material culture 283
7.6 The Mukul Group 286
7.7 Classic intra-settlement land in southwestern Tzacauil 288
7.8 The Jaltun Group 290
7.8.1 Overview of the Jaltun Group 291
7.8.2 Jaltun Group construction history 291
7.8.3 Jaltun Group location and intra-settlement features 295
7.8.4 Jaltun Group material culture 297
7.9 The T'uup Group 297
7.9.1 Overview of the T'uup Group 297
7.9.2 T'uup Group construction history 298
7.9.3 T'uup Group location and intra-settlement features 298
7.9.4 T'uup Group material culture 301
7.10 Chapter summary 301

Chapter 8 Tzacauil in the Anthropocene 307
8.1 Introduction 307
8.2 Conquest and early Colonialism in Yucatán 308
8.3 *Haciendas* and the beginnings of privatization in Yucatán 313
8.4 Yaxunah and Cetelac in the Bourbon era, 18th-19th centuries 317
8.5 The Caste War of Yucatán 323
8.6 Yaxunah and Cetelac during the Caste War 326
8.7 Notions of industry and progress in pre-Revolution Yucatán 327
8.8 Post-Revolution agrarian reform 329
8.9 Establishing the Yaxunah *ejido*, ca. 1910-1960 332
8.10 The neoliberalization of the agricultural sector in Yucatán 336
8.11 Tzacauil and the neoliberal Yaxunah *ejido* 340
8.12 Chapter summary 353

Chapter 9 The Long View of Agricultural Sustainability at Tzacauil 355

9.1 Introduction 355
9.2 Efficiency and conservation at Formative and Classic Tzacauil 356
9.3 Rural livelihoods at Formative and Classic Tzacauil 362
9.4 Governance at Formative and Classic Tzacauil 370
9.5 Resilience at Formative and Classic Tzacauil 374
9.6 The long view of agricultural sustainability: Implications for now 377
9.7 Chapter summary 379

Chapter 10 Conclusion: Xíimbal k'áax 380

Appendices 388

References 628

List of Figures

Figure

1.1 Yaxunah *ejidatarios* Don Jerónimo and Don Fausto, discussing the prospect of farming at Tzacauil 3

1.2 Map showing Tzacauil's location in the northern Maya lowlands of the Yucatán Peninsula 4

1.3 LiDAR image of Tzacauil 6

1.4 Malerized map of the Tzacauil archaeological site 6

1.5 Google Earth Image showing Tzacauil at the eastern edge of the *ejido* of the town of Yaxunah 11

1.6 Cenote X-auil 18

1.7 Cenote X-auil 18

1.8 El Manantial 19

1.9 Map of the Maya area showing Yaxuná's location 20

1.10 Yaxuná's ceremonial core 21

1.11 View of the Tzacauil Acropolis from the East Acropolis of Yaxuná 21

1.12 Carnegie Institution of Washington map of Yaxuná 25

1.13 David Freidel, co-director of the Selz Foundation Yaxuná Archaeological Project 25

1.14 Selz Foundation archaeologists excavating at Yaxuná 25

1.15 Selz Foundation map of Yaxuná 29

1.16 Yaxuná structures consolidated by INAH 32

1.17 Map of the PIPCY study region 32

1.18 Map of the PIPCY survey project area east of Yaxuná 34

1.19 PIPCY team that mapped Tzacauil in 2007 36

1.20 Mapping Yaxuná's eastern hinterland 36

1.21 PIPCY surface collection team in the 2014 season 37
1.22 PIPCY archaeologists, 2014 season 37
2.1 The five principles of sustainable agriculture outlined by the FAO 44
3.1 Map of geological zones 62
3.2 Exposed bedrock 64
3.3 *Sarteneja* in bedrock at Tzacauil 64
3.4 Large *sarteneja* at Tzacauil 64
3.5 *Sarteneja* at Tzacauil, possibly modified 64
3.6 *Milpa* planted on bedrock and soil 66
3.7 Natural container gardening in a bedrock cavity 66
3.8 Kancab 67
3.9 Plan of a 20th century Yucatán houselot 71
3.10 20th century Chan Kom houselot 71
3.11 Houselot garden at Yaxunah 76
3.12 Yaxunah houselot with ancillary structures 76
3.13 Outdoor kitchen in Yaxunah 76
3.14 Hearth and turkeys in a Yaxunah houselot 76
3.15 Cooking and eating in a Yaxunah houselot 76
3.16 Yaxunah houselot orchard 76
3.17 Corncrib in a Yaxunah houselot 77
3.18 Limestone extracting pit in a Yaxunah houselot 77
3.19 *Albarrada* houselot wall 78
3.20 Orchard and garden in a Yaxunah houselot 78
3.21 Container gardening in a Yaxunah houselot 78
3.22 *Milpa* in the Yaxunah *ejido* 78
4.1 LiDAR image of the Yaxuná E Group 96
4.2 Floor sequence in the Yaxuná E Group Plaza 96
4.3 Incised cross in early plaza floor at the Yaxuná E Group 96
4.4 Formative settlement and monumental architecture at Yaxuná 104
4.5 Yaxuná East Acropolis 105

4.6 Plan of the Yaxuná East Acropolis showing location of 2013 test pit 105
4.7 Construction cells in fill of the Yaxuná East Acropolis 107
4.8 Boulder-lined platform at Yaxuná 107
4.9 Boulder-lined platform at Yaxuná 107
4.10 Boulder-lined platform at Yaxuná 107
4.11 Middle Formative sites in the Yaxuná hinterland 110
4.12 Late Formative sites in the Yaxuná hinterland 110
5.1 Tzacauil survey team at Yaxuná 133
5.2 Tzacauil survey team 134
5.3 Tzacauil survey team 134
5.4 Tzacauil survey team 134
5.5 Tzacauil survey team 134
5.6 Tzacauil survey team 134
5.7 Tzacauil survey team 134
5.8 Tzacauil survey team 134
5.9 Tzacauil survey team 134
5.10 Tzacauil survey team 135
5.11 Tzacauil survey team 135
5.12 Tzacauil survey team 135
5.13 Tzacauil survey team 135
5.14 Tzacauil survey team 135
5.15 Tzacauil survey team 135
5.16 Tzacauil survey team 135
5.17 Tzacauil survey team 135
5.18 Tzacauil survey team 136
5.19 Tzacauil survey team 136
5.20 Map of Tzacauil showing kancabales and tzekeles 136
5.21 Excavating a boulder-lined platform at Tzacauil 143
5.22 Location of intra-settlement trenches at Tzacauil 153
5.23 Average soil pH in Tzacauil trenches 155

5.24 Average soil phosphate in Tzacauil trenches 155
5.25 Average soil nitrite in Tzacauil trenches 156
5.26 Average soil carbonates in Tzacauil trenches 156
5.27 Average pH in intra-settlement areas 157
5.28 Average phosphate in intra-settlement areas 157
5.29 Average carbonates in intra-settlement areas 158
5.30 Average nitrite in intra-settlement areas 158
5.31 Schematic showing relative differences in soil phosphate levels at Tzacauil 160
5.32 Schematic showing relative differences in soil carbonate levels at Tzacauil 161
5.33 Schematic showing relative differences in soil pH levels at Tzacauil 162
6.1 Map of Tzacauil in the Formative period 165
6.2 Examples of Middle Formative ceramics 166
6.3 Middle Formative sherd counts from house groups and acropolis excavations 167
6.4 Middle Formative ceramic mass from house group and acropolis excavations 167
6.5 Approaching the Tzacauil Acropolis 170
6.6 Profile of Tzacauil Acropolis excavation 170
6.7 Profile of Tzacauil Acropolis excavation 170
6.8 Map of Tzacauil Sacbe, showing relationship between Yaxuná, Joya, and Tzacauil 173
6.9 Yaxunah *ejiditarios* in the Joya Rejollada 176
6.10 *Albarrada* in Joya Rejollada 176
6.11 Plan of Jach Group 180
6.12 Southeast corner of the Jach Group, with Tzacauil Acropolis to the left 182
6.13 Bedrock “shelf” on the northwest side of the Jach Group 182
6.14 Stylized plan of the Jach Group 182
6.15 Stylized plan of construction phases of the Jach Group 182

6.16 Jach Group north-south *corte* along W16 line 185
6.17 Detail of Jach Group north-south *corte* along W16 line 185
6.18 Jach Group Unit N08W18 Level 3.1 showing dry core fill over bedrock 186
6.19 Excavating earlier basal platform wall on the south side of the Jach Group 186
6.20 Jach Group east-west *corte* along N06 line 186
6.21 Detail of the Jach Group east-west *corte* along N06 line showing earlier platform wall and construction over bedrock 186
6.22 Close-up of Middle Formative ceramic vessel buried at the base of the Jach Group basal platform wall 187
6.23 Middle Formative ceramic vessel buried at the base of the Jach Group basal platform wall 187
6.24 View of the Jach Group basal platform's southern expansion and earlier platform wall 187
6.25 Jach Group *corte* along the basal platform's ramp 190
6.26 Jach Group ramp 190
6.27 Step at the base of the Jach Group ramp 190
6.28 Jach Group east-west *corte* along the N11.5 line 190
6.29 Detail of the Jach Group east-west *corte* along the N11.5 line, showing earlier basal platform wall and construction cell building technique 192
6.30 Construction cells on the west side of the Jach Group, Unit N10W22 192
6.31 Construction cells on the west side of the Jach Group in N10W22 192
6.32 Slabs covering dry-core fill in Unit N08W22 of the Jach Group 192
6.33 Slab used to "seal" dry-core fill in Unit N08W22 of the Jach Group 192
6.34 Excavations of Structure 1B of the Jach Group 193
6.35 Structure 1C of the Jach Group 193
6.36 Jach Group east-west *corte* along N20 line 193
6.37 Stepping stones in kancab west of the Jach Group basal platform 194
6.38 Profile of Trench 2 196
6.39 Trench 2 196

6.40 Trench 2 196
6.41 Profile of Trench 3 196
6.42 Trench 3 196
6.43 Profile of Trench 5 197
6.44 Trench 5 197
6.45 Ceramic density in Formative house groups at Tzacauil 201
6.46 Proportions of bowls and jars in Middle Formative assemblages 202
6.47 Proportions of bowls and jars in Formative ceramic assemblages 202
6.48 Ratio of bowls to jars in all Middle Formative diagnostic sherds 203
6.49 Ratio of bowls to jars in all Formative diagnostic sherds 203
6.50 Metate fragement found in the fill of the Jach Group, Unit N24W14 1.1 ... 203
6.51 P'aak Group 205
6.52 Plan of the P'aak Group excavation 205
6.53 Stylized plan of the P'aak Group 205
6.54 North-south *corte* of Structure 4A of the P'aak Group 206
6.55 East-west *corte* of Structure 4A of the P'aak Group 206
6.56 Excavating Structure 4A of the P'aak Group 206
6.57 Arcing wall of Structure 4A of the P'aak Group, Unit N24E44 208
6.58 Structure 4A of the P'aak Group after excavation 208
6.59 Exposed bahpek north of Structure 4A, P'aak Group 208
6.60 Structure 4B of the P'aak Group 208
6.61 North-south *corte* of Structure 4B of the P'aak Group 211
6.62 East-west *corte* of Structure 4B of the P'aak Group 211
6.63 Stepping stones in kancab around perimeter of Structure 4B, P'aak 211
6.64 Figuring out wall fall in Structure 4B, P'aak Group 211
6.65 Structure 4B of the P'aak Group after excavation 212
6.66 Profile of Trench 6 213
6.67 Trench 6 214
6.68 Profile of Trench 7 215
6.69 Trench 7 216

6.70 Sáastun Group 220
6.71 View off the north side of the Sáastun Group basal platform 220
6.72 Plan of the Sáastun Group excavation 220
6.73 Stylized plan of the Sáastun Group 221
6.74 North-south *corte* of the Sáastun Group basal platform 222
6.75 East-west *corte* of the Sáastun Group basal platform along N28 line 222
6.76 East-west *corte* of the Sáastun Group basal platform along N30 line 222
6.77 East-west *corte* of the Sáastun Group basal platform along N34 line 222
6.78 Excavations on the western side of the Sáastun Group basal platform 224
6.79 Fill of the Sáastu Group basal platform 224
6.80 Structure 3A of the Sáastun Group..... 224
6.81 Excavating Structure 3A of the Sáastun Group 224
6.82 Structure 3B of the Sáastun Group..... 224
6.83 North-south *corte* of Structure 3C of the Sáastun Group..... 225
6.84 East-west *corte* of Structure 3C of the Sáastun Group..... 225
6.85 Structure 3C of the Sáastun Group 225
6.86 Excavating Structure 3C of the Sáastun Group..... 225
6.87 Stylized plan of the Chamal Group 230
6.88 Chamal Group basal platform..... 230
6.89 View of the top of the Chamal Group basal platform..... 230
6.90 Plan of the Chamal Group basal platform excavations 231
6.91 Stylized plan of the Chamal Group basal platform and superstructures ... 232
6.92 North-south *corte* of the Chamal Group basal platform along central axis 233
6.93 East-west *corte* of the Chamal Group basal platform..... 233
6.94 Construction phases of the Chamal Group basal platform..... 233
6.95 Prepared bedrock surface below construction of Structure 8A of the Chamal Group 235
6.96 Dry-core fill “sealed” with slabs in Structure 8A of the Chamal Group..... 235
6.97 View of the Chamal Group superstructures, showing the elements of the second phase of construction 235

6.98 Excavating Structure 8A of the Chamal Group 237
6.99 Excavating Structure 8A of the Chamal Group 237
6.100 Plan of Structure 8C of the Chamal Group 239
6.101 Stylized plan of Structure 8C 239
6.102 North-south *corte* of Structure 8C of the Chamal Group 239
6.103 East-west *corte* of Structure 8C of the Chamal Group 239
6.104 Chamal Group Structure 8C, Unit N16E16, excavating bedrock cavity... 242
6.105 Excavating Chamal Group Structure 8C..... 242
6.106 Well-laid fill and floor in the construction of Structure 8C 242
6.107 Chamal Group excavations 242
6.108 Chamal Group excavations 242
6.109 Small reservoir (*charco*)south of the Chamal Group 242
6.110 Profile of Trench 4 243
6.111 Trench 4 243
6.112 Bedrock in Trench 4 243
6.113 Bedrock in Trench 4 243
6.114 Stone-cutting tools found in Trench 4 245
6.115 Profile of Trench 8 247
6.116 Trench 8 247
6.117 Trench 8 247
6.118 West side of the Kaan Group, with the Mukul Group visible to the right . 250
6.119 The top of the Kaan Group basal platform 250
6.120 Plan of the Kaan Group excavations 251
6.121 Stylized plan of the Kaan Group, with both occupation phases 251
6.122 Stylized plan of the Kaan Group, showing just the Formative occupation phase..... 251
6.123 Bedrock “finger” of the Kaan Group..... 252
6.124 Bedrock “finger” of the Kaan Group..... 252
6.125 Bedrock “finger” of the Kaan Group, looking south 252
6.126 *Corte* along the bedrock “finger” of the Kaan Group 252

6.127 East-west *corte* of the Kaan Group, along the N26 line 253
6.128 East-west *corte* of the Kaan Group, along the center line 253
6.129 North-south *corte* of the Kaan Group, along the E29 line..... 253
6.130 Boulder-lined wall of the Kaan Group basal platform, Unit N20E28..... 253
6.131 Preserved segment of basal platform wall exposed in Unit N26E20..... 253
6.132 Plan of the Pool Group excavation 256
6.133 Stylized plan of the Pool Group, showing location of Formative period Structure 6A-sub relative to later Classic period structures..... 257
6.134 Profile drawing of Pool Group Structures 6A and 6A-sub..... 258
6.135 East-west *corte* of Structure 6C and 6B of the Pool Group 258
6.136 North-south *corte* of Structure 6C of the Pool Group, showing underlying bedrock cavity..... 258
6.137 Excavating the bedrock cavity beneath Pool Group Structure 6C..... 259
6.138 Bedrock cavity beneath Pool Group Structure 6C 259
6.139 Possible sculpted head found in the bedrock cavity below Structure 6C of the Pool Group 260
6.140 North-south *corte* drawing of Structure 6A and Structure 6A-sub of the Pool Group..... 261
6.141 Structure 6A and Structure 6A-sub, Pool Group..... 261
6.142 Kaan Group and the constructed walkway 263
6.143 Constructed walkway..... 263
6.144 Close-up of constructed walkway 263
6.145 Profile of Trench 1 and its relationship to Structure 6A 263
7.1 Map of Tzacauil in the Classic period..... 270
7.2 Joya archaeological site 271
7.3 Classic period modifications of pre-existing Formative architecture at the Kaan Group 274
7.4 Late Classic renovations to the western side of the Kaan Group basal platform, Unit N36E26 274
7.5 Classic period access added to the western side of the Kaan Group,

Unit N30E22 274
7.6 View from above of Classic period access added to the western side of the Kaan Group, Unit N30E22 275
7.7 Close-up of stucco on Classic period access on the west side of the Kaan Group, Unit N30E20 275
7.8 Classic period expansion of the Kaan Group basal platform, showing possible capstones 275
7.9 Classic period expansion of the Kaan Group basal platform, showing possible capstones 275
7.10 Structure 5B of the Kaan Group 275
7.11 Ceramic density in Classic house groups at Tzacauil 278
7.12 Ceramic density across all Tzacauil house groups 278
7.13 Proportions of bowls and jars in Classic ceramic assemblages 279
7.14 Stylized plan of the Pool Group 283
7.15 Excavations of Structure 6A of the Pool Group 283
7.16 Structure 6B of the Pool Group, showing location of maize-grinding tools 283
7.17 Excavating Structure 6C of the Pool Group 283
7.18 Greenstone celt from the Pool Group 285
7.19 Broken chert perforator from the Pool Group 285
7.20 Fragment of marine shell from the Pool Group 285
7.21 Sketch of the Mukul Group indicating location of test pit 285
7.22 *Corte* drawing of Structure 2A of the Mukul Group, including test pit profile 287
7.23 View from the Mukul Group to the Kaan Group 287
7.24 Mukul Group 287
7.25 Jaltun Group 292
7.26 Plan of the Jaltun Group excavation 292
7.27 East-west *corte* of the Jaltun Group 293
7.28 North-south *corte* of the Jaltun Group 293

7.29 *Sarteneja* south of the Jaltun Group 293
7.30 Profile of Trench 9 296
7.31 Trench 9 296
7.32 Trench 9 296
7.33 Plan of the T'uup Group excavation 299
7.34 Stylized plan of the T'uup Group 299
7.35 North-south *corte* of the T'uup Group 300
7.36 East-west *corte* of the T'uup Group 300
7.37 T'uup Group 300
7.38 Excavations in the T'uup Group, Unit N22W22 300
7.39 Metate at Yaxuná 305
7.40 Metate ground into a boulder of a boulder-lined platform at Yaxuná 305
8.1 Map of the Yaxcabá area, showing locations of Yaxunah and Cetelac 318
8.2 *Hacienda* Cetelac manor house in 2014 319
8.3 Yaxunah *ejidatarios* at *Hacienda* Cetelac in 2017 319
8.4 Map of *Hacienda* Cetelac 319
8.5 Plan of a houselot associated with *Hacienda* Cetelac 321
8.6 Catholic church at Yaxunah, finished in 1817 322
8.7 Yaxunah *ejidatarios* at Tzacauil 341
8.8 Yaxunah eco-tourism brochure 344
8.9 Artisanal woodcarving at Yaxunah 346
8.10 Drinking soda during a break at Tzacauil 350
8.11 Promotional material for Rick Bayless' show, filmed at Yaxunah 350
8.12 Chef René Redzepi 351
8.13 Maize sourced from Yaxunah for Noma Tulum 351
8.14 Yaxunah women making tortillas at Noma Tulum 351
8.15 Social media posts related to culinary tourism, service projects, and sustainable agriculture at Yaxunah 353
10.1 Xíimbal k'áax 385
C.1 Chipped stone Tz-1 N16E18 2.1 485

C.2 Chipped stone Tz-1 N18E16 3.1 485
C.3 Chipped stone Tz-1 N22E18 2.1 485
C.4 Chipped stone Tz-1 N16E18 2.2 485
C.5 Chipped stone Tz-1 N18E18 2.1 485
C.6 Chipped stone Tz-1 N22E18 2.1 485
C.7 Chipped stone Tz-1 N18E16 2.1 485
C.8 Chipped stone Tz-1 N18E20 4.1 485
C.9 Chipped stone Tz-1 N22E18 2.3 485
C.10 Chipped stone Tz-1 N18E16 2.1 485
C.11 Chipped stone Tz-1 N20E18 1.1 485
C.12 Chipped stone Tz-1 N22E18 3.1 485
C.13 Chipped stone Tz-1 N24E16 1.1 486
C.14 Ground stone Tz-1 N10E16 1.1 486
C.15 Ground stone Tz-1 N16E18 4.1 486
C.16 Chipped stone Tz-1 N24E20 1.1 486
C.17 Ground stone Tz-1 N14E18 1.1 486
C.18 Ground stone Tz-1 N16E20 1.1 486
C.19 Chipped stone Tz-1 N30E16 1.2 486
C.20 Ground stone Tz-1 N16E12 1.3 486
C.21 Possible volcanic stones Tz-1 N16E20 1.1 486
C.22 Marine shell Tz-1 N16E14 1.1 486
C.23 Ground stone Tz-1 N16E18 1.1 486
C.24 Metate foot Tz-1 N18E12 2.2 486
C.25 Ground stone Tz-1 N10E14 1.1 486
C.26 Ground stone Tz-1 N16E18 4.1 486
C.27 Ground stone Tz-1 N18E16 2.1 486
C.28 Possible lithics Tz-1 N18E16 2.1 487
C.29 Ground stone Tzacauil Tz-1 N18E22 2.1 487
C.30 Ground stone Tz-1 N22E18 2.1 487
C.31 Ground stone Tz-1 N18E16 2.2 487

C.32 Metate fragment Tz-1 N20E16 1.1 487
C.33 Ground stone Tz-1 N22E18 2.1 487
C.34 Ground stone Tz-1 N18E18 2.1 487
C.35 Ground stone Tz-1 N20E18 487
C.36 Ground stone Tz-1 N26E18 1.4 487
C.37 Ground stone Tz-1 N18E20 4.1 487
C.38 Ground stone Tz-1 N20E18 1.1 487
C.39 Ground stone Tz-1 (out of context) 487
C.40 Ground stone Tz-1 N18E22 1.1 487
C.41 Ground stone Tz-1 N20E20 1.1 487
C.42 Chipped stone Tz-3-1-N12W16-1.1 488
C.43 Chipped stone Tz-3-1-N20W16-1.1 488
C.44 Chipped stone Tz-3-6-N22E20-1.1 488
C.45 Chipped stone Tz-3-1-N14W20-1.2 488
C.46 Chipped stone Tz-3-1-N22W14-2.1 488
C.47 Chipped stone `Tz-3-6C-N24E20-3.1 488
C.48 Chipped stone Tz-3-1-N20W14-2.1 488
C.49 Chipped stone Tz-3-6A-N20E24-2.1 488
C.50 Chipped stone Tz-3-6C-N24E22-1.1 488
C.51 Chipped stone Tz-3-1-N18W16-1.1 488
C.52 Chipped stone Tz-3-6A-N17E20-24-1.1 488
C.53 Chipped stone Tz-3-6C-N24E22-1.1 488
C.54 Chipped stone Tz-3-1-N20W12-2.1 488
C.55 Chipped stone Tz-3-6A-N20E21-4.2 488
C.56 Chipped stone Tz-3-6-N24E24-3.3 488
C.57 Chipped stone Tz-3-6B-N24E26-1.2 489
C.58 Chipped stone Tz-3-6C-N26E20-4.2 489
C.59 Chipped stone Tz-5-P2-2.1 489
C.60 Chipped stone Tz-3-6B-N24E26-2.1 489
C.61 Chipped stone Tz-3-6C-N26E22-2.2 489

C.62 Chipped stone Tz-5-P2-3.1 489
C.63 Lithics Tz-3-6B-N25E26-1.2 489
C.64 Lithics Tz-3-7-N22E20-1.1 489
C.65 Ground stone Tz-3-1-N12W16-1.1 489
C.66 Chipped stone Tz-3-6B-N25E26-1.2 489
C.67 Chipped stone Tz-3-7-N24E19-1.1 489
C.68 Ground stone Tz-3-1-N14W12-1.1 489
C.69 Chipped stone Tz-3-6C-N25E22-2.1 489
C.70 Chipped stone Tz-5-P1-1.2 489
C.71 Ground stone Tz-3-1-N14W18-1.1 489
C.72 Ground stone Tz-3-1-N16W12-2.1 490
C.73 Ground stone Tz-3-1-N18W14-1.1 490
C.74 Ground stone Tz-3-1-N18W18-1.1 490
C.75 Ground stone Tz-3-6A-N18E20-1.1 490
C.76 Ground stone Tz-3-6A-N18E21-2.2 490
C.77 Ground stone Tz-3-6A-N18E22-1.2 490
C.78 Cuña Tz-3-6A-N18E22-2.1 490
C.79 Ground stone Tz-3-6A-N18E22-2.1 490
C.80 Ground stone Tz-3-6A-N20E20-1.2 490
C.81 Ground stone Tz-3-6A-N20E22-4.1 490
C.82 Ground stone Tz-3-6-N22E20-1.1 490
C.83 Ground stone Tz-3-6A-N22E22-1.1 490
C.84 Ground stone Tz-3-6A-N22E24-1.1 490
C.85 Ground stone Tz-3-6-N22E26-1.1 490
C.86 Ground stone Tz-3-6C-0.0 490
C.87 Ground stone Tz-3-6C-N24E20-1.1 491
C.88 Ground stone Tz-3-6-N24E20-1.2 491
C.89 Ground stone Tz-3-6C-N24E20-2.1 491
C.90 Ground stone Tz-3-6C-N24E20-2.2 491
C.91 Metate fragment Tz-3-6C-N24E20-2.2 491

C.92 Ground stone Tz-3-6C-N24E20-4.1 491
C.93 Ground stone (P4)Tz-3-6B-0.0 491
C.94 Ground stone Tz-3-6C-N25E22-1.1 491
C.95 Ground stone (P1)Tz-3-6B-N25E26-1.1 491
C.96 Ground stone (P2)Tz-3-6B-N25E26-1.1 491
C.97 Ground stone (P3)Tz-3-6B-N25E26-1.1 491
C.98 Ground stone (P5)Tz-3-6B-N25E26-1.1 491
C.99 Ground stone (P6)Tz-3-6B-N25E26-1.1 491
C.100 Ground stone Tz-3-6B-N25E26-1.2 491
C.101 Ground stone (P7)Tz-3-6B-N25E26-1.2 491
C.102 Ground stone (P8)Tz-3-6B-N25E26-1.2 492
C.103 Ground stone (P9)Tz-3-6B-N25E26-1.2 492
C.104 Ground stone Tz-3-6C-N26E20-1.1 492
C.105 Ground stone Tz-3-6C-N26E20-1.2 492
C.106 Ground stone Tz-3-6C-N26E20-2.1 492
C.107 Ground stone Tz-3-6C-N26E20-2.1 492
C.108 Ground stone Tz-3-6C-N26E20-2.2 492
C.109 Possible lithic Tz-3-6C-N26E20-4.1 492
C.110 Ground stone Tz-3-6C-N26E22-2.1 492
C.111 Ground stone Tz-3-6-N26E24-1.2 492
C.112 Ground stone Tz-3-6C-N28E20-1.1 492
C.113 Ground stone Tz-3-6C-N28E20-1.2 492
C.114 Ground stone Tz-3-6C-N28E20-1.3 492
C.115 Cuña Tz-3-7-N26E20-2.1 492
C.116 Ground stone l Tz-3-7-N28E20-1.2 492
C.117 Ground stone Tz-4-T1-N20E28 493
C.118 Ground stone Tz-4-T1-N20E30-1.1 493
C.119 Ground stone Tz-4-T1-N20E32-1.1 493
C.120 Marine shell Tz-3-6-N26E24-1.2 493
C.121 Chipped stone Tz-3-6C-N24E20-2.2 493

C.122 Marine shell Tz-3-6B-N25E26-1.2 493
C.123 Green stone celt Tz-3-6B-N26E26-1.1 493
C.124 Possible sculpture (human head?)Tz-3-6C-N26E20-4.1 493
C.125 Ground stone Tz-5-3 N30E40 2.1 (1) 493
C.126 Ground stone Tz-5-3-N30E40 2.1 (1) 493
C.127 Ground stone Tz-3-5 N32E38 1.1 (2) 493
C.128 Ground stone Tz-3-5-N32E38 1.1 (2) 494
C.129 Ground stone Tz-5-3-N32E36 1.1 (3) 494
C.130 Ground stone Tz-5-3-N26E34 1.1 (4) 494
C.131 Ground stone Tz-5-3-N32E38 1.1 (5) 494
C.132 Ground stone Tz-5-3-N24E36 1.1 (6) 494
C.133 Ground stone Tz-5-3-N30E31 1.1 (7) 494
C.134 Ground stone Tz-5-3-N38E32 1.1 (8) 494
C.135 Ground stone Tz-5-3-N36E38 1.1 (9) 494
C.136 Metate foot Tz-5-3 N28E36 1.1 (10) 494
C.137 Ground stone Tz-5-3-N32E38 1.1 (11) 494
C.138 Ground stone Tz-5-3-N30E34 1.1 (12) 494
C.139 Ground stone Tz-5-3-N26E36-1.1 (13) 494
C.140 Metate fragment Tz-5-3-N26E36-1.1 (13) 494
C.141 Ground stone Tz-5-3-N32E40 1.1 (14) 494
C.142 Ground stone Tz-5-3-N34E40 1.1 (15) 494
C.143 Ground stone Tz-5-3-N26E30 1.1 (16) 495
C.144 Ground stone Tz-5-3-N34E38-1.1 (17) 495
C.145 Ground stone Tz-5-3-N30E30 1.1 (18) 495
C.146 Ground stone Tz-5-5-N40E26 1.1 (19) 495
C.147 Ground stone Tz-5-4-N16R40 1.1 (20) 495
C.148 Ground stone Tz-5-4-N16R40 1.1 (20) 495
C.149 Metate fragment Tz-5-4-N16E40 1.1 (21) 495
C.150 Ground stone Tz-5-4-N18E38 1.1 (22) 495
C.151 Ground stone Tz-5-4-N20E38 1.1 495

C.152 Ground stone Tz-5-4-N24E40 2.1 (24) 495
C.153 Ground stone Tz-5-4-N22E44-1.1 (25) 495
C.154 Ground stone Tz-5-4-N18E40 1.1 (26) 495
C.155 Ground stone Tz-5-4-N22E20 2.1 (27) 495
C.156 Ground stone Tz-5-4-N22E40 2.1 (28) 495
C.157 Burned stones Tz-4-T2-N10E10 1.1 495
C.158 Ground stone Tz-4-T4-N30E10 1.1 (31) 496
C.159 Ground stone Tz-4-T4-N30E10 1.1 (31) 496
C.160 Ground stone Tz-4-T4-N24E10 1.1 (32) 496
C.161 Ground stone Tz-4-T4-N24E10 1.1 (32) 496
C.162 Ground stone Tz-4-T4-N24E10 1.1 (32) 496
C.163 Ground stone Tz-4-T4-N24E10 1.1 (32) 496
C.164 Ground stone Tz-4-T4-N24E10 1.1 (32) 496
C.165 Ground stone Tz-4-T4-N24E10 1.1 (32) 496
C.166 Ground stone Tz-4-T4-N24E10 1.1 (32) 496
C.167 Ground stone Tz-4-T4-N24E10 1.1 (32) 496
C.168 Ground stone Tz-4-T5-N32E10 1.1 (33) 496
C.169 Ground stone Tz-4-T4-N30E10 1.1 (34) 496
C.170 Ground stone Tz-4-T4-N30E10 1.1 (34) 496
C.171 Ground stone Tz-4-T7-N10E10 1.1 (35) 496
C.172 Ground stone Tz-4-T3-N10E36 1.1 (38) 496
C.173 Stone cutting debris Tz-4-T4-N30E10 1.1 497
C.174 Ground stone Tz-4-T4-N28E10 1.1 (37) 497
C.175 Ground stone Tz-6-8A-N16E14 2.1 (39) 497
C.176 Ground stone Tz-5-5-N30E22 1.2 (40) 497
C.177 Ground stone Tz-5-5-N30E22 1.2 (40) 497
C.178 Ground stone Tz-5-2-N30E22 1.1 (41) 497
C.179 Ground stone Tz-6-3A-N22E22 1.1 (42) 497
C.180 Ground stone Tz-5-5-N40E28 1.1 (43) 497
C.181 Ground stone Tz-5-5-N38E32 1.1 (44) 497

C.182 Ground stone Tz-6-8A-N14E14 1.1 (45) 497
C.183 Ground stone Tz-5-5-N38E28 1.1 (46) 497
C.184 Ground stone Tz-5-5-N38E28 1.1 (46) 497
C.185 Ground stone Tz-5-5-N36E26 2.1 (48) 497
C.186 Ground stone Tz-5-5-N29E36 1.1 (49) 497
C.187 Ground stone Tz-5-5-N29E36 1.1 (49) 497
C.188 Ground stone Tz-5-5-N22E28 1.1 (50) 498
C.189 Ground stone Tz-6-8A-N16E16 2.3 (51) 498
C.190 Ground stone Tz-6-8A-N16E14 3.1 (52) 498
C.191 Metate foot Tz-6-8A-N14E14 2.1 (53) 498
C.192 Ground stone Tz-4-T4-N30E10 1.1 (54) 498
C.193 Ground stone Tz-5-1N12W23 1.1 (55) 498
C.194 Ground stone Tz-4-T3-N10E34 1.1 (56) 498
C.195 Ground stone Tz-5-1-N24W22 1.1 (57) 498
C.196 Ground stone Tz-4-T4-N16E10 1.1 (58) 498
C.197 Ground stone Tz-5-1-N12W20 1.1 (59) 498
C.198 Ground stone Tz-6-8A-N16E16 1.1 (60) 498
C.199 Ground stone Tz-6-8A-N14E16 5.1 (61) 498
C.200 Ground stone Tz-4-T6-N14E10 1.1 (62) 498
C.201 Ground stone Tz-5-1-N12W08 1.1 (63) 498
C.202 Lithics Tz-5-1-N18E28 1.1 (64) 498
C.203 Ground stone Tz-5-1-N18W28 1.1 (64) 499
C.204 Ground stone Tz-5-1-N18W28 1.1 (64) 499
C.205 Ground stone Tz-5-1-N18W22 1.1 (65) 499
C.206 Ground stone Tz-5-1-N18W22 1.1 (65) 499
C.207 Ground stone Tz-6-3A-N24E20 1.1 (66) 499
C.208 Ground stone Tz-54-N26E40 2.1 (29) 499
C.209 Metate fragments Tz-54-N26E40 2.1 (29) 499
C.210 Ground stone Tz-5-4-N26E40 2.1 (29) 499
C.211 Ground stone Tz-5-4-N26E40 2.1 (29) 499

C.212 Ground stone Tz-5-3-N36E30 1.1 (66) 499
C.213 Ground stone Tz-5-1 (67) 499
C.214 Ground stone Tz-5-1-N14W08 1.1 (68) 499
C.215 Ground stone Tz-5-5-N26E28 2.1 (69) 499
C.216 Ground stone Tz-5-5-N26E34 1.1 (70) 499
C.217 Ground stone Tz-5-5-N30E22 1.1 (71) 499
C.218 Ground stone Tz-5-5-N38E38 1.1 (72) 500
C.219 Ground stone Tz-5-5-N26E24 1.1 (73) 500
C.220 Ground stone Tz-5-5-N32E28 1.1 (74) 500
C.221 Ground stone Tz-4-T5-N14E10 1.1 (75) 500
C.222 Ground stone Tz-4-T7-N14E10 1.1 (76) 500
C.223 Ground stone Tz-6-3A-N24E20 1.1 (77) 500
C.224 Ground stone Tz-4-T4-N24E10 1.1 (78) 500
C.225 Ground stone Tz-4-T7-N14E10 1.1 (79) 500
C.226 Lithics Tz-4-T7-N12E10 1.1 (80) 500
C.227 Ground stone Tz-4-T3-N10E36 1.1 (81) 500
C.228 Ground stone Tz-4-T5-N12E10 1.1 (82) 500
C.229 Ground stone Tz-5-4-N20E34 1.1 (83) 500
C.230 Lithic Tz-5-3-N32E32 1.1 lítica (85) 500
C.231 Lithics Tz-5-3-N28E28 1.1 (86) 500
C.232 Chipped stone Tz-5-3-N26E32 1.1 (87) 500
C.233 Lithics Tz-5-3-N30E30 1.1 (88) 501
C.234 Lithic Tz-5-3-N30E30 1.1 (88) 501
C.235 Ground stone Tz-5-3-N32E32 1.2 501
C.236 Chipped stone Tz-5-1-N10W20 1.1 501
C.237 Ground stone Tz-5-4-N18E42 1.1 501
C.238 Ground stone found on the surface of the kancab walkway (93) 501
C.239 Ground stone found on the surface of the kancab walkway (93) 501
C.240 Ground stone found on the surface of the kancab walkway (93) 501
C.241 Lithics Tz-5-3-N30E34 1.1 (94) 501

C.242 Ground stone Tz-5-3-N28E42 1.1 (95) 501
C.243 Ground stone Tz-5-3-N28E42 1.1 (95) 501
C.244 Lithic Tz-5-3-N34E32 1.1 (96)..... 501
C.245 Ground stone Tz-5-3-N30E36 1.1 (97) 501
C.246 Ground stone Tz-5-3-N32E30-1.1 (98) 501
C.247 Ground stone Tz-5-3-N32E30 1.1 (98) 501
C.248 Obsidian Tz-5-3-N34E36 1.1 (84)..... 502
C.249 Obsidian Tz-5-3-N32E38 1.1 502

List of Tables

Table

1.1 Chronology for the Yaxuná and Tzacauil study region 7

3.1 Spanish and Yucatec terms used frequently in this study 63

5.1 Stone tool counts by proposed function 151

6.1 Middle Formative ceramics, by sherd count and mass, found during excavations of the Tzacauil house groups and in the Tzacauil Acropolis 166

6.2 Ceramic density across Formative house groups 201

6.3 Ceramic vessel form counts in Tzacauil house groups and Tzacauil Acropolis excavations 201

7.1 Ceramic density across Classic house groups 279

7.2 Ceramic density across all house groups at Tzacauil 279

A.1 Jach Group ceramics 388

A.2 P'aak Group ceramics 398

A.3 Sáastun Group ceramics 401

A.4 Chamal Group ceramics 407

A.5 Kaan Group ceramics 418

A.6 Pool Group ceramics 427

A.7 Jaltun Group ceramics 443

A.8 T'uup Group ceramics 444

A.9 Tzacauil Acropolis ceramics 445

A.10 Ceramics from Tzacauil intra-settlement trenches 450

B.1 Jach Group lithics 451

B.2 P'aak Group lithics 455

B.3 Sáastun Group lithics 459

B.4 Chamal Group lithics 465
B.5 Kaan Group lithics 471
B.6 Jaltun Group lithics 474
B.7 Pool Group lithics 474
B.8 Lithics from Tzacauil intra-settlement trenches 480
D.1 Soil chemistry data from Tzacauil 503

List of Appendices

Appendix

A. Tzacauil Ceramic Data 388
B. Tzacauil Lithic Artifact Registry..... 451
C. Tzacauil Artifacts Photograph Registry..... 485
D. Soil Chemistry Data 503
E. Excavation Descriptions 508

Abstract

This dissertation investigates the landscape of the archaeological site of Tzacauil, Yucatán, Mexico as a record of long-term interactions between Maya farmers and their local environment. Using the framework of historical ecology, the author argues that we can enhance understanding of modern agricultural sustainability through rigorous study of past farming communities. The archaeology of past farming communities can draw out the entanglements between political, social, economic, and environmental dynamics underlying sustainability. To show this, the author situates archaeological perspectives in the five principles of sustainable agriculture outlined by the Food and Agriculture Organization (FAO) of the United Nations (UN): efficiency, conservation, rural livelihoods, governance, and resilience. This approach is applied to the specific case of the modern Maya town of Yaxunah, Yucatán, and its *ejido* or collective agricultural landholding. Yaxunah's *ejido* includes the pre-Hispanic archaeological site of Tzacauil, where two farming communities formed in the past. The first formed during the transition to full-time agriculture in the Maya lowlands (Formative period, ca. 2000 years ago). The second formed during the height of pre-Hispanic population in the region (Classic period, ca. 1000 years ago). Weaving together interdisciplinary approaches including ethnographic work with Yaxunah farmers and extensive archaeological excavations, the author demonstrates how Tzacauil's landscape can be "read" as an environmental history of interactions between people and place. Tzacauil's landscape shows that the Formative hinterland farming village that formed here was essentially a graft of a segment of urban settlement. The Formative villagers practiced intensive, place-based agricultural and social practices. Households were individually autonomous but also participated in community-building strategies. However, emerging social inequalities, political instability, and environmental changes made the Formative Tzacauil community vulnerable, and it was abandoned. By the time

a later settlement formed here in the Classic period, new rural Maya lifeways had developed, as well as new forms of political leadership. Farming communities transitioned to more flexible and shifting agricultural strategies. Households pooled labor collectively and were more mobile on the landscape. Evidence suggests that political leaders endorsed this transition, and that it may have been resilient enough to allow hinterland farmers to persist through the major changes of the Maya collapse. After discussing archaeological work at Tzacuail, this dissertation also delves into more recent histories of farmers and land in Yucatán. The author traces the environmental history of the Yaxunah *ejido* and its farmers into the present, showing how 21st century practices are increasingly at odds with the careful balance struck between farmers and political leaders in the past. In particular, neoliberal land privatization directly undermines notions of flexible land tenure that are essential for long-term sustainability in Maya farming. Returning to the FAO's principles of sustainable agriculture, the author assesses the long view of sustainability at Tzacauil by synthesizing 2000 years of farmers' interactions with this particular place. The dissertation concludes by arguing that Maya farmers are not static bystanders in larger political and environmental processes. Rather, farmers are active agents of change in social and agricultural sustainability. By studying past agriculture, the author argues that we can discern long-term processes of environmental learning in the landscape, and take those insights as lessons for the future.

Chapter 1
Introduction

But our memory of ourselves, hard earned,
is one of the land's seeds, as a seed
is the memory of the life of its kind in its place,
to pass on into life the knowledge
of what has died. What we owe the future
is not a new start, for we can only begin
with what has happened. We owe the future
the past, the long knowledge
that is the potency of time to come.
Wendell Berry
"At a Country Funeral", 1987

1.1 Prelude

It was not until the third day of my third field season at Tzacauil that I realized what this story was going to be about. Like so many revelations in Yucatán archaeology, this one began with a pile of rocks.

This particular pile of rocks was in a low-lying patch of soil in the scrub forest of the archaeological site of Tzacauil in the Mexican state of Yucatán. I was there too, that day, along with six members of the Maya community of Yaxunah; there were four men, two women, all decades older than me, all *ejidatarios*, the collective owners of this land. The pile of rocks, really no more than a scatter, felt like a personal attack: it was not supposed to be there. It was early in the summer, and I hadn't yet abandoned the idea – as you eventually do every field season – that everything was going to go as nicely as I had planned it in my grant proposals. So it felt like an unmapped ancient structure could throw off my whole project, if not ruin my life.

I frowned, my eyes locked on the computer screen in my hands as I weakly protested in Spanish, "It's not on the map… are you sure it's a structure?" I glanced

nervously up at the six others, all regarding the pile of rocks with mild interest or indifference. I was the only one offended by the audacity of this structure that was not, according to the expensive equipment hanging around my neck, supposed to be there.

Don Fausto[1], whom we all recognized implicitly as our leader, was confident as he sized up the pile. "*Sí es*," he said simply, hands on his hips. He continued in Spanish, "The ancient people (*los antiguos*) used this for storing corn. We build ones just like this today." The matter was settled. He switched to Maya, and the conversation flared up as he, don Inocente, and don Crisanto began talking all at once, gesturing expansively to illustrate their spontaneous debate about, I guessed, the proper construction of corncribs.

Now what? I let the tablet and GPS drop to my side. I crouched down next to don Jerónimo, who sat silently playing with his sandal strap, unmoved and unimpressed with the rock pile and the debate about said rock pile. The two other women, doña Camila and doña Laura, were mostly silent too, though Camila occasionally injected a sentence into the conversation with a flourish of her *coa* (a hook-shaped machete-like tool for cutting brush). I watched their faces as they talked, picking up the verbal scraps I could comprehend, the Maya words I knew and the Spanish that punctuated their Maya. But I was lost, and so I sat quietly stewing in my own sense of crisis.

All of a sudden, Crisanto seemed to realize something – a revelation. He looked down at Jerónimo, who by now had finished with his sandal and was adjusting his baseball cap. Crisanto asked Jerónimo a question, and it ended with a phrase I knew, "*ma sí, no?*" "Isn't that right?"

I watched as Jerónimo turned to look again, now with curiosity, at the pile of rocks. Suddenly his eyes widened, and he pushed his baseball cap back on his brow, his face suddenly opened with surprised recognition. He looked twenty years younger. He smiled, almost as in disbelief, and laughed as he answered Crisanto. Then everyone laughed and looked at me expectantly, forgetting, as they often did, that I was lost. "What? What is it? What's happening?" I asked.

[1] Names have been changed.

Figure 1.1 Yaxunah *ejiditarios* Don Jerónimo and Don Fausto, discussing the prospect of farming at Tzacauil

Crisanto, still chuckling and shaking his head, answered me in Spanish. “It’s a structure, Chelsea, but you don’t have to worry about this one. Don Jerónimo was the last person who made *milpa* here.” He clapped his hand on don Jerónimo’s shoulder. Don Jerónimo, who did not speak much Spanish, smiled at me sheepishly.

“I don’t understand.”

“He built this to store his corn.”

“So. It’s not ancient?”

“No. It’s fifteen years old,” Crisanto replied. “He forgot all about it.”

Now I laughed with them. This was the first time I had heard about anyone from Yaxunah farming at Tzacauil, and decided this was as good a moment as any to take some video. I asked Jerónimo about the last time he had made *milpa* here, and why he doesn’t – why no one does – anymore (Figure 1.1). The *ejidatarios* gave their reasons, and their reasons were many. The land is too far from town. The land is too poor. There are too many *tejones* ((coatimundi; *Nasua narica*). There are too many spirits. No one wants to make *milpa* anymore, anywhere, it is too risky and the chemicals too expensive.

Figure 1.2 Map showing Tzacauil's location in the northern Maya lowlands of the Yucatán Peninsula

I was here to study how this place, Tzacauil, tells a story about Maya farming. But there in that clearing, huddled around the rocks, I realized that I had been thinking that that story was over, the chapters neatly resolved into archaeological assemblages that I could parcel up and examine from a safe distance. Now I was seeing a different reality. I stared at the rocks. "You don't have to worry about this one," Crisanto had said.

The group stirred. Don Fausto was ready to move on to something the *antiguos* had actually built. He unsheathed his machete and turned, waving for us to follow, to keep walking in the direction we had been headed before these rocks came crashing into our morning. "Let's walk the woods," he urged. "K'oox xiimbal k'aax."

We left don Jerónimo's rock pile, date circa AD 2002, and I never stumbled upon it again the rest of the season. But I haven't stopped worrying about it since.

1.2 The premise of this work

This work sets out to show that the agricultural past matters. By studying the agricultural past, we enhance our understanding of recent and ongoing histories of change in our modern food systems. We gain a deeper appreciation of the diversity of

human strategies that sustained past communities for generations. We can see more clearly *which* of those strategies worked, *how* they worked, and *under what conditions* – social, political, and environmental –they worked. We can learn from our collective archive of past successes and failures to look ahead towards an imagined, more sustainable future. Though grounded in the realities of the 21st century, this is an unapologetically optimistic endeavor. It is also an endeavor that is bound to specific landscapes. It requires that we tie our efforts to particular places, where we can trace the interactions between humans and their local environments from the deep past into the living present.

My particular effort here examines that landscape of a place known as Tzacauil, in the southeastern Mexican state of Yucatán (Figures 1.2-1.4). I conducted research there to understand how Tzacauil's landscape is a recording of the long-term interactions between people, in this case hinterland[2] farmers and their families, and the local environment of this particular place in central Yucatán. To be able to read the landscape in this way requires diverse approaches. Archaeological methods allowed me to study the abandoned monuments, houses, and activity areas of Maya farmers who lived here approximately 2000 years ago (Late to Terminal Formative period), and then again about 1000 years ago (Late to Terminal Classic period) (see Table 1.1). Study of 16th-20th century texts, censuses, and agrarian policy documents allowed me to bring this story of Maya farmers into the recent past. Finally, by working closely with Maya farmers who are the modern owners of Tzacauil's lands, I incorporated ethnographic and ecological approaches to situate Tzacauil's landscape in the 21st century. Together, these approaches enable us to see how small-scale Maya farmers interacted with each other and with their local environment, from the adoption of agriculture into the modern Anthropocene.

[2] I use the term "hinterland" throughout this study to refer to the outlying lands in the periphery of a center, in this case usually the archaeological site of Yaxuná. I will use "hinterland farming communities" to refer to small-scale agricultural settlements in hinterlands. I prefer "hinterland" as a more neutral term to "periphery" (which carries the baggage of world systems theory) and to "rural" (which assumes categorical differences, i.e. a rural-urban dichotomy). I will use "rural" occasionally when this categorical difference can be demonstrated. See also Iannone et al. 2014 and LeCount and Yaeger 2010 for further discussion of this term.

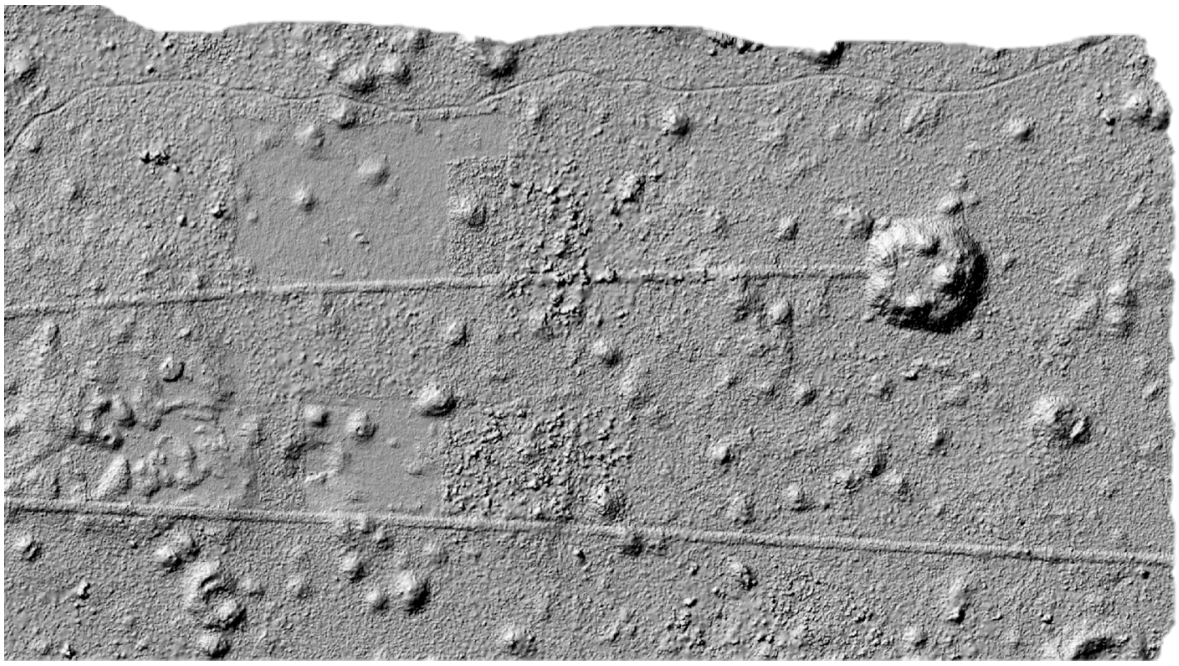

Figure 1.3 LiDAR image of Tzacauil

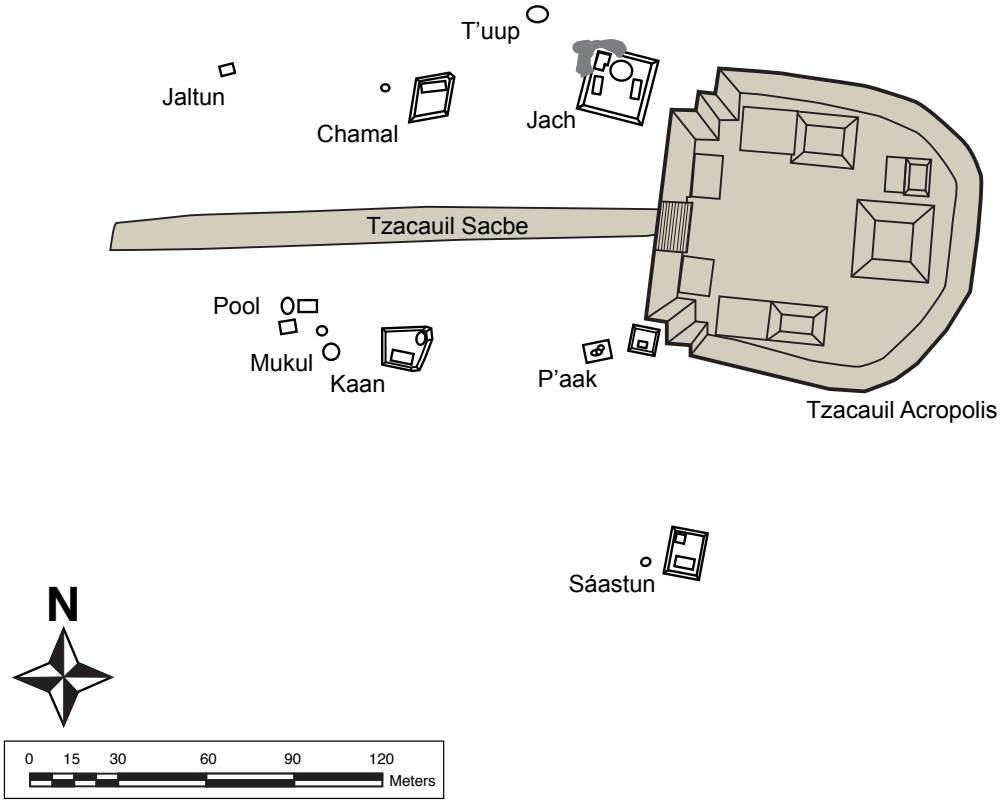

Figure 1.4 Malerized map of the Tzacauil archaeological site (redrawn from Hutson et al. 2012a)

Chronology	Time period	Previous Ceramic Complexes (after Johnstone 2001; modified by Stanton and Magnoni 2015)	New Ceramic Complexes	Common Ceramic Groups
A.D. 1800	Colonial	Yaxuná VI	Huntak	Olive Jars
A.D. 1750				
A.D. 1700				
A.D. 1650	**Scant Evidence of Occupation**			
A.D. 1600				
A.D. 1550				
A.D. 1500				
A.D. 1450				
A.D. 1400	Postclassic	Yaxuná V	Xilik	Mama Panabá Navulá
A.D. 1350				
A.D. 1300				
A.D. 1250				
A.D. 1200				
A.D. 1150	**Scant Evidence of Occupation**			
A.D. 1100				
A.D. 1050	Terminal Classic	Yaxuná IVb	Helep	Dzitás Sisal Dzibiac
A.D. 1000				
A.D. 950				
A.D. 900				
A.D. 850				
A.D. 800		Yaxuná IVa	Tsolik	Muna Teabo Ticul Sisal, Chum
A.D. 750				
A.D. 700				
A.D. 650	Late Classic	Yaxuná III	Yulum	Arena, Chum Chuburná Batres Maxcanú, Sabán
A.D. 600				
A.D. 550				
A.D. 500	Early Classic	Yaxuná II	Tepalil	Xanabá Polvero Sabán Sierra (Flaky) Dos Arroyos Oxil Aguila
A.D. 450				
A.D. 400				
A.D. 350				
A.D. 300				
A.D. 250				
A.D. 200	Terminal Formative	Yaxuná Ic	Ahal	Xanabá Sierra Polvero Alex Sabán, Ucú Dos Arroyos
A.D. 150				
A.D. 100				
A.D. 50				
0				
50 B.C.	Late Formative	Yaxuná Ib	Ka'nal	Sierra Flor
100 B.C.				

150 B.C.				Ucú Zapatista Tamanché Sabán
200 B.C.				
250 B.C.				
300 B.C.				
350 B.C.	Middle Formative	Yaxuná Ia	Hok'ol	Joventud Dzudzuquil Pital Ucú Achiotes El Llanto
400 B.C.				
450 B.C.				
500 B.C.				
550 B.C.				
600 B.C.				
650 B.C.				
700 B.C.			Late Laapal	Joventud Kin, Chel Kanxoc, Hunukú Huchim Dzeal
750 B.C.				
800 B.C.				
850 B.C.				
900 B.C.				
950 B.C.			Early Laapal	Chel, Kanxoc Huchim, Hunukú
1000 B.C.				

Table 1.1 Chronology for the Yaxuná and Tzacauil study region, developed by Travis Stanton

To my knowledge, this work at Tzacauil is among the most comprehensive archaeological studies of past Maya communities for any period, but particularly for the Formative period (though some salvage archaeological work has taken place at Formative northern Maya settlements; e.g., Hernández Hernández and Arias López 2003; Hernández Hernández et al. 2016). Archaeologists have been able to do fascinating work on the community-level of Maya social organization (e.g., Canuto and Yaeger 2000) but even studies that investigate rural settlements (e.g., Robin 2012, 2013) have typically relied on small representative samples (e.g., of houses within a settlement) from which to extrapolate their conclusions. Tzacauil is, in a way, a "bite-sized" community that permits a more holistic consideration of the totality of experiences and interactions that would have existed within a single settlement. At its peak in the Late to Terminal Formative, I doubt that Tzacauil's population exceeded a hundred people, and at other times in its history it may have only been home to a few individuals at a time. Tzacauil is such a small site, and such sites are not often targeted for intensive excavations. But small sites like this are ubiquitous in the Maya area and have been somewhat missing from our rigorous considerations of themes like political integration, agricultural production, and social identity. Investigating small sites like

Tzacauil lets us address those gaps while offering the ability for more truly holistic community-level studies.

So at Tzacauil, it was possible to excavate a much larger sample of the total settlement (close to 100%) for both the Formative and Classic occupations of the site. If we had not excavated the sample of house groups we did (eight out of nine), we would have missed some of the most fascinating insights of this study: (1) that even among a shared community identity, there were emerging social inequalities among Late and Terminal Formative households; (2) that Tzacauil had a small Classic period occupation; (3) that residential architecture from the Classic period suggests greater population mobility and a greater reliance on shifting cultivation; and (4) that the house groups and intra-settlement areas of Tzacauil yield evidence of major changes in hinterland agricultural practice and political organization.

This research shows that hinterland Maya farmers were, and continue to be, active agents in larger dynamics of social and environmental sustainability. The argument that I will elaborate in the following chapters is that the sustainability of hinterland Maya farming practices depends on a delicate balance between political intervention and farmer mobility. To farm sustainably, Maya farmers need to be allowed to be mobile. This mobility is far from a free-for-all; rather, it is a carefully organized system in which land tenure is not the right to occupy land, but the right to leave land and know that you or your descendants will be able to return to it someday.

Maya agriculture in the central Yucatán region can be thought of as a spectrum ranging between place-based, intensive strategies on one end, and shifting, extensive strategies (slash-and-burn farming, called *milpa* agriculture in this region) on the other. At different points in the region's history, Maya farmers have adjusted their position on that spectrum, emphasizing certain kinds of strategies more than others depending on a broad range of political, environmental, and social factors.

I will show here that rural Maya farmers in this region began to emphasize *milpa* agriculture (shifting and extensive strategies) sometime in the Classic period. As I will demonstrate using archaeological evidence from Tzacauil, some earlier rural farming settlements instead emphasized place-based, intensive agricultural strategies – the

same place-based strategies that had concomitantly developed in the urbanizing center at Yaxuná. There are indications that this arrangement required strong political intervention to make it work, and so such governing structures were also replicated. After successfully tethering a farming community to Tzacauil for about two centuries, these place-based agricultural and community-building strategies seem to have been abandoned in the hinterland. Now, political leaders and rural farmers transitioned towards a political and agricultural system that supported shifting strategies.

In this work, I argue that this Classic period shift marks the origins of the *milpa* agricultural system that continues to persist today. That it continued fairly stably for so long is a testament to how sustainable it can be, provided the right conditions (social, political, environmental, economic) are present. Once the transition to rural *milpa* farming took place,

political authorities do not seem to have attempted to keep rural farmers in one place. Through the Classic and even into the very early Colonial period, political control of Yaxuná's hinterlands may have changed multiple times. Yet despite these changes, pre-Hispanic political leaders seem to have understood the benefits of supporting farmers'extensive agricultural practices, even though these same practices meant farming households moved around fairly frequently. Central Yucatán farmers may still have been required to pay tribute and fulfill other political obligations, but they seem to have been allowed to move about the landscape as *milpa* farming required.

On the other hand, the story of the last several centuries is one of political authorities incapable or unwilling to accept this particular kind of land tenure as the best fit, for not only the farmers but also for long-term agricultural productivity. As I will show here, the culmination of this conflict is neoliberal agrarian reform. Land privatization is destroying the sustainability of small-scale farming in Yucatán because it pre-empts the ability of farmers to adjust their agricultural strategies in response to societal and environmental changes. Privatizing the forested, fallow lands that the neoliberal economy regards as "unproductive" would likely be irreversible. It would preclude the possibility of a return to shifting *milpa* agriculture in the future. The loss of this flexibility would negate twenty centuries of agricultural trial and error. It would constitute a

rejection of the carefully orchestrated successes won from the lessons of previous failures.

The rest of this introductory chapter lays groundwork for the discussions ahead. First, my understanding of the Tzacauil landscape as a recording of human-environment interactions is situated in historical ecology. The next section will consider historical ecology as a useful framework for environmental anthropological archaeology.

I then turn to Yucatán. I will present the archaeological sites of Tzacauil and its neighbor Yaxuná. I will also introduce Yaxunah, the modern Maya community that owns the lands where those sites are located as part of its *ejido*, or collective agricultural landholding (Figure 1.5). After this, I move on to a discussion of past archaeological research at Tzacauil and in the Yaxunah *ejido*. Following this, I offer a map of the chapters ahead.

Figure 1.5 Google Earth image showing Tzacauil at the eastern edge of the *ejido* of the town of Yaxunah

1.3 Historical ecology and the anthropological study of landscapes

Historical ecology is a framework that examines the long-term, mutual impacts and interactions of people and the environment in particular places. It combines approaches from archaeology, cultural anthropology, history, and ecology to understand human-environment relationships at a multitude of temporal and spatial scales. In this section I will contextualize historical-ecological approaches within the larger intellectual

history of anthropology, and then go on to show how and why historical ecology is unique. I will explore how historical ecology's unit of analysis – the landscape – is conceptualized. The section will close with some specific directions on how I will be using historical ecology to frame research at Tzacauil.

Anthropologists were interested in humankind's relationship to nature long before the term "historical ecology" began appearing in the late 20th century. Cultural ecology, growing out of the work of mid-20th century scholars like Julian Steward (1955), Roy Rappaport (1968, 1979), and Robert McC. Netting (1981, 1983) brought the environment to the center of anthropological understandings of why and how societies change over time. Others like Eric Wolf (1982, 1990) and Piers Blaikie (1985) combined aspects of cultural ecology with insights from political economy – particularly Marxist thought – to form an approach they called political ecology, which added a political dimension to formerly apolitical studies of social-environmental relationships. Also emerging from this milieu, Marvin Harris' (1968, 1979) concept of cultural materialism proposed to explain objectively any sociopolitical systems based on the materialist framework supplied by Marx's Three Levels of Culture (infrastructure, structure, and superstructure). While these theoretical paradigms within mid-20th century cultural anthropology overlapped in several ways, the most important commonalities for understanding historical ecology's emergence are their shared (1) distinction that humans and nature are separate entities; (2) reliance on adaptation as the principal driver of cultures' relationships to the environment; and (3) use of the scientific method to study and explain human-environment relationships.

North American archaeology was ignited by these scientifically rigorous, systematic approaches to the human condition in the 1960s-70s. Proponents of this so-called New Archaeology (later known as processual archaeology) were not content to simply compile culture-histories – they declared that it was possible, using the scientific method, to understand past cultures through the physical traces they left behind (Binford 1962, 1967, 1978; Binford and Binford 1968; Flannery 1972; Willey and Phillips 1958). Using a paradigm derived from Darwinian evolution and applied to human societies – cultural evolution – processual archaeologists studied adaptation to environmental

change at the level not of the individual but of the entire *culture* and the totality of its system. Processual archaeologists strove to generate views of the past not trapped in static, single moments, but rather views that captured change and development over long periods of time. Moreover, they argued that the application of the scientific method in archaeology meant that culture could be studied from an unbiased, objective stance. The field was transformed. Archaeology was going to be anthropological: its goals were to ask and answer questions about human society.

In the past fifty years, critiques of some of processual archaeology's central tenets have steered anthropological archaeology in new directions – and in particular, have brought the study of human-environment relationships into new theoretical grounds. As pointed out by others (Isendahl 2016), the late 20th century saw the proliferation of research programs designed to define and explain the relationships between humans, culture, and environment: a non-exhaustive list of them might include ecological, environmental, and landscape anthropology; environmental and landscape archaeology; environmental history; ecological economics; and political, social, and system ecology (Isendahl 2016:128). Historical ecology builds on – but is distinct from – these approaches. What, then, sets historical ecology apart as an anthropological paradigm? Let us examine its main assertions and see.

Humans are agents of environmental change.

Historical ecology is deliberately anthropocentric: humans are seen as a keystone species (i.e. a species with a disproportionately large impact on its environment relative to its abundance; see Paine 1995) and as agents of change in the environment (Balée 1998, 2006:79; Balée and Erickson 2006:1, 5; Crumley 1994, 2007). Historical ecologists reject the idea that nature and society can be separated, instead arguing that most, if not all, of Earth's nonhuman biosphere has been affected by human action – and that not all of these impacts are necessarily degrading or destructive (Balée 1998). Historical ecology consciously moves away from frameworks that would cast humanity as distinct from, and often in opposition to, the natural world, proposing instead that "humans are natural, and nature is human" (Kidder and Balée

1998:405). Humans are *not* simply adapting or reacting to environmental change, as has been posited by other frameworks. Humans cause environmental change, at the level of the individual, the household, the community, the polity, and the region (and in the last few centuries, at the global level). The short- and long- term effects of those changes may be intended or unintended (Crumley 2015; Doolittle 2015; Thompson 2013). Human cognition and perception play a significant role in this ongoing, mutual interaction (Crumley 1994:4; Schaan 2012). As a society's relationship with its local environments develops over time, those changes are historical and ecological, not evolutionary, and must be studied as such (Balée 1998). At its essence, historical ecology says that the relationship between culture and environment is not a dichotomy – it is an ongoing **dialogue** (Balée 1998:14; Ingerson 1994:65).

Landscapes are records of human-environmental interaction.

Landscapes are the material manifestation of the relationship between humans and their local environment, and they constitute the primary unit of analysis in historical ecology (Balée 1998; Crumley and Marquardt 1987; Crumley 1994:6; Schaan 2012) as well as in the field of landscape archaeology more generally (e.g., Ashmore and Knapp 1999; Bender 1993; Tilley 1994). "Landscape" is a useful term because it transcends disciplinary boundaries (another of historical ecology's central tenets; e.g., Crumley and Marquardt 1990). Precisely at the same time, though, landscape's flexibility as a term has led to some nebulous and even contradictory definitions among anthropological archaeologists whose approaches fall under the umbrella of "landscape archaeology" (Thompson 2013). The sense in which I use the term landscape in this study follows how its use by historical ecologists, who conceptualize landscapes as texts.

> "Reliable and widely available evidence for the historical interrelatedness of humans and the environment may be read in the landscape." (Crumley 1994:6)

> "(T)he landscape is similar to a text that tracks human actions, natural processes, and the ongoing interaction between the two." (Thompson 2013:4)

> "(Landscapes) form primary sources and source contexts for studying, deducing, and interpreting the interactions between humans and the environment over the long term." (Isendahl 2016:130)

Historical ecology embraces the landscape as a unit of analysis that allows consideration of totalities, that is, to approach the subject of study as a whole and not simply as disparate parts (Patterson 1994). It is important to realize that landscapes are not *only* shaped by the obvious features of human modification and land-use – the dams, mounds, ditches, and canals. Landscapes also retain the physical evidence of small-scale economic transactions, incremental changes, labor, skill, and mental activities (Crumley 1994:9; Doolittle 2015; Ford and Clarke 2015), what Thompson (2013:1) might call the "whispers" on the landscape. At all scales, people are active managers of the changing landscape (Balée 1994:117; Crumley 2015:8; Erickson 2008:160; Thompson 2013:4). The goals of historical ecology are to use archaeological, historical, ethnographic, and environmental records to figure out how and why humans manipulate the landscape, and to understand the historical context in which those decisions and actions took place.

A multi-scalar approach is needed to understand human-environmental interaction.

Landscapes – the physical records of ongoing human-environmental interaction – can only be understood by linking together multiple scales of analysis, both temporal and spatial (Balée 1998; Balée and Erickson 2006; Crumley 1994; Erickson 2008). Anthropologists working in a historical-ecological framework move from one scale to another to bring different patterns and relationships into focus (Crumley 1994:7-9; Marquardt and Crumley 1987:7). This multi-scalar approach is especially important as it relates to historical ecology's connections to the modern sustainability discourse (see item #5, below). Moving between decadal, centennial, and millennial scales of analysis problematizes our assumptions about what "long-term" and "sustainable" actually mean

(Crumley 2015; Fisher and Feinman 2005; Ford and Clark 2015; Wells 2015). Historical ecology gives archaeologists a framework to account for many variables operating at different tempos and in different spaces.

Historical ecology erodes the distinctions between social science and natural science.

Historical ecology is decidedly scientific and evidence-validated, but cannot be neatly categorized as either a social science or a natural science – it bridges disciplines and integrates diverse kinds of data (Armstrong et al. 2017; Balée 1998; Crumley 1994; Crumley 2015). If we want to understand the totality of human-environment interactions in a landscape, we need to be prepared to embrace methods and approaches from multiple disciplines. The disciplinary boundaries between the social sciences and natural sciences are an impediment to this effort. Crumley (1994:2) points out how these distinctions have created a rift in anthropology when she says the "first part of the story of the human species is couched in evolutionary and environmental terms, the second denies environment a meaningful role in human history". Historical ecology offers a metalanguage (Balée 1998:1) to cross the perceived gulf between disciplines and creates paths through which data can be integrated into a comprehensive, interdisciplinary framework (Crumley 1994). This interdisciplinary goal is part of a greater transformation in science as a whole (Kidder and Balée 1998), and, in anthropology in particular, has generated new kinds of research goals, questions, and data (e.g. De León 2015).

Historical-ecological research explicitly links to modern sustainability discourse.

In the historical ecology framework, anthropological investigations of past societies make clear connections to current environmental issues faced by modern societies (Armstrong et al. 2017; Chase and Scarborough 2014; Crumley 1994, 2015; Fisher and Feinman 2005; Isendahl 2016:130. This is not done as an afterthought; it is a clear goal from the beginning of research design. This work is especially important since today's sustainability initiatives (e.g., implementation of conservation agriculture,

education and outreach programs) often operate according to short time scales, which, by definition cannot result in true, long-lasting sustainability. Just as problematic, though, is archaeologists' frequent failure to connect to modern environmental issues and contemporary data sets (Wells 2015). Historical ecology provides a language and framework for introducing potential lessons from past societies into the sustainability discourse. This commitment in historical ecology often involves giving preference to Indigenous voices and knowledge (Armstrong et al. 2017; Schaan 2012:27) and using the pre-industrial past to guide decision-making (Redman 1999; Wells 2015; see also e.g., Davies 2012; Rautio et al. 2016).

To conclude this section, historical ecology provides a framework and language for interdisciplinary approaches to past, present, and future human-environment interactions. Its terminology, goals, and landscape focus align well with my approach to understanding the 2000-year history of agrarian change as materialized in the Tzacauil landscape.

1.4 Introducing Tzacauil and the Yaxunah *ejido*

Tzacauil is an archaeological site in central Yucatán, Mexico (Figures 1.2-1.4). The site is made up of a large pyramid – the Tzacauil Acropolis – at whose base begins a raised limestone causeway – the Tzacauil Sacbe (a Yucatec word meaning "white road") – which cuts across the terrain and runs west for several hundred meters. There are about two dozen low mounds scattered in front of the Tzacauil Acropolis and on either side of the sacbe. These mounds are the remains of houses, kitchens, and storage buildings, built and lived in by people who made a home here in the past. The site today is forested with the dense, low-lying scrub typical of secondary growth in central Yucatán. Tzacauil's terrain is a mosaic of exposed bedrock (tzekeles) and low-lying expanses of reddish-brown soils (kancabales). The nearest permanent water sources are two *cenotes* (sinkholes reaching potable water that fell as rain and percolated through the porous limestone bedrock); they are known locally as El

Figure 1.6 Cenote X-auil

Figure 1.7 Cenote X-auil (Stanton and Magnoni 2011

Manantial and Cenote X-auil and are about 225 meters southeast and 450 meters northeast, respectively, of the Tzacauil Acropolis (Figures 1.6-1.8).

People came to live at Tzacauil at least two different times in the past – once about 2000 years ago, in time periods Maya archaeologists call the Late and Terminal Formative (also called Preclassic) that spans about 300 BC – AD 250, and then again during the time periods designated the Late and Terminal Classic, which we can place around AD 550 – 1050. These time periods are derived from stylistic changes we see in the site's ceramics and architecture, and while they help us somewhat to situate Tzacauil in world history, the multi-century length of both periods can make them somewhat unwieldy in practice. Based on the investigations described in the chapters ahead, it seems more likely that Tzacauil's two occupations were each short-lived, and probably took place (1) in the latter part of the Late Formative and through the end of the Terminal Formative, and then (2) again with sporadic occupation from the Late Classic through the Terminal Classic.

Yet before, during, between, and after those two distinct occupations at Tzacauil, the larger region shows continuous signs of human activity. Most of this activity is focused just 3.2 kilometers to the west at the archaeological site of Yaxuná (Figures 1.9-1.11. Yaxuná was the regional center – the capital, we could say – of a large area in central Yucatán beginning as early as the Middle Formative period (ca. 1000 – 300 BC). People built huge monumental architecture at Yaxuná in this early phase, and continued

Figure 1.8 El Manantial (from Stanton and Magnoni 2011)

with even more ostentatious building projects into the Late Formative. They began to fill in the lands around these temples and plazas with humbler, but still substantial, platforms, which in turn supported their houses. Yaxuná faced political upheaval later on at the hands of larger rivals like Cobá and Chichén Itzá, but these tensions appear not to have slowed the growth of the population during the later part of the Classic period. All this time, from the Middle Formative to the Terminal Classic, Yaxuná was not abandoned. People continued to live there. Yet it is clear that Yaxuná's occupation was not constant. The archaeological data strongly indicate that Yaxuná peaked twice in population: once during the Late Formative and again in the Terminal Classic – the same times that witnessed the crystallization of settlement less than an hour's walk away out at Tzacauil.

Today, the archaeological sites of Tzacauil and Yaxuná, along with others, are situated in lands belonging to the modern Maya (i.e. Yucatec Maya-speaking people) community of Yaxunah (e.g., Alococer Puerto 2001; Hernández Álvarez 2014). These lands form the Yaxunah *ejido*, a communally-owned landholding, the rights to which are

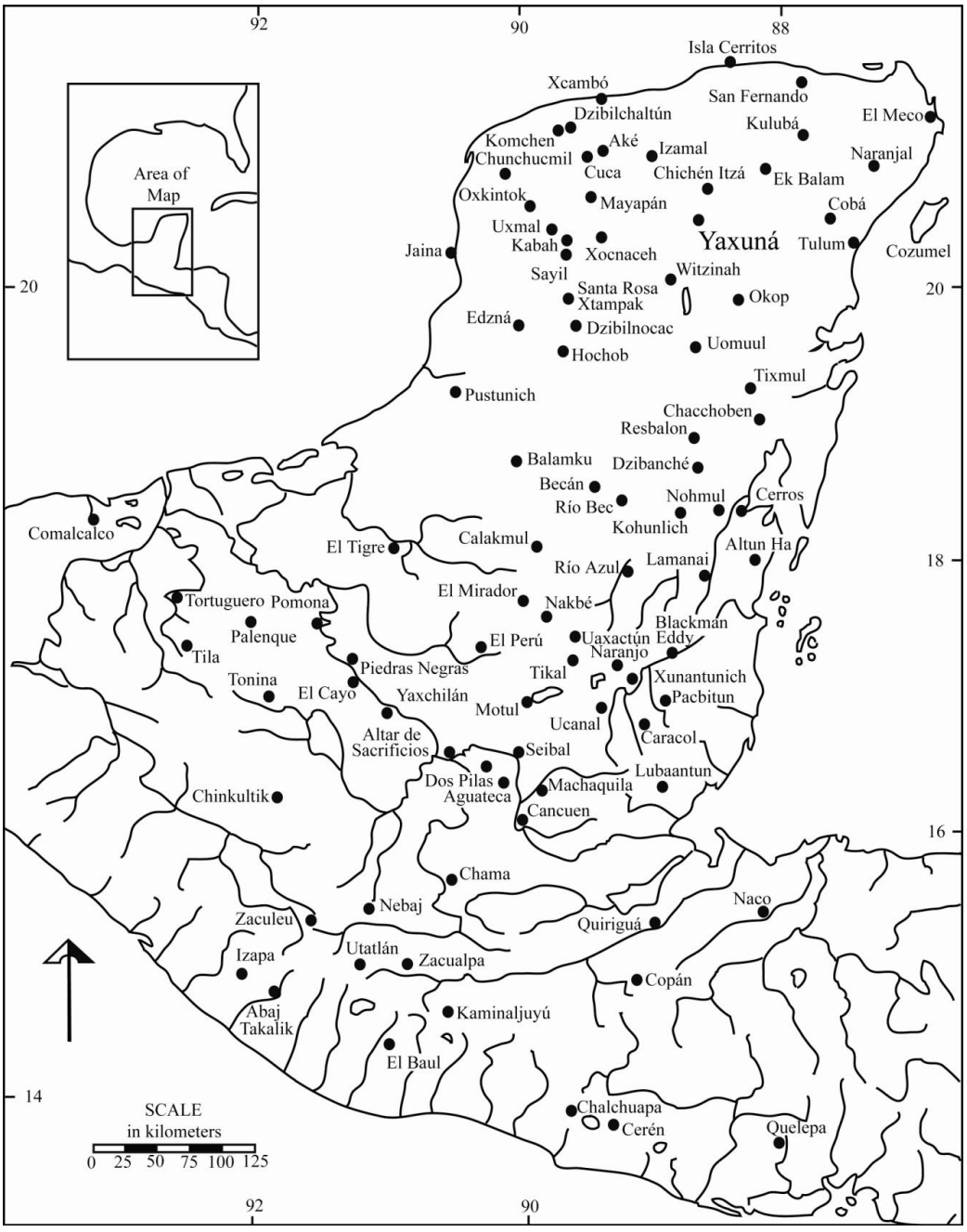

Figure 1.9 Map of the Maya area showing Yaxuná's location (from Stanton et al. 2010)

passed down from generation to generation (usually from fathers to sons). Owning rights to the *ejido* – that is, being what is called an *ejidatario* (or *ejidataria*; women do hold *ejido* rights but in smaller numbers) – grants a person and his/her family access to use the landholding for planting crops, hunting, grazing livestock, raising honeybees, and collecting resources like water, firewood, fruit, hardwood trees, and forage for

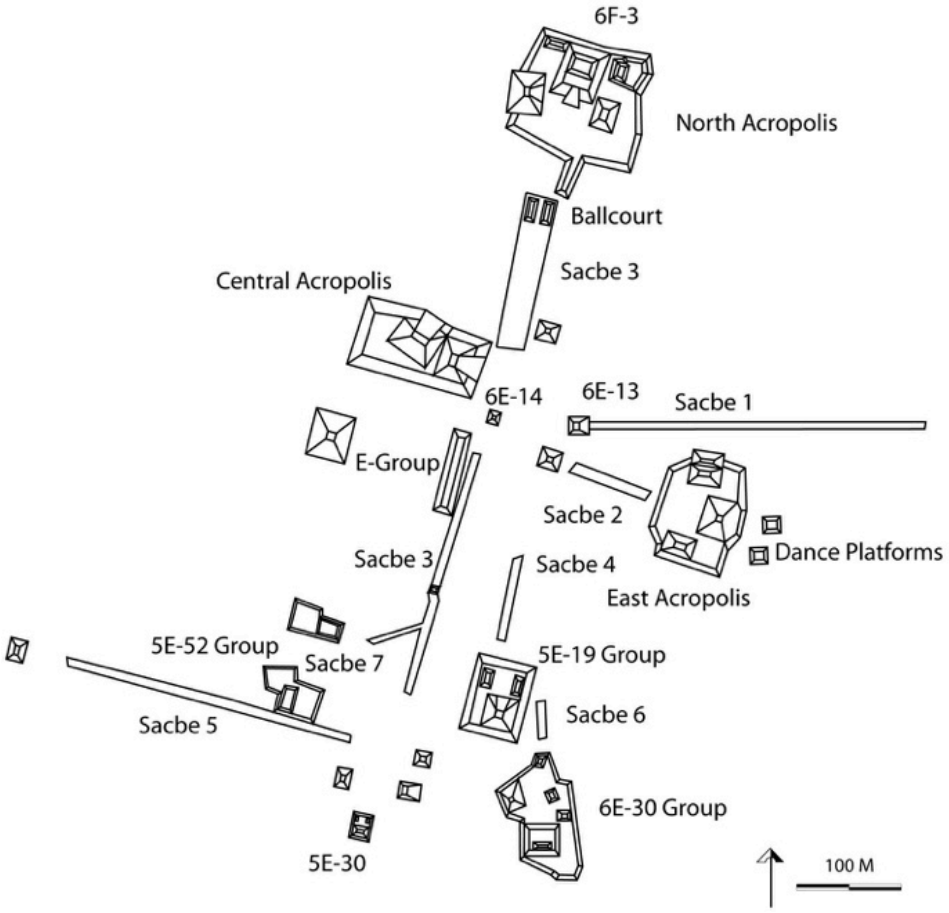

Figure 1.10 Yaxuná's ceremonial core

Figure 1.11 View of the Tzacauil Acropolis from the East Acropolis of Yaxuná (from Stanton and Magnoni 2011)

animals. *Ejidatarios* also maintain the exclusive right to work on archaeological projects operating within the *ejido*, based on an arrangement that was made in the 1980s and has persisted to today. Being an *ejidatario* is a source of prestige within the Yaxunah community.

While the *ejido* sprawls out over an area of some 4066 hectares, most modern community life is centered around the town of Yaxunah itself. Yaxunah is situated at the western fringes of the archaeological site of Yaxuná, and probably overlaps part of the ancient city. The town's grid was laid out in the Colonial period (see Chapter 8). Near the center of this grid are the *cenote* Lol-ha and the standing remains of a Colonial church, finished in 1817. The early 19th century settlement at Yaxunah had a close neighbor in Cetelac, a cattle-raising *hacienda* of the same time period situated to the east among the ruins of the Yaxuná archaeological site (Alexander 2004)[3]. Both Yaxunah and Cetelac were abandoned with the onset of the Caste War in 1847. Towards the end of the war in the early 20th century, displaced Maya families began to settle down again, and a few chose to reclaim the old Colonial town of Yaxunah from the forest. The descendants of these founding families represent the majority of the Yaxunah *ejidatarios* in the early 21st century. Today the town has about 600 people, most of whom in one way or another make their living from Yucatán's tourism industry. Yaxuneros' economic involvement with tourism is diverse: carving wooden masks to sell to vendors in Pisté, who then raise the prices and sell the masks to tourists in Chichén Itzá (Patjane Floriuk 2009); selling food to (or working in) internationally-acclaimed, upscale restaurants in Mérida, Tulum, and Cancun (Ardren 2018; Bianet Castellanos 2010; Re Cruz 2006); and hosting short homestays for Mexican and foreign tour groups for service projects and in search of the elusive "Mayan experience" (López Pacheco et al. 2016). Modern Yaxunah defies easy classification: its people simultaneously maintain many Indigenous lifeways – several of which trace their origins back to pre-

[3] There remains debate about the age of *hacienda* Cetelac; some architectural evidence suggests it might be older than the dates proposed by Rani Alexander (Traci Ardren, personal communication 2019). Hopefully this will be resolved with future excavations, but for now I follow the chronology used by Alexander (1993, 1998, 1999, 2004, 2006).

Conquest times – while also actively engaging in an increasingly digital, globalized world.

1.5 Previous archaeological work in the Yaxunah *ejido*

At the time I write this, nearly ninety years have passed since the first archaeologists began to visit the area that, today, is known as the Yaxunah *ejido*. Yaxunah, as I mentioned, had been abandoned with the onset of the Caste War in 1847. It was not until 1917 that seven displaced Maya families from further east decided to resettle the Colonial ghost town, and not until 1934 that the Yaxunah *ejido* received official recognition from the Mexican government (Hernández Álvarez 2014). The first visits to Yaxunah by U.S. American archaeologists (described below) are recorded for 1927 and 1933. The point – and the reason why a history of archaeology in this place deserves the attention I will give it here – is that Yaxuneros have been interacting with foreign archaeologists almost for as long as the modern town has existed. To omit archaeological projects from the narrative of the Yaxunah *ejido* is to miss a major part of the story. Therefore in this section, I not only outline the history of previous archaeological research done within the domain of the *ejido*, I also try to introduce (when data are available) how archaeological projects interacted with people in town.

1.5.1 The Carnegie Institution of Washington in Yaxuná (1927-1933)

The history of archaeological research in the Yaxunah *ejido* began with the Carnegie Institution of Washington. So began the archaeological history of many important Maya sites: the Carnegie Institution sponsored archaeological excavations throughout Mexico and Central America from 1913 to 1957, providing the first scientific documentation for places like Chichén Itzá, Cobá, Kaminaljuyú, Copán, Yaxchilán, and Uaxactun. Yaxuná, the largest and most politically significant archaeological site in the boundaries of the Yaxunah *ejido*, received some attention from Carnegie archaeologists who were working out of Chichén Itzá, some 24 km northwest. Here in Yaxuná, Carnegie archaeologists believed they might find the data necessary to articulate the political history of the northern Maya lowlands, particularly in regard to the dynamics

between Chichén Itzá and Cobá (Kidder 1930). Yaxuná had clear links to both Chichén Itzá and Cobá. It was physically close to Chichén Itzá, and physically linked to Cobá via a raised limestone causeway – today called the Yaxuná-Cobá Sacbe or Sacbe 1 – that connects the two sites by traversing a hundred kilometers of forest.

Carnegie archaeologists had long been interested in the Yaxuná-Cobá sacbe. Armed with previous descriptions of the sacbe from 19th-century travel accounts (Stephens 1843), the Institution launched several attempts to survey the sacbe in its entirety – but these early expeditions all failed to cover its full extent (Bennett 1930; Villa Rojas 1933). It was finally Mexican anthropologist Alfonso Villa Rojas, sponsored by the Carnegie Institution and aided by twelve Maya men, who chopped and recorded his way along the sacbe from Yaxuná to Cobá over three weeks in 1933 (Villa Rojas 1933, 1934). Though no mention is made of the site we know today as Tzacauil, this crew of sacbe explorers would have passed just 270 m south of it during the very first hours of their endeavor. We can imagine, but never know, that the twelve men who worked for Villa Rojas tried to draw his attention to the large mound – Xnoojmuul, the Tzacauil Acropolis– on that first day of chopping… and perhaps Villa Rojas did investigate it, or perhaps he was too focused on the task at hand to lose time veering away from the task at hand.

Aside from this work along the Yaxuná-Cobá sacbe, the Carnegie Institution periodically sent its researchers on the 7-hour trek on horseback from Pisté to Yaxuná in order to collect data from the site itself (O'Neill 1933). Ralph Roys journeyed there to investigate the 19th century hacienda Cetelac (Roys 1933). Other Carnegie Institution archaeologists were sent to document the pre-Columbian architecture of Yaxuná's site core (Figure 1.12). They were decidedly unimpressed. Summarizing the project's first visit to Yaxuná, Morley (1927) dryly described the ruinous state of site's largest pyramid (today known as the Central Acropolis) before conceding, "It is obviously of much earlier date than Chichén Itzá." This mild editorializing notwithstanding, the Carnegie Institution produced the first map of the monumental architecture of Yaxuná's site core (Kidder 1935; O'Neill 1933). Obtaining ceramics was another reason that Carnegie archaeologists continued to visit Yaxuná: they needed sherds (fragments of broken

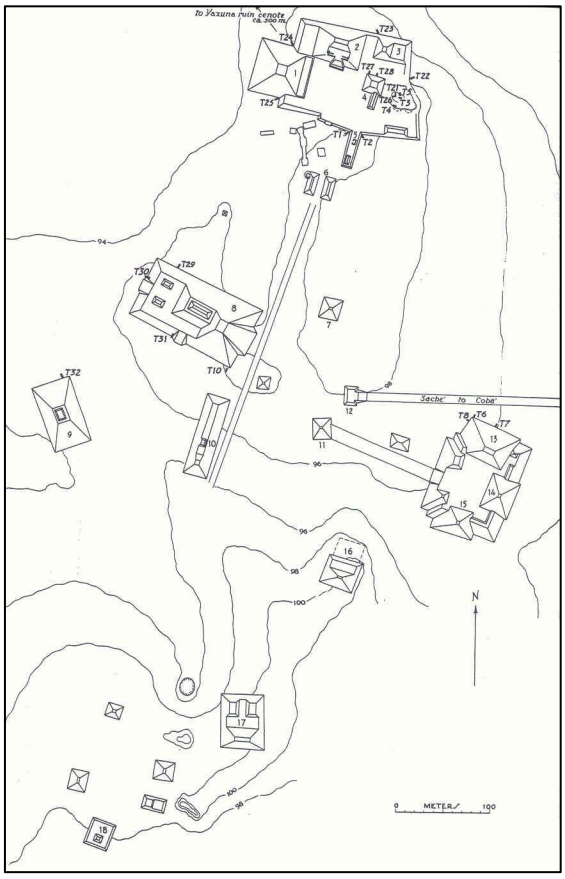

Figure 1.12 Carnegie Institution of Washington map of Yaxuná (from Brainerd 1958)

Figure 1.13 David Freidel, co-director of the Selz Foundation Yaxuná Archaeological Project

Figure 1.14 Selz Foundation archaeologists excavating at Yaxuná

pottery) to build a ceramic sequence for Yucatán, and the Institution's prescient hunch that Yaxuná was a much older site than Chichén Itzá meant that Yaxuná would play an important role in building this regional ceramic chronology. Early attempts by project ceramicists to figure out this chronology (Kidder 1932; Roberts 1933, 1935) were picked up and completed by George Brainerd. Brainerd ultimately went on to define the ceramic sequence for the northern Maya lowlands (Brainerd 1940, 1942, 1958). These Carnegie Institution visits to Yaxunah no doubt involved interaction with (and likely the hiring of) people from the village, but as in most archaeological reports, such interactions were not considered worth describing.

More than forty years of Carnegie Institution research in the Maya area came to an end in 1958. World War II had signaled the beginning of the end, as several of the Institution's leading Maya scholars left to serve in the military, leaving the future of the

CIW in doubt. After the war, critiques and questions about funding undermined researchers' visions for a long-term, sustained research effort. After funding a final, inspired research project based at Mayapán from 1949-1955, the Carnegie Institution of Washington terminated its program of research in the Maya area. Fortunately for Maya studies, the data and intellectual momentum generated by four decades of Carnegie work in Mexico and Central America spurred the development of major independent projects in places like Dzibilchaltún, Palenque, and Tikal. For sites in the Yaxunah *ejido*, though, it would be decades before archaeological research would resume.

1.5.2 The Selz Foundation Yaxuná Archaeological Project (1986-1996)

Archaeological research at Yaxuná began again in 1986 with the arrival of a project directed by U.S. American archaeologist David Freidel (along with, over the years, various co-directors including Mexican archaeologists Tomás Gallareta Negrón Fernando Robles, and Rafael Cobos Palma, as well as U.S. American archaeologists Maynard Cliff, Charles Suhler, and Traci Ardren) (Ardren et al. 1994; Freidel 1987; Suhler and Freidel 1993; Stanton et al. 2010) (Figures 1.13, 1.14). In 1989, the project started receiving support from private benefactor Bernard Selz, and so it was at this point it adopted the name it would work under for nearly a decade of research: the Selz Foundation Yaxuná Archaeological Project – or simply the Selz Project (see Stanton et al. 2010).

Freidel and his colleagues had two main goals at Yaxuná. First, research at Yaxuná promised to offer insights into early (i.e. Formative) sociopolitical complexity in the northern Maya lowlands. Second, Yaxuná was believed to have had an important role in regional dynamics during the Late and Terminal Classic – the same Cobá and Chichén Itzá links that had attracted Carnegie Institution archaeologists.

Regarding the first goal of documenting the Formative origins of sociopolitical complexity in the north, Freidel had come to Yaxuná after working at the Late Formative site of Cerros, located in Belize and in the region called the southern Maya lowlands (Freidel 1979). It was well known at this point that social complexity had developed in the Formative southern lowlands at this time – but what was going on in the northern

Maya lowlands (i.e. Yucatán) at this time was unknown. Archaeologist E. Wyllys Andrews V had shown that, indeed, there were Middle and Late Formative settlements in the northern lowlands (Andrews and Ringle 1992; Ringle 1985; Ringle and Andrews 1988, 1990), but the question remained as to whether similar levels of social complexity developed simultaneously in the north. Freidel had read Brainerd's (1958) assertions that Yaxuná probably had a significant Late Formative settlement, and so it seemed like the place to go to answer this question.

The second goal of articulating Late and Terminal Classic regional politics through Yaxuná was a response to a hypothesis proposed by Andrews and Robles Castellanos (1985). They suggested that at the end of the Classic period, Yaxuná had been incorporated into the regional polity of Cobá (hence the Yaxuná-Cobá sacbe) and was functioning as the principal outpost on Cobá's western frontier (Freidel 1992; Schele and Freidel 1990). Proponents of this scenario proposed that Yaxuná, then, had received the brunt of conflict and tension associated with a standoff between the two larger centers of Cobá in the east, and Chichén Itzá in the west. This hypothesis was mostly borne out using stylistic differences in ceramics of the eastern and western peninsula. Freidel and colleagues' excavations at Yaxuná would look for archaeological evidence.

The first three seasons (1986-89) of the Selz Project were mostly spent surveying and mapping the Yaxuná archaeological site, along with collecting chronological data from a limited number of test excavations (Figure 1.15). Interest in mapping Yaxuná coincided with the Mexican government's effort to register known archaeological sites, a research program called the INAH Atlas Project (Garza T. and Kurjack 1980; Kurjack and Garza T. 1981). A member of the INAH Atlas Project established the exact location of Yaxuná and laid out the west-east baseline that was used for mapping the site in 1986 (Freidel 1987). It would also have been around this time, perhaps on this same visit to Yaxuná, that the INAH Atlas Project registered Tzacauil – and also, then, the moment that its official (and meaningless) name was

assigned[4]. Selz Project members mapped the central site core of Yaxuná using a theodolite, taking advantage of the surface visibility afforded by cleared *milpa* land and a severe drought in the summer of 1988. In addition to mapping the main architectural groups of Yaxuná (Structure 5F-1, North Acropolis, East Acropolis), the project mapped the 19th-century hacienda, Cetelac, as part of Rani Alexander's doctoral research (e.g., Alexander 1998, 2004, 2006). When the map was complete and the appropriate permits obtained, the project went ahead with test excavations in monumental architecture. This strategy, called "summit tests", lets archaeologists recover ceramics from sealed construction phases of a large building by puncturing through its layers of superimposed floors. The ceramics obtained from such a summit test can be used to date a building's construction history – and, in the case of these preliminary pits, were used to confirm what previous archaeologists had suspected (specifically, Morley from sixty years previous): Yaxuná had huge monumental architecture in the Late Formative. In other words Yaxuná was obviously of much earlier date than Chichén Itzá.

Research resumed in 1991 with larger-scale excavations. The Selz Project excavated (1) Yaxuná's only ballcourt, just south of the North Acropolis; (2) two Early to Late Classic elite residential groups; (3) a cluster of early architectural groups located just south of the site center; and (4) two so-called dance platforms off the east side of the East Acropolis (Freidel et al. 1998; Stanton 2000; Suhler 1996). The last two operations described produced a great deal of data pointing to Yaxuná's development and regional importance in the Middle and Late Formative; these data will be discussed in subsequent chapters. Outside of the Yaxuná archaeological zone (but still within the Yaxunah *ejido*), Traci Ardren (1997) began her doctoral investigation of an outlying acropolis known as Xkanhá. Preliminary work was also done at the outlying sites of Popola and X'telhu.

The 1992 season was used to advance the investigation of several groups that had been preliminarily investigated in earlier seasons. Again, most of the work took

[4] The name "Tzacauil" is probably the result of archaeologists mis-hearing or misunderstanding the word "*Xauil*", the name by which Yaxuneros call the nearby *cenote*, which, confusingly, is surrounded by an archaeological site that is officially registered as Xauil. Locals today call the Tzacauil archaeological site "*Xnooj mul*", which means "Big Mound" and refers to the Tzacauil Acropolis. Nor is Yaxuná exempt from this identity crisis: among Yaxuneros, the Yaxuná Archaeological Zone is known as "*Xlacah*", which means "Old Town".

place at Yaxuná. At the North Acropolis, project archaeologists exposed two range structures with signs of ritual termination (i.e. intentional destruction) and architectural influence from the Puuc region of western Yucatán (Suhler 1996). Excavations continued at the Formative "dance platforms" next to the East Acropolis. The project also excavated a series of test pits in residential architecture throughout the Yaxuná archaeological zone, recovering chronological ceramic data and, often, human burials from the Late to Terminal Classic (Stanton et al. 2010). In the northern part of the *ejido*, Ardren's continued work at Xkanhá showed that the acropolis there had been reinforced with defensive features. It should also be noted that from this season on to its end in 1996, the Selz Project was co-directed by Freidel, Ardren, and Suhler.

Field research in 1993 focused on Yaxuná's North Acropolis, particularly on two of the structures associated with this architectural complex (Structures 6F-4, 6F-3, and 6F-68). By excavating directly into North Acropolis architecture, excavators working under Suhler's supervision found two royal tombs: one (Burial 24) containing the remains of more than ten individuals; another containing an Early Classic individual (Burial 23) (Ardren 2002; Freidel et al. 2003; Suhler 1996; Stanton et al. 2010). Other research during the 1993 season included excavations at the ballcourt plaza, the terminus building at the Yaxuná end of the Yaxuná-Cobá Sacbe, and a Late Preclassic architectural group (5E-19) that was found to have some of the earliest monumental construction known for the northern Maya lowlands (Stanton and Ardren 2005).

The final seasons (1994-1996) of the Selz Project continued exploration of structures associated with Yaxuná's North Acropolis (6F-3, 6F-4, and 6F-68). The project was also able to document a defensive wall that had been constructed around the top of the North Acropolis' main platform (Ambrosino et al. 2003)). Some mapping was also completed in the eastern part of Yaxuná along the sides of Sacbe 1. Mention is made in a later report that Selz Project archaeologists Justine Shaw and Dave Johnstone visited Tzacauil in 1996 (probably during survey of the area east of Yaxuná) but they made no formal investigations and nothing more is said about their visit (Stanton et al. 2010:19).

Figure 1.15 Selz Foundation map of Yaxuná (from Stanton et al. 2010)

The conclusion of the Selz Foundation Yaxuná Archaeological Project can be a delicate subject today for some archaeologists and members of the Yaxunah community. The project ended somewhat abruptly, due in part to disagreements between government archaeologists and Selz Project archaeologists. These disagreements were inflamed by pressure from the local government to open Yaxuná to tourism (Travis Stanton, personal communication 2019) and federal initiatives to develop tourism in rural areas throughout Mexico (Traci Ardren, personal communication 2019; see also Meyers 2012; Reyes 2015). The Selz Project was ultimately dissolved. Its end ushered in the next period of research, conducted by INAH archaeologists.

Regardless of why the Selz Project ended, the contributions it made provided a base of knowledge and practice for ongoing archaeological research in the Yaxunah

ejido. Current field projects still follow the system of weekly labor rotation for hiring workers, an arrangement established by the Selz Project. There remain several links between current field projects and the Selz Project. Travis Stanton, who did his doctoral research at Yaxuná (Stanton 2000), returned to work at the site with INAH's authorization ten years later; he was later joined as co-director by former Selz Project co-director Traci Ardren, who continues to conduct research in the *ejido.*

1.5.3 INAH research at Yaxuná (1997-2000, 2005)

The year after the Selz Project ended, the Mexican Instituto Nacional de Antropología e Historia (INAH) began work in the Yaxuná archaeological zone under the direction of Arqlga. Lourdes Toscano Hernández (Novelo Rincón 2012; Toscano Hernández and Ortegón Zapata 2003; Toscano Hernández et al. 1998). The INAH project at Yaxuná focused its efforts on the North Acropolis and the buildings in its vicinity. They excavated the Ball Court, the Puuc Group (a cluster of structures with clear stylistic influences from the Puuc region of western Yucatán), and the terminus building of the Yaxuná-Cobá Sacbe. These structures were also consolidated (restored) and left exposed so that visitors to Yaxuná could see what they would have looked like during their final building stages (Figure 1.16). Consolidation of excavated architecture is required by law for all archaeological projects working in Mexico, but while U.S. American projects tend to regard it as an obligation secondary to research objectives, many INAH projects prioritize consolidation as a principal goal. Both approaches have their values and limitations. Twenty years later, INAH's successful consolidation of a handful of monumental structures in Yaxuná continues to hold a lasting influence, both on how people in Yaxunah relate to the site, and how they view the goals of ongoing and future archaeological work.

1.5.4 PIPCY (2007-present)

The latest archaeological project working in the Yaxunah *ejido* is, in many ways, a revival of the earlier Selz Project. Travis Stanton had been a graduate student working with Freidel at Yaxuná when the Selz Project suddenly ended. His dissertation (Stanton

Figure 1.16 Yaxuná structures consolidated by INAH

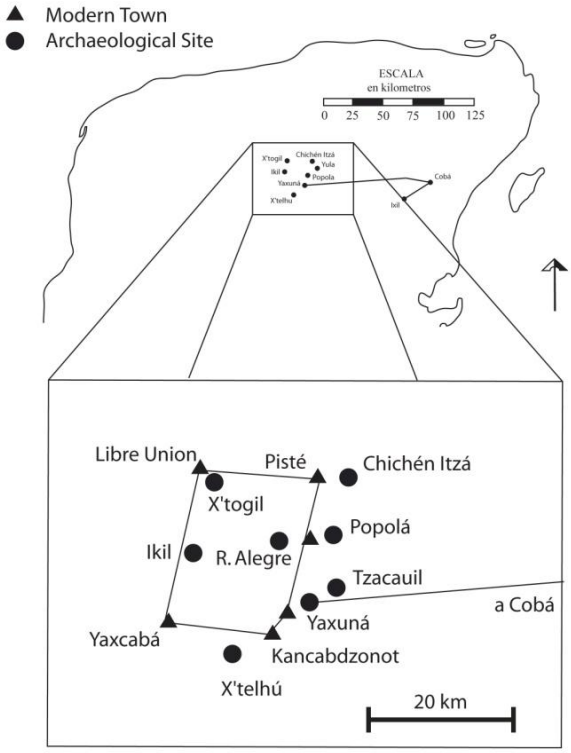

Figure 1.17 Map of the PIPCY study region, showing locations of Yaxuná and Tzacauil

2000) essentially synthesized project data into an analysis of early sociopolitical development in Yaxuná. After working in a few different places around Yucatán, in 2005 Stanton returned to the Yaxcabá municipality (where Yaxuná/Yaxunah is located) and started surveying sites with the idea of investigating a transect between Yaxuná and Chichén Itzá. He visited several sites, including Tzacauil. However, he ultimately had to move in a different thematic direction because, as he was made aware mid-season,

INAH was already running a salvage project (again under Lourdes Toscano Hernández) along the road from Pisté to Yaxunah – in other words, from Chichén Itzá to Yaxuná. Stanton invited two colleagues, Scott Hutson and Aline Magnoni, to join him as co-directors of a project based in the Yaxcaba municipality that would investigate the economic, social, and political changes in the vicinity of Chichén Itzá. The project would be called the *Proyecto de Interacción Política del Centro de Yucatán*, or PIPCY for short (Figure 1.17).

PIPCY's first official season, which took place in 2007, was an important one for Tzacauil (Stanton and Mangoni 2011; Stanton et al 2008). Though project archaeologists visited a couple of other sites in the region, most of their efforts were spent surveying a 28-hectare area east of Yaxuná (Figures 1.18-1.20). They used a total station to map the structures and topography of Tzacauil and Joya (a site about halfway between Tzacauil and Yaxuná, that will be discussed in subsequent chapters). The archaeologists were accompanied by eight workers from Yaxunah who were hired to cut *brechas* (clear lines through vegetation used for mapping and survey) and clear vegetation from structures. When they worked at Tzacauil, this team organized the site into 50 x 50 meter blocks that were then searched for structures. Archaeologists working in central Yucatán all know that sometimes natural outcrops of bedrock appear to be structures – and sometimes structures appear to be natural outcrops of bedrock. Based on my later reassessment of the Tzacauil site, the map had to be slightly revised to reflect that one mapped structure was (in my estimation) really just a bedrock outcrop, as well as to include a large platform that somehow had escaped undetected during the 2007 mapping program. Regardless, this mapping effort provided the foundation for my work and marks the beginning of scientific research at Tzacauil.

Project archaeologists tried to assign a date to Tzacauil based on their survey. Usually surface ceramics can be used to date sites in central Yucatán, and so they tried to do this at Tzacauil. They could not. The report from that season chalks the problem up to dense vegetation cover, but the reality (as I confirmed years later) is that Tzacauil simply has very few ceramics in general, whether on the surface or in construction fills. This is likely a product of its short occupation. All that could be used to date the site,

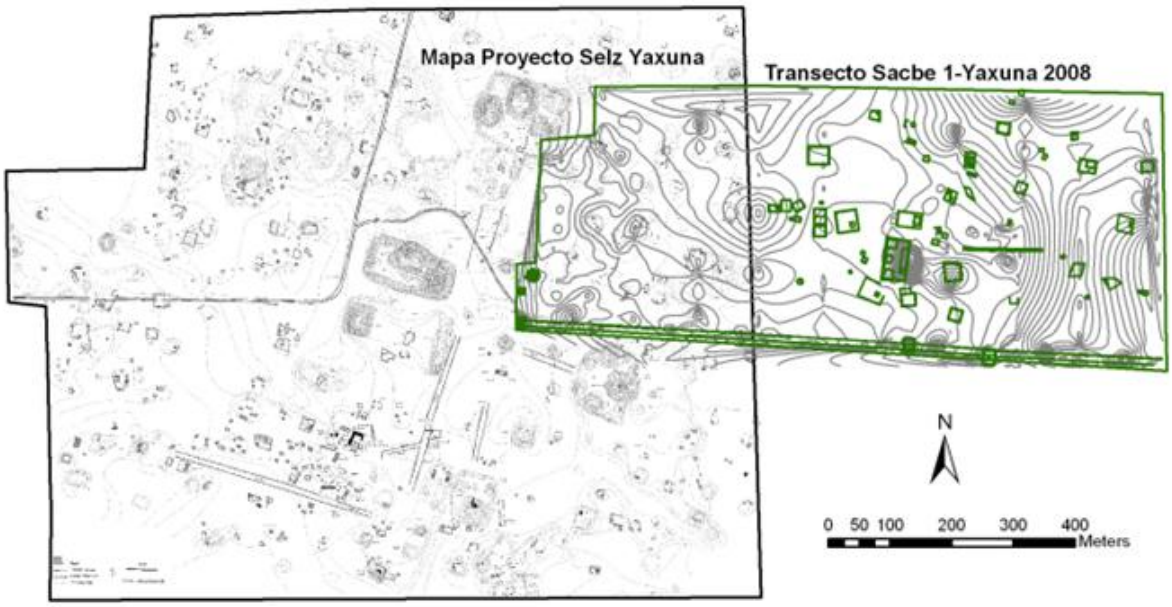

Figure 1.18 Map of the PIPCY survey project area east of Yaxuná (from Stanton and Magnoni 2011)

then, was the architectural style of the Tzacauil Acropolis. As a triadic group style construction, the Tzacauil Acropolis is similar to Late Formative architecture seen in the distant Mirador Basin of Guatemala (Hansen 1990) and, closer, in the East Acropolis of Yaxuná (Stanton and Ardren 2005). Based on this, Tzacauil was assigned a Late Formative date (Hutson et al. 2012a, 2012b).

This sparked questions about Tzacauil's relationship to Yaxuná. As I mentioned at the beginning of this chapter, Tzacauil has a sacbe – called the Tzacauil Sacbe – that runs from the base of the Tzacauil Acropolis to the west, more or less bisecting the site's settlement. The sacbe crosses 1.1 km before arriving at the site of Joya, or more precisely, the site's namesake: a huge *rejollada*, or natural depression where soil and moisture accumulates. These *rejolladas* form microclimates, encouraging the growth of large trees and other vegetation. Among Yaxuneros, this particularly large *rejollada* is called *la joya* (*joya*, sometimes *hoya*, is another Spanish word for *rejollada*). The Tzacauil Sacbe is patchy here, and there is evidence that a later settlement at Joya robbed its stones to build their houses. The sacbe picks up again, though, and continues onward, fizzling out at a distance of nearly 1700 m from the Tzacauil Acropolis. Follow the line of the sacbe further, though, and it heads right for Yaxuná's E-

Group, a major Formative gathering place (discussed more below). With or without the sacbe, Yaxuná is less than an hour's walk from Tzacauil, and the smaller site's acropolis, as has already been mentioned, bears strong resemblance to Yaxuná's East Acropolis. The project co-directors explored ideas of what this relationship might have been (Hutson et al. 2012a, 2012b), but their conclusions were limited by the lack of excavation data from Tzacauil.

In 2008, PIPCY researchers continued this survey work east of Yaxuná. At Tzacauil, they were able to find surface ceramics on top of the Tzacauil Acropolis; as suspected, these dated to the Late Formative. They finished survey work around the Tzacauil Acropolis to confirm the site boundaries that had been proposed previously, and in doing so, found another site (X-auil) around the nearby cenote (Cenote X-auil); regardless of X-auil's proximity to Tzacauil, the distance between the sites is great enough that they are considered discrete settlements. Additionally, X-auil's surface ceramics and architecture suggest a Late or Terminal Classic date for the site.

PIPCY's continued work in the Yaxunah *ejido* for the next few seasons focused on investigations of local caves, Formative period domestic areas (6E-30 Group), and Formative monumental architecture (Marengo Camacho 2013; Slater 2014; Stanton and Magnoni 2009, 2011, 2014, 2016). Much of this work helped improve our understanding of Yaxuná's ceramic sequence. Ryan Collins (2018) supervised large-scale excavations in Yaxuná's E-Group plaza – an important Middle and Late Formative public gathering place that will be discussed later – for four seasons beginning in 2013. César Torres Ochoa also supervised excavations of key Formative contexts in the 2013 season: he and his team excavated two "plaza tests" into Yaxuná's East Acropolis and North Acropolis to confirm that both were built in the Late Formative. Torres Ochoa also re-opened and expanded excavations of the 6E-30 Group, which was an elite residential complex during the Middle and Late Formative (Torres Ochoa 2017). My first season with PIPCY was in 2013, and I spent it first helping Collins open up excavations in the E-Group Plaza and then assisting Torres Ochoa in the 6E-30 Group.

Household archaeology became a major focus of the project starting in 2014. I wanted to understand the early development of household activities and land-use

Figure 1.19 PIPCY team that mapped Tzacauil in 2007

Figure 1.20 Mapping Yaxuná's eastern hinterland (from Stanton and Magnoni 2011)

practices in the Formative period. So, in 2014, I directed surface collection of domestic platforms and structures throughout Yaxuná (Fisher 2014). We hoped surface collections would help us identify houses with a strong Formative component – ideally, without later reoccupation – for future excavations. Based on these surface collection data, I selected two promising-looking house groups in Yaxuná for horizontal excavation in the 2015 season (Fisher 2016). Halfway through the season, after Stanton gave a brief but consequential look at the ceramics that had been coming out of the excavation, we had to face the reality that both house groups had clearly been completely re-modeled and re-occupied during the Classic period. Realizing that it would be nearly impossible to distinguish between Formative and Classic household activities in such shallow, continuously-used contexts, that same season I began work at Tzacauil – there, at least how we understood it then, we would find "pure" Formative contexts (i.e. archaeological contexts without substantial Classic period overburden or disturbance).

This was how I came to conduct three seasons of research, adding up to about eight months across 2015-2017, at Tzacauil (Fisher 2016, 2017). During those three seasons that I was at Tzacauil, PIPCY continued work in the Yaxunah *ejido* and in the other areas of the Yaxcaba municipality (Figures 1.21-1.22). One of the project efforts with the greatest consequences for work at Tzacauil was the collection of LiDAR data over the Yaxuná study region in 2013. I was then able to use LiDAR images of Tzacauil for my landscape investigations in 2017 (Figure 1.3). This LiDAR is part of a project that

Figure 1.21 PIPCY surface collection team in the 2014 season

Figure 1.22 PIPCY archaeologists, 2014 season

grew out of PIPCY, the *Proyecto del* Sacbe *de Yaxuná-Cobá* (PSYC), that is investigating Sacbe 1 and how its construction affected life at either end, and in the middle, of this longest road the Maya built. This work is still in progress as I write this in 2018.

1.6 Organization of the chapters ahead

Having established the premise and context of this work, we can look forward to the chapters ahead.

In Chapter 2, I develop a definition of sustainable agriculture for evaluating Maya farming practices. I organize this discussion based on the five principles of sustainable agriculture proposed by the Food and Agriculture Organization of the United Nations (FAO 2017). These principles are (1) efficiency, (2) conservation, (3) rural livelihoods, (4) resilience, and (5) governance. For each principle, I will talk about how it contributes to overall sustainability, and briefly review how each dimension has been discussed in the archaeological and ethnographic research for the Maya area. Adopting the FAO framework emphasizes the interrelationships between social, political, and environmental dynamics underlying agricultural sustainability and makes it easier to draw direct comparisons between past and present agricultural systems.

In Chapter 3, I examine the various elements of the Yucatán landscape: land, households, houses, and houselots. This chapter provides an ecological overview to central Yucatán, and emphasizes how Maya farming families integrate the natural materials of their local environment into the fabric and infrastructure of their daily lives. Here I also cover how household archaeology in the Maya area has pulled together archaeological and ethnographic data to allow us to reconstruct how people were living in the past. I also discuss how ethnoarchaeological research allows us to associate archaeological patterns with specific domestic activities.

Chapter 4 is an in-depth account of the culture history of the northern Maya lowlands, with particular emphasis on Yaxuná. This chapter synthesizes the archaeological data from Yaxuná into a unified narrative with the broad historical dynamics known for the rest of the peninsula. This historical context is essential for understanding Tzacauil.

Chapter 5 outlines the methodologies I used. To “read” the Tzacauil landscape as a recording of long-term human-environment interaction, I integrated methods based in ethnographic and archaeological research. In this chapter I introduce the ethnographic work I did with Yaxunah *ejidatarios* to understand agricultural potential and land-use in Tzacauil. I then turn to a detailed description of the archaeological strategies my project employed, including horizontal excavations of nearly all Tzacauil house groups, test excavations in the Tzacauil Acropolis, and excavations in intra-settlement

areas. I also describe the laboratory analyses I conducted for this project, including artifact analysis and the chemical analysis of soil samples.

Chapters 6 and 7 detail the two respective occupations that occurred at Tzacauil, the Formative occupation and the Classic occupation, respectively, based on the three seasons of fieldwork I conducted there. I present detailed data on house group construction history, intra-settlement location and features, and material culture for the Tzacauil settlement.

Chapter 8 shifts focus to a discussion of what Tzacauil can tell us about the interactions between small-scale Maya farmers and their local environment in the Anthropocene. I go through the history of Yucatán from the Postclassic period into the Conquest and Colonial periods, integrating data from the Yaxunah *ejido* whenever it is available. Moving forward in time, I examine how liberal agrarian reform has reshaped Maya farming practices since the 18th century. This discussion culminates by situating Yaxunah farmers and Tzacauil in the context of the neoliberal agrarian reforms of the past thirty years.

Chapter 9 steps back from the period-by-period approach of the previous three chapters and weaves a continuous narrative of small-scale Maya farming at Tzacauil. Here I show how the various lines of evidence are telling a story about contested resources, threatened land tenure, political intervention, and farmer mobility. I propose that the times when Maya agriculture was arguably most sustainable in central Yucatán coincide with times when farmers had the security and protection to move about freely, and above all, to be secure in leaving a place and being able to come back years later. As I will show, this is directly at odds with the current program of neoliberal agrarian reform that is gaining momentum in Yucatán.

Finally, Chapter 10 concludes this dissertation with a summary and discussion of future directions and applications of this work. We will turn now to a discussion of how past Maya agricultural sustainability can be evaluated through archaeological investigation.

Chapter 2
Sustainable Agriculture in the Maya Area

2.1 Introduction

What I set out to do in the chapters that follow is not simply to document agricultural change at Tzacauil, but to evaluate the *agricultural sustainability* of the various farming communities that have interacted with this specific environment over the last 2000 years. This distinction matters; I am framing this work deliberately in terms of a larger discourse around sustainability, food sovereignty, and environmental justice. More archaeologists have been chiming into the activist discourse around agricultural sustainability in recent years, contending that our field has something important to contribute to this conversation (e.g., Barthel and Isendahl 2013; Boger et al. 2014; Carmody et al. 2017; Chase and Scarborough 2014; Guttmann-Bond 2010; Jackson et al. 2018; Kaptijn 2018; Kennett and Beach 2013; Kondolf and Farahani 2018; Manuel et al. 2018; Mays 2017; Scarborough et al. 2012a; Stump 2013; van der Leeuw 2014). This desire to make a difference – or feel that we are making a difference – is understandable, given the harbingers of a not-so-distant global food crisis and the rising threats posed by anthropogenic climate change (e.g., FAO 2014a).

And archaeologists are positioned to contribute to this effort. What are we bringing to the table? Our greatest strength, I believe, is our capacity to show that agricultural sustainability is historically contingent. We have the ability to figure out under what conditions (environmental, social, political, economic) an agricultural system works, and under what conditions that same system stops working. We can tack back and forth between a wide range of temporal and spatial scales, all the while enhancing even the deepest histories with human narratives. But in order to maximize the utility of archaeology's contribution to the larger sustainability discourse, we have to frame our

questions, data, and conclusions such that they can be in conversation with sustainability policy-makers and scholars in other disciplines, as well as with the public.

This chapter sets up the framework I will use to evaluate agricultural sustainability at Tzacauil over twenty centuries. I start by defining "agricultural sustainability" and situating the concept within historical ecology, the approach I first introduced in Chapter 1. I then bring in a set of principles for determining agricultural sustainability that have been developed by the Food and Agriculture Organization (FAO) of the United Nations (UN). I discuss each of these principles – efficiency and conservation, rural livelihoods, governance, and resilience – in greater detail, and provide an overview of how each of these principles might be matched to specific archaeological data recovered from past Maya agricultural systems. These will be the parameters by which I eventually evaluate agricultural sustainability at Tzacauil in Chapter 9.

2.2 Defining agricultural sustainability

Sustainable agriculture is the production of food and other agricultural products, like fiber and fuel, in ways that (1) ensure that future generations will be able to continue to do so, and (2) simultaneously conserve and, ideally, enhance the environment (FAO 1997, 2014a, 2014b; Pretty 2008; WCED 1987). The various components of food and agriculture are dynamic, and interrelated; to deal with these complex relationships, it is helpful to employ the language of systems. I will use agricultural system (and sometimes food system) to refer to the people, institutions, and processes (e.g., production, distribution, consumption) involved in agriculture.

In this dissertation, I use the framework of historical ecology and its analytical focus on the landscape to demonstrate that agricultural sustainability is historically contingent and a cultural construct. Rather than assuming that sustainability existed in the pre-Hispanic Maya past, I enlist archaeological methods to track "on the ground" changes in Maya community farming practices. Historical ecology allows us to "read" the landscape as an ongoing record of long-term interactions between humans and their local environment. By connecting the archaeology of past farming communities to

current and more recent histories of land-use, we can trace out a narrative of agricultural sustainability and disruption in a single place, Tzacauil, over twenty centuries. This long-view is important because it helps us evaluate 21st century sustainability initiatives against the trials and errors of past agricultural systems. If we can understand how and why particular agricultural systems have thrived and collapsed in a place, we can leverage that knowledge to plan for more sustainable agricultural systems in the future.

So how do archaeologists "read" the past agricultural systems materialized in a landscape? Fortunately as sustainability science has progressed over recent decades, so too has archaeology been gathering and refining a diverse suite of tools and approaches for investigating agricultural sustainability in the past.

Innovations in our ability to study past ecological relationships have transformed the archaeological study of past agricultural systems. We can reconstruct detailed pictures of ancient farming practices, cuisines, and nutrition through the analysis of plant, animal, and human remains (e.g., Beck et al. 2018; Colledge et al. 2004; Clutton-Brock 1989; Evershed 2008; Graff 2018; Hillman 1981; Lentz et al. 2014, 2018; Piperno 2009, 2011; Piperno and Flannery 2001; Zeder 2011). Land-use practices can be inferred through the measurement of chemical residues preserved in soils, even in areas that otherwise lack visible archaeological traces (e.g., Beach 1998; Rodrigues et al. 2017; Wells et al. 2018). Paleoclimate analysis lets us link our archaeological data to larger contexts of environmental and climate variability (e.g., Dillehay et al. 2007; Kintigh and Ingram 2018; Nelson et al. 2016). Accelerated advances in survey technology, especially in geophysical methods and LiDAR (Light Detection and Ranging), have revolutionized our capacity to document and analyze landscape modifications and settlement patterns (e.g., Chase et al. 2010; Evans et al. 2013; Kirch et al. 2012; Macrae and Iannone 2016; McCoy and Ladefoged 2009). Computational modeling has been leveraged to manipulate the diverse variables involved in past agricultural and subsistence systems (e.g., Altaweel 2008; Altaweel and Watanabe 2012; French and Duffy 2014). When combined with traditional kinds of archaeological investigation like

horizontal excavation and pedestrian survey, these recent innovations enhance our ability to understand past agricultural systems.

These advances help our field to evaluate agricultural sustainability in the past, but they are not the be-all end-all to this endeavor. There has been a tendency among archaeologists (as among other scientists participating in sustainability research), I think, to treat agricultural sustainability as a primarily environmental concern, when in reality it is just as (if not more) a question of social, political, and economic factors. But archaeology is well situated to deal with these interrelated dynamics and trace out how they impact agricultural systems over extended periods of time.

To bring these dynamics to the forefront, and to keep this discussion grounded in contemporary discourse around sustainable agriculture, I have found it useful to employ the guidelines for sustainable agriculture outlined by the Food and Agriculture Organization (FAO) of the United Nations (UN) (FAO 2014a) (Figure 2.1). These guidelines are used by the FAO to structure policy discussions and sustainability initiatives in a global context, and they provide a pathway forward for archaeology to contribute meaningfully to this ongoing endeavor to make our agriculture more sustainable.

The five principles of sustainable agriculture used by the FAO are: (1) efficiency, (2) conservation, (3) rural livelihoods, (4) resilience, and (5) governance. For thinking about these principles in archaeological context, I restructure these principles slightly. First I combine efficiency and conservation into a single category because for archaeological purposes, these principles deal with the "toolkit" of sustainable agriculture: the physical components of the agricultural system itself (e.g., terraces, raised fields, irrigation canals). The other three components have to do with how that "toolkit" actually operates in a larger social and environmental context. Here, I will reorder the remaining three components, placing resilience at the end, simply because resilience deals with collapse events and for considering past agricultural systems, it makes narrative sense to place these at the end. Readers will notice that there is considerable overlap in the categories, particularly in the case studies that I introduce; put differently, a case study discussed under the category of governance could also fit

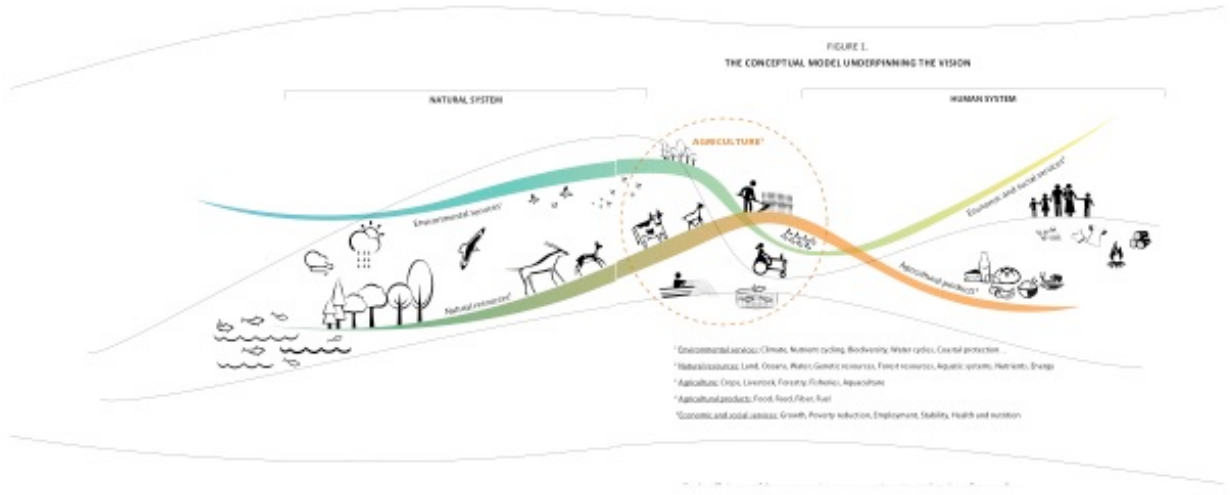

Figure 2.1 The five principles of sustainable agriculture outlined by the FAO (from FAO 2014a)

into a discussion of resilience, for example. This is not a drawback. Rather, it emphasizes the interconnected dynamics of these various components of sustainable agriculture. All dimensions must be accounted for when evaluating the (un)sustainability of any given agricultural system.

The rest of this chapter will discuss these dimensions of agricultural sustainability and particularly how they relate to previous archaeological research on Maya agriculture. These dimensions will be used as guidelines to evaluate agricultural sustainability at Tzacauil in the Formative period, in the Classic period, and in the Anthropocene.

2.3 Efficiency and conservation in Maya agriculture

FAO's first dimensions of sustainable agriculture are efficiency and conservation. "Improving efficiency in the use of resources is crucial to sustainable agriculture," FAO (2014a:20) says, and later adds, "sustainability requires direct action to conserve, protect, and enhance natural resources" (FAO 2014a:23). Efficiency and conservation provide us with our "toolkit" for sustainable agriculture – the infrastructure, strategies, and organization of cultivation itself. In the Maya area, archaeologists have been able to document a wide variety of approaches to agricultural efficiency and conservation.

Agricultural efficiency is about doing more with less: enhancing agricultural production while minimizing resource use. To work out this balance, farmers around the world have developed intensification, which we can think of as the process of manipulating inputs to increase agricultural efficiency (e.g., Boserup 1965; Tilman et al. 2011). Intensification often relies on physical infrastructure and place-based cultivation strategies (i.e. strategies where efforts are concentrated in a single place over extended periods of time). As a result, intensification is amenable to archaeological documentation and has been studied all over the world (e.g., Kirch 1994; Marcus and Stanish 2006; Stone 1994). We know that Maya farmers deployed several kinds of intensification strategies to increase agricultural production.

Even as efficiency increases agricultural yields, it can (and often does) strain local ecosystems if deliberate action is not taken to combat resource depletion. This is where conservation comes in (FAO 2014a; Hobbs et al. 2008; Pittelkow et al. 2015). In modern farming contexts, FAO recommends a program of techniques and approaches that it collectively refers to as "conservation agriculture" (FAO 2014a; Knowler and Bradshaw 2007; Palm et al. 2014). Many strategies of conservation agriculture explicitly draw on traditional farming practices with considerable time depth (FAO 2018; Sanz et al. 2017). As archaeologists have worked to elucidate conservation agriculture in the past, we are learning how the Maya coupled their intensification strategies with conservation efforts.

The nature of archaeology is such that we are more likely to recognize place-based agricultural strategies that were practiced over extended periods of time. Such strategies in the Maya area invariably combined elements of efficiency and conservation with considerable overlap between the two dimensions; it makes sense to consider them as intertwined efforts. In this section, I will address some of the most salient agricultural strategies in the Maya "toolkit" and discuss how these strategies simultaneously intensified production (efficiency) while enhancing natural resources (conservation). These strategies include water management, raised field farming, terracing, intra-settlement agriculture, agroforestry, and *milpa* or slash-fire farming. It is

important to stress that these strategies were practiced in concert with one another as part of a diversified suite of subsistence practices.

Water management in the Maya area, as in other tropical settings, arose to deal with extreme seasonality between wet and dry seasons. Maya settlements had to figure out ways to deal with an excess of water in the rainy season, and a lack of it in the dry season. Archaeologists attending to these strategies have documented a diverse range of water storage features throughout the Maya area that managed the seasonal availability of water (e.g., Isendahl 2011; Lucero 1999, 2006; Lucero and Fash 2006; Marcus 2006; Scarborough 1994, 2003; Scarborough and Lucero 2010). In huge centers like Tikal, the Maya integrated water management directly into urban settlement through the construction of switching stations, filtration systems, and dams (Scarborough et al. 2012). Plants and aquatic animals maintained water quality in reservoirs in mimicry of natural wetland environments (Lucero et al. 2011; Puleston 1977). Grey water was recycled by draining it downslope towards agricultural fields (Scarborough and Isaac 1993). Little work has been done on water management in the central Yucatán study area, but Yaxuná does have at least one constructed reservoir (Stanton et al. 2010) and the bedrock terrain of the area is riddled with natural cavities that can be used as seasonal reservoirs (e.g., Fedick et al. 2008). These water management strategies could be used by Maya farmers to use water more efficiently over the course of the agricultural cycle. Many of these water management strategies persist today in rural areas of the Yucatán Peninsula (e.g., Faust 1998).

Another way that pre-Hispanic Maya farmers intensified agricultural production was through the construction and cultivation of raised fields in wetland environments (Beach et al. 2009; Harrison and Turner 1978; Siemens 1982; Turner and Harrison 1981,1983). Raised field agriculture involves the mounding-up of soil into beds or ridges in wetlands, leaving gaps (swales) between beds where water flowed. Raised fields could be watered more easily over the course of the agricultural cycle, and organic matter from the wetlands was applied to the beds to enhance soil quality (e.g., Puleston 1977; Thompson 1974). By mimicking and even enhancing the aquatic eco-systems of

natural wetlands, raised field farming enhanced production while also promoting resource conservation (Lucero 2018).

Like raised field farming, terrace agriculture involves substantial terraforming that lends itself well to archaeological identification in the Maya area. Terrace farming modifies naturally sloping terrain into graduated steps (terraces) that can be used for cultivation (FAO 2018; Sanz et al. 2017). Terraces promote and maintain soil health through the prevention of erosion. They enhance agricultural production by creating stable microclimates that facilitate plant development, and they can easily be integrated with water management infrastructure (e.g. Wyatt 2012). Ancient Maya terrace systems have been documented in hilly and mountainous regions, particularly in the southern Maya lowlands and the Puuc region of western Yucatán (e.g., Beach et al. 2018; Chase and Chase 1998; Kunen 2001; Macrae and Iannone 2016; Murtha 2002). These can range from small household-managed terrace systems (e.g., Wyatt 2008) to vast state-sponsored terrace systems (e.g., Chase and Chase 2014).

In our models of Maya food systems, intra-settlement agriculture is gaining traction as one of the most important strategies of intensification and conservation agriculture practiced in the Maya area. Intra-settlement agriculture (also called infield agriculture; see Fisher 2014a; Netting 1993) refers to intensively cultivated plots of land situated around and between farmers' homes. The term embraces a wide range of cultivation strategies localized around the residence, encompassing farmsteads along with the polycultural homegardens (also called dooryard gardens, houselot gardens, kitchen gardens, and *solares*) typical of tropical societies (Killion 1992; Kuumar and Nair 2006; Lope-Alzina and Howard 2012; Wilken 1987). Intra-settlement agriculture allows farmers to use space and time efficiently. By situating the agricultural plot close to the home, farming households could more easily provide the high labor inputs required by intensive agriculture. Living near – and often literally embedded in – the agricultural landholding allowed household members to fertilize soil through the deposition of domestic refuse and facilitated regular weeding, hand watering, pruning, and general monitoring of crops, gardens, and orchards. Maya homegardens have been recognized as a kind of conservation agriculture (e.g., DeClerck and Negreros-Castillo 2000).

These homegardens emulate the biodiversity of nature through integrating diverse animal and plant species, and in creating anthropogenic replications of multi-tiered forests, promote soil health, conserve water, and reduce soil erosion (Sanz et al. 2017). These intra-settlement agricultural strategies, and their archaeological signatures, will be discussed more in Chapter 3.

Thanks to long-running research projects and the application of new technologies (particularly LiDAR), we are learning that many Classic period (AD 250-900) Maya cities relied on intra-settlement agriculture to sustain urban populations for centuries (e.g., Chase and Chase 1998; Fisher 2014; Fletcher 2009, 2012; Isendahl 2012; Isendahl and Smith 2013; Lemonnier and Vannière 2013; Lucero et al. 2015; Masson and Peraza Lope 2014). The maintenance of open space between and around houses for intensive cultivation has prompted archaeologists to think of centers like Caracol, Tikal, Cobá, Mayapán, and the Río Bec nuclear zone as possible “garden cities”, “low-density cities”, and “agro-urban” settlements. Intra-settlement agriculture was an important strategy for agricultural efficiency and conservation in the Maya lowlands and, as we will see in the particular case discussed here, critical in the development of hinterland agricultural production at Tzacauil.

The counterpart and complement to intra-settlement agriculture is the *milpa*. Whereas intra-settlement cultivation concentrates high inputs of labor in particular places, *milpa* (also called slash-fire, slash-and-burn, or swidden) is extensive and shifting (e.g., Emerson 1953; Terán and Rasmussen 2009; Schmook et al. 2013). It is less costly in terms of daily labor, but more costly in terms of the amount of land required. To make *milpa*, first a parcel of land is selected; its vegetation is chopped, allowed to dry, and then burned; then the parcel is cultivated. The burned organic matter returns nutrients to the soil. The process may be repeated in the same place a second year, but by the third crop yields are diminished and the parcel must be allowed to “rest” or lay fallow for a period of several years. *Milpa*, as it is traditionally practiced in Yucatán, is inherently polycultural, combining the symbiotic planting of maize, beans, squash, and other plants in a single plot (Terán and Rasmussen 2009). This diversity emulates nature and helps to promote the conservation of soil health.

The role of *milpa* agriculture in supporting pre-Hispanic Maya civilization was a source of major debate among archaeologists in the 20th century. *Milpa* was and continues to be the primary form of smallholder Maya agriculture, historically and through modern times. But given the amount of land it requires over extended periods of time, it seemed impossible that large urban populations could have been supported through reliance on *milpa* agriculture (e.g., Benedict and Steggerda 1936; Redfield and Villa Rojas 1934). The second half of the 20th century saw our understanding of Maya agriculture revolutionized, as archaeologists began to recognize that slash-fire farming would have been just one among a diverse "mosaic" of subsistence strategies (Fedick 1996; Flannery 1982; Hammond 1978). Yet even still, our projections of *milpa*'s current role onto the ancient past have inhibited our understanding of the temporal and spatial scales at which Maya agricultural systems functioned.

Fortunately this is changing. Ford and Nigh's (2009, 2015) work on what they call the Maya forest garden has shown that making *milpa* was actually part of a much larger, landscape-level strategy of agroforestry that operated not on the scale of seasons but of generations. In thinking particularly about how such agroforestry might have been practiced in Yucatán, we see that *rejolladas*, natural depressions where soil and moisture accumulate, may have factored into this sophisticated arrangement of forest and field (Gómez-Pompa et al. 1990; Kepecs and Boucher 1996; Lowry 2013). As the pre-Contact Maya practiced it, that is, as a form of agroforestry, *milpa* agriculture is inherently sustainable because it replicates and even enhances the forest eco-system. This fits with a historical-ecological analysis of the practice discussed by Wells (2015), who points out that *milpa*'s sustainability depends on the scale – both temporal and spatial – at which it is addressed. Reliance on ethnographic and historic data may be too short-sighted for understanding the long-term sustainability of practices like slash-fire agriculture in the hands of generations of ancient Maya farmers; luckily, archaeology is making strides in clarifying this deep history.

Taken together, these strategies comprise a "toolkit" for sustainable agriculture in the Maya area. Appraising this "toolkit" through strictly ecological parameters, each strategy can be considered inherently sustainable. Yet when we situate these practices

in the real-world context of social and political dynamics, we see how and why under certain conditions they flourish and under others they fail. This is why it is so critical that we treat agricultural sustainability as a historically contingent, cultural construct.

2.4 Rural livelihoods and Maya agriculture

We move now into a discussion of how the toolkit of Maya agriculture actually worked – and failed to work – in the messiness of larger social and environmental dynamics. We will start with the dimension of rural livelihoods. FAO's principle of rural livelihoods asserts that if farming communities do not benefit from an agricultural system, their agriculture will not be sustainable (FAO 2014a, 2017; FAO et al. 2017). Rural communities have to be able to access resources and economic opportunities, participate in markets, and have a say in decision-making. The importance of decision-making is particularly crucial in matters of land tenure (FAO 2012, 2014a). Land tenure insecurity incentivizes transient (i.e. unsustainable) land-use practices, while also jeopardizing the wellbeing of rural communities.

The archaeological study of rural livelihoods in the Maya area draws from a robust tradition of household and community archaeology (e.g., Canuto and Yaeger 2000; Hutson 2010; Wilk and Ashmore 1988) and particularly from the study of rural Maya commoners (e.g., Lohse and Valdez 2004; Webster and Gonlin 1988). When household archaeology is aligned with investigations of land-use practices and foodways, we can document how rural communities and their wellbeing fit into larger narratives of agrarian change. In this section I want to focus specifically on a single case study to show how archaeologists can investigate the intersections of rural livelihoods and agricultural sustainability. The case comes from the site of Chan, in Belize, where Cynthia Robin conducted one of the leading archaeological studies of rural Maya life.

The ancient Maya farming community of Chan, Belize, is located in the hinterlands of the much larger political center of Xunantunich (LeCount and Yaeger 2010). Farming families called Chan home for 2000 years (800 BC – AD 1200), a period that saw the rise and fall of nearby centers like Xunantunich (Robin 2012). Cynthia

Robin's robust research program at Chan investigated the site's households, agricultural terraces, and community center, and provide one of the best cases for the importance of *social* sustainability in a sustainable agricultural system. Robin effectively makes the case that the daily aspects of everyday life are not inconsequential, but rather constitute the very practices of social and environmental sustainability (Robin 2012, 2013).

Chan's farmers managed a complex system of terrace agriculture. The research program mapped 1223 terraces at the site that are directly integrated into the settlement; farming families lived surrounded by the terraces they cultivated (Robin 2012). A sample of terraces and associated water management features were excavated under the supervision of Andrew Wyatt (2008, 2012). Unlike some other terraced Maya settlements, Chan's terraced landscape lacked property divisions. Terraces frequently extend across several household groups, suggesting that multiple households could cooperate to build, maintain, and cultivate terraces. Signs of intensification on the terraces in the form of household ash and organic food waste, added to amend the soil, suggest that terrace cultivation at Chan was managed intensively, more like we today might associate with gardening (Wyatt 2008, 2012).

Chan's terraces seem to have approached near constant production, a scenario further supported by farmers' skillful efforts to keep the terraces watered. A sophisticated system of water management features, including a springhouse, irrigation canals, reservoirs of different sizes and elevations, and the manipulation of underground streams, fed water to the terraces (Wyatt 2008, 2012, 2014). Like the terraces themselves, Chan's water management system suggests local management and organic, accretional growth over time. Chan's terraced landscape becomes even more fascinating when we consider that it emerged long before the nearby, powerful political center of Xunantunich began exerting influence in the region – meaning that Chan's farmers were not manipulated to intensify agricultural production, as Boserupian or Wittfogelian models of intensification would suggest, but rather that they themselves innovated this technology through generational transfer of knowledge and intimate familiarity with their ecological surroundings (Wyatt 2012; Robin 2013). This picture of generational continuity on the land is reinforced by ritual practices that reaffirmed

household and community relationships to particular places through the interment of ancestors and caches.

Agroforestry was another important part of human-environment interactions in Chan's landscape. Lentz and colleagues' (2012) examined wood ash and other botanical remains collected through flotation from various contexts at Chan. They found that households at Chan incorporated diverse subsistence strategies, including the cultivation of annual crops (maize, beans, and squash) along with the management of stands of fruit trees. While these analyses cannot tell us how agroforestry was managed or where the trees were in relation to households, they do provide some fascinating insights into the sustainability of Chan's agroforestry. The trees represented in deposits at Chan suggest mature, closed canopy tropical forests throughout the duration of Chan's twenty centuries of occupation. Preferred hardwood trees, like chico zapote, can be found in deposits throughout this history, in contrast to places like Tikal, where chico zapote disappears abruptly from the chronological sequence and are replaced with less desirable woods (Lentz and Hockaday 2009). This suggests that whereas people living at Tikal over-exploited trees like chico zapote, people at Chan managed their forest resources such that chico zapote, and mature stands of forest more generally, were available to future generations indefinitely.

The research program at Chan recognized that documenting strategies of sustainable terrace cultivation and agroforestry was not enough to understand how this community steadily flourished for 2000 years – understanding social sustainability is equally essential. This involved looking at the other elements of household and community economy supported by agriculture, including quarrying, chipped-stone tool production, obsidian exchange, and the production of shell ornaments and ceramics (Hearth 2012; Kestle 2012; Robin 2012a). Questions of identity were explored at Chan's households and community center from the lenses of gender and ritual (Blackmore 2012, 2014; Robin 2002a, 2006; Robin et al. 2012). So-called vacant spaces traditionally overlooked by archaeologists were investigated as loci of daily practices (Robin 1999, 2002b, 2006), as was the very "stuff", soil and limestone, of the Chan landscape (Robin 2015). Even while Chan's leaders did enjoy certain privileges, social

stratification across the community was relatively unpronounced: everyone lived in perishable houses, goods were distributed equitably, and health was consistent across the population (Robin et al. 2014; Robin 2012a, 2012b). Ritual at Chan shifted from an early emphasis on ancestor veneration to ceremonies that emphasized the community as a whole and that reinforced inter-generational connections between people and the land (Robin 2016; Robin et al. 2012b).

Pulling this all together, people living at Chan enjoyed a remarkably high quality of life that was sustained, fairly steadily, across the span of twenty centuries through local innovations and multigenerational transmission of ecological, ritual, agricultural, and social knowledge. Chan's community leaders actively worked to create an inclusive political rhetoric, rather than emphasize social differences. Chan makes a strong case for the power of coupling local knowledge with inclusive, cooperative management strategies for long-term sustainable agriculture with direct benefits for rural communities. The work at Chan exemplifies the importance of rural communities having secure, stable land tenure rights in order for agriculture to be sustainable.

2.5 Governance and Maya agriculture

As the FAO explains, food and agricultural systems are inherently implicated in political dynamics, and therefore, "sustainable food and agriculture requires responsible and effective governance mechanisms" (FAO 2014a:30). This concept of "good governance", defined as a series of obligations for political leaders, is critical for agricultural sustainability (FAO 2012, 2014a). Political leaders have to be willing and able to advocate for social justice. Leaders must not only recognize people's rights to land and resources, but also work to defend those rights. Leaders must create avenues for bottom-up participation in agricultural management and decision-making. Leaders must seek the endorsement and compliance of farming communities by working and learning alongside them. All of this must be done from a position of long-term care and stewardship of natural resources (IFAD 1999).

The political dimension of Maya agricultural sustainability is, like rural livelihoods, best understood through case studies. Here I want to focus on two cases that offer a

comparative framework for thinking about the political nature of food production in Maya settlements. These comparative cases, which are the center of Caracol in Belize and the Río Bec nuclear zone in Campeche, Mexico, are both from the southern Maya lowlands region, and both deal mostly with the Classic period. While these parameters make them quite different from Tzacauil, these cases are still useful for thinking about the role of government in Maya agricultural sustainability.

The site of Caracol is located in the Vaca Plateau region of Belize. Caracol has been the subject of long-term research led by Arlen Chase and Diane Z. Chase and their colleagues, and this work is at the forefront of discussions of agricultural sustainability in the Maya area (Chase 2016; Chase and Chase 1998, 2001, 2009, 2012, 2014a, 2014b; Chase et al. 2008, 2010; Murtha 2002). At Caracol, farmers practiced a kind of intra-settlement urban agriculture that was tied to a vast, terraced landscape that was almost completely anthropogenic. This terrace system appears to have been managed by centralized political leadership, which deployed two complementary strategies to keep it running. First, the centralized political leadership at Caracol took on the burden of building and maintaining the infrastructure required by the vast terrace network (e.g., terraces, reservoirs, roads). Second, the leadership simultaneously promoted a collective, shared social identity among the households of the Caracol settlement. Through a common suite of material culture, spatial organization, and foodways, Caracol households participated in a broader community rhetoric grounded in notions of egalitarianism. These strategies worked well for a while, but ultimately Caracol's direct political intervention in the city's agricultural system was unsustainable. As Chase and Chase demonstrate, the initial construction of Caracol's terraced landscape had been a response to environmental stress: intensifying agricultural production (i.e. through terraces) minimized the risks associated with interannual climate variability. However, these terraces did much more than just buffer against seasonal crop damage – they actually enhanced production to the point of surplus and, eventually, stability and prosperity. Yet as Caracol's leaders benefited more from the terraces, they became more dependent on it and the specific kind of settlement organization (i.e. low-density) that it required. As a result of this dependence,

political leaders had to sink more and more resources into expanding and maintaining the terrace agricultural system. Caracol's subsistence base became rigid and vulnerable. Eventually, political leaders' struggle to maintain these strategies of social cohesion and agricultural infrastructure coalesced with environmental stresses of climate change. Caracol's terraces – and the city they supported – were abandoned during the so-called Classic Maya collapse.

Even though it is considered "low-density", Caracol was still relatively centralized compared to the weakly nucleated settlement of the Río Bec nuclear zone in Campeche, Mexico. Intensive field reseach in this region conducted by M. Charlotte Arnauld, Eva Lemonnier, Boris Vannièrre, Dominique Michelet, and others has shown that the Río Bec nuclear zone relied heavily on intra-settlement agriculture (Arnauld et al. 2012, 2013; Lemonnier and Vannièrre 2013). Yet here there is little evidence of political intercession. Rather, each household in the settlement is embedded in its own autonomous agrarian domain. These domains, which are referred to as agricultural production units, were delimited using natural and constructed boundaries. Lemonnier and Vannièrre (2013) note that these domains varied in size, and found that larger domains (i.e. landholdings) correspond with the architectural monumentality of the associated house group. The largest of these units were also found to have practiced intensification in the form of terracing, and even appeared to be in the process of expanding into the domains of smaller units; this suggests that households may have been contesting access to landholdings amongst themselves. These intra-settlement farmsteads were being managed by individual households, with each household acting autonomously and even occasionally encroaching on the landholdings of its neighbors. The archaeological evidence suggests a dynamic, constantly changing agricultural system that developed between about AD 600-900. Like Caracol and so many other settlements of the southern lowlands, the Río Bec nuclear zone was abandoned at the Classic period collapse. That this place too was abandoned, despite having such a different organizational system from Caracol, suggests the severity of the climate events that upended so many agricultural systems during the collapse.

Political dynamics have deep reverberations for an agricultural system's sustainability, and elucidating governance's role in the downfall of several agricultural systems – and civilizations – has been one of archaeology's strongest contributions to the sustainability discourse so far (e.g., Lustig et al. 2018; Marston and Miller 2014; Morehart and Frederick 2014; Millhauser and Morehart 2018). As we will see at Tzacauil, the shifting role of political authority in these hinterlands east of Yaxuná had significant implications for agricultural practices and their sustainability.

2.6 Resilience and Maya agriculture

Change is unavoidable. When change comes, how will an agricultural system deal with it? How will it mitigate internal and external stress? How – and how fast – will it recover from a crisis? The FAO insists that enhanced resilience of people, communities, and ecosystems is critical for agricultural sustainability (FAO 2014a:28, 2017a). Resilience is the "ability of a system and its component parts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and basic manner, by ensuring the preservation, restoration, or improvement of its essential basic structures and functions" (IPCC 2012:5; see also Folke 2006; Holling 1973, 1986; Holling and Gunderson 2002; Walker and Salt 2006; Walker et al. 2004).

Archaeologists have applied resilience approaches to think through the ways socio-ecological systems resist, absorb, and bounce back from change (e.g., Fisher and Feinman 2009; Marston 2015; Morell-Hart 2012; Redman 1999, 2005; Redman and Kinzig 2003). Such applications have been particular useful for studying the major transformation events that we commonly refer to as collapses. In thinking through collapse, resilience approaches have allowed archaeologists to disentangle the interrelated causes and effects – social, political, economic, and environmental – that underlie such events (e.g., Faulseit 2016; McAnany and Yoffee 2010; Tainter 1988), and to hone in on the specific contributions of climate variability (e.g., Chase and Chase 2016; Crumley 2015; Kennett et al. 2012; Lucero et al. 2011). Of all these collapse events in our collective human past, perhaps none has received as much attention as

the so-called Classic Maya Collapse, which overhauled many of the norms that had characterized life in the Maya area up until around AD 900.

Alone, no single explanation can account for the large-scale transformation that upended Classic Maya political structures around AD 900. The picture is much more complex than even the language of collapse would suggest: as more fieldwork is conducted, we are learning that this event involved multiple waves of transformative change, occurring at different times and tempos across the Maya area (Aimers 2007; Douglas et al. 2015; Dunning et al. 2012; Haug et al. 2003; Hoggarth et al. 2016, 2017; Iannone 2014; Marcus 1992, 1998; Masson 2012; Webster 2002). With the caveat that the "collapse" cannot and should not be treated as a single event, we are seeing the emergence of patterns that suggest these transformations were likely closely connected to agriculture and state-level management of labor and land.

We have learned that in the centuries leading up to the Classic Maya collapse, many Maya cities incorporated intra-settlement agriculture into their urban landscapes (e.g., Arnauld 2008; Barthel and Isendahl 2013; Chase and Chase 1998). As discussed in the previous section on governance, intra-settlement agriculture may have developed simultaneously in multiple places within the Maya area, but that does not mean it was managed in the same way from city to city. Even accounting for these diverse management strategies, place-based intra-settlement agriculture seems to have been abandoned everywhere with the collapse of Classic period political institutions. Urban Maya farmers did not disappear; they left the cities and dispersed out into the forest to farm, as their rural counterparts had been doing for centuries (Culbert 1973; Harrison and Turner 1978; Turner and Sabloff 2012). Resilience thinking provides a useful framework for thinking about this agro-urban exodus and the larger complexities of how agricultural decision-making were involved in the Maya collapse.

One of the most interesting patterns that have emerged from this resilience approach has been the finding that the agricultural practices that were virtually the same could persist or fall apart under different conditions. So, deforestation could and did go past the point of no return in some parts of the Maya area, causing massive damage to soil and arboreal resources (Beach et al. 2008; Lentz and Hockaday 2009); in other

places, people's long-term access to economically valuable trees of mature, closed-canopy forest was uncompromised thanks to multigenerational forest management strategies (Ford and Nigh 2009, 2015; Lentz et al. 2012). Some Maya centers combated soil erosion by constructing terraces (Kunen 2001, 2004); others, for whatever reason, never did (Dunning and Beach 2010). Farming communities in naturally vulnerable areas, like the coastal plains of Belize, were more resilient to environmental changes than their counterparts in the peninsula's interior because centuries of water table fluctuations had taught them how to diversify their agricultural base (Luzzadder-Beach et al. 2012; Luzzadder-Beach and Beach 2009; Pohl and Bloom 1996; Turner 1983). And even within single regions, growing attention to the household and community level of analysis has shown that Maya farmers were remarkably resilient in their agriculture and water management practices, even when political institutions were crumbling around them (Iannone et al. 2014; Robin 2012, 2013; Smyth et al. 2017).

Threading through this complex web of agricultural persistence and disruption is a sort of "bottom-up" bottom line: as Classic Maya kingship was flailing, small-scale rural Maya farmers were remarkably resilient. Small Maya farming communities continued to practice wetland cultivation, terrace agriculture, and agroforestry while their more powerful urban neighbors – which were often practicing the same agricultural strategies, simply on a larger scale – were being abandoned en masse. Growing attention to households, communities, and smaller-scale settlements is changing the way we think about Maya agriculture and resilience. This work at Tzacauil stands to contribute to this research, not just on the Classic Maya collapse but also on an earlier collapse event proposed for the end of the Formative period (see Chapter 4). Moving forward, the archaeology of resilience in the Maya area and beyond (e.g., Dugmore et al. 2012; Hegmon et al. 2008; Nelson et al. 2012, 2016; Spielmann et al. 2016) suggests that the more flexible a society's agricultural system, the more likely it is to survive change.

2.7 Chapter summary

Agricultural sustainability is not a simple equation between inputs and outputs. It is a complex, historically contingent cultural construct that has to be framed in terms of social, political, economic, and environmental dynamics. Anthropological archaeology that focuses on landscapes as the unit of analysis, an approach grounded in historical ecology, is capable of recovering the material traces of these interrelated dynamics and tracking how they change over time. With this in mind, in this chapter I invoked the principles of sustainable agriculture outlined by the Food and Agricultural Organization (FAO) of the United Nations (UN) to frame my reckoning of past and present farming communities at Tzacauil. By addressing how these principles of efficiency, conservation, rural livelihoods, governance, and resilience have previously been studied by Maya archaeologists, I set the stage for considering how these principles co-relate over twenty centuries at Tzacauil. We turn now to the landscape of central Yucatán, and the material expressions of Maya farmers' interactions with their local environment that populate that landscape.

Chapter 3
The Yucatán Landscape

3.1 Introduction

The framework of historical ecology situates landscapes as recordings of long-term interactions between humans and the local environment. To "read" Tzacauil's landscape in order to evaluate the agricultural sustainability of past and present Maya farming communities, we have to first gather a better sense of the physical materials of the landscape, both human and non-human contributions. This chapter pulls together the many elements that make up the central Yucatán landscape, setting the scene for the chapters that follow. First the ecological boundaries of the northern Yucatán Peninsula are laid out, with brief summaries of the region's geology, water, soil, climate, and plant and animal life. Then we turn to populating this natural setting by introducing Yucatec Maya households, houses, and houselots. As I explain below, I rely mainly on early 20th century ethnographic accounts in this chapter; in subsequent chapters, we will explore the changing roles of the Yucatec Maya household, house, and houselot throughout the modern era. Next is a section that connects land-use practices documented ethnographically with archaeologically recoverable material correlates of those practices. This chapter concludes with a brief summary, in which I stress that this information is not meant to cast the landscape as static or timeless – but as a single point from which to view the historical dynamics between people and environment that create and change this landscape.

3.2 Yucatán ecology

The Maya area – that is, the area of southeastern Mesoamerica characterized by a shared language family and suite of cultural practices – includes three distinct regions. Moving north from the Pacific Coast of Chiapas and Guatemala, we find first the Maya

Highlands, a mountainous region characterized by high elevations, cool temperatures, and cloud forest. Next, we pass through the southern Maya lowlands, the quintessential rainforest of the Guatemalan Petén district and parts of Mexico and Belize, characterized by high-canopy jungle, rivers, and enormous biodiversity. We finally arrive at the northern part of the Yucatán Peninsula, which is drier, flatter, surrounded by the sea, and covered with thorny scrub forest and grasslands. Geopolitical boundaries divide this area into three Mexican states: all of Yucatán, and parts of northern Campeche and Quintana Roo. These are the northern Maya lowlands.

Tzacauil and the Yaxunah *ejido* are located in the middle of the northern Yucatán Peninsula. The peninsula is a large, fairly flat, low-lying Cenozoic marine limestone platform that projects north from the Petén into the Gulf of Mexico and the Caribbean Sea (Maldonado-Koerdell 1964). The platform is geologically young: it emerged during the Pleistocene and was subsequently covered with Pliocene calcareous rock, namely limestone, marl, and gypsum. In the western part of the peninsula, the Puuc hills or *Sierrita de Ticul* reach heights of 130 meters above sea level; aside from those western hills, the terrain in the northern part of the peninsula is a relatively flat, pitted karst plain (West 1964; Ringle 1985).

The Yucatán Peninsula can be further subdivided based on variation in its geology (Figure 3.1). A classification by Isphording (1975) places Tzacauil in the Northeastern Coastal Plain, an area distinguished by older limestone formations and more extensive solution features that is delimited by the coast of Quintana Roo to the east, the Puuc hills to the southwest, and the Northwestern Coastal Plain to the northwest. Wilson (1980) brought higher resolution to the peninsula's geography by breaking the Northeastern Coastal Plain into a coastal zone and an inland zone; Tzacauil is located in the inland zone. Here, the main elevation is about 25 meters above sea level.

The bedrock underlying Tzacauil and its surrounding region influenced – and continues to influence – local human-environment interactions (Mercer 1975; Mosely and Terry 1980; Kepecs and Boucher 1996; Wilson 1980) (Figure 3.2). Many of the features and resources associated with bedrock occur below ground level or in cavities

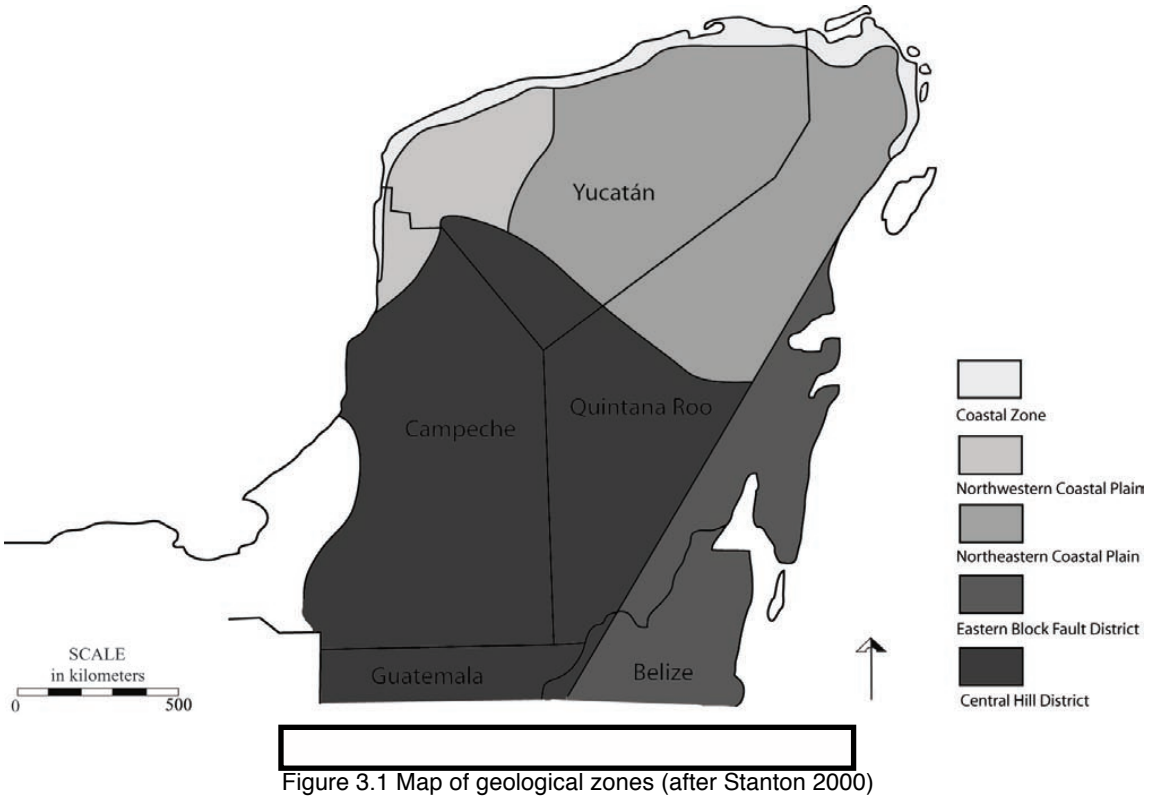

Figure 3.1 Map of geological zones (after Stanton 2000)

at the surface. Bedrock here in central Yucatán is extremely porous. In some places, the bedrock is quite thin and may break open – as a result, the karst surface is pockmarked with apertures opening to sinkholes, some of which reach the water table below and others that stop short of it. When such a sinkhole reaches the water table, it is called a *cenote* (after Mayan dz'onot) (see Table 3.1 for a list of Yucatec and Spanish terms used frequently in this text). There is no permanent surface water in this part of Yucatán, and so in the past as today, cenotes are extremely important features in the landscape. Even when depressions in the karst topography do not reach the water table, they are vital ecological features (see Houck 2006). Caves (wet and dry) are common and hold ritual significance in this part of Yucatán. *Rejolladas* (sometimes called *hoyas* or *joyas*) are large, natural depressions where soil and moisture accumulate (e.g. Kepecs and Boucher 1996; Lowry 2013). They often create microclimates and support a great deal of biodiversity, including large trees that otherwise could not grow on the surface. *Bajos* are depressions in bedrock, shallower

Term	Language	Definition
Albarrada	Spanish	A dry-laid multicourse stone wall, usually used as houselot boundaries in contemporary Maya villages
Bahpek	Yucatec	Construction technique by which fist-sized cobbles (chich) are packed into a compact surface with soil, and possibly sascab, to create a floor or building site
Cal	Spanish	Burnt lime used similar to mortar in construction
Cenote	Spanish	Natural pit or sinkhole in limestone bedrock, exposing groundwater underneath (after Yucatec "ts'onot")
Chaká	Yucatec	Hardwood tree (*Bursera simaruba*) used for woodcarving in Yucatán
Chich	Yucatec	Fist-sized cobbles of limestone often used as sub-floor ballast in traditional Maya construction
Chichitos	Yucatec	Small limestone pebbles often used in traditional Maya construction
Ejido	Spanish	Communally-owned and collectively-farmed landholding, recognized and supported by the Mexican federal government
Ejiditario	Spanish	An individual who shares communal rights to an *ejido*
Kancab	Yucatec	Reddish-brown clay soil (calcareous red alfisols) overlying a yellow subsoil common in Yucatán
Kancabal	Yucatec	Low-lying, flat expanses of kancab (plural: kancabales)
Milpa	Spanish	Extensive shifting cultivation system practiced in Mesoamerica, by which a parcel of forest is cut, burned, planted for a couple of seasons with a polycultural crop (typically maize, beans, and squash) and then allowed to fallow for eight years. Also known as swidden, slash-and-burn, and slash-fire agriculture.
Rejollada	Spanish	Natural sinkhole where soil and moisture accumulate, creating a microclimate that supports highly bio-diverse forest ecology
Sacbe	Yucatec	Literally "white road", raised limestone causeways
Sarteneja	Spanish	A natural, sometimes modified, cavity in limestone bedrock where rainwater and/or soil and moisture accumulate
Sascab	Yucatec	Lime marl powder used for making plaster, mortar, and other construction materials
Tejón	Spanish	White-nosed coati, also known as coatimundi (*Nasua narica*)
Tzekel	Yucatec	Bedrock, or an expanse of exposed bedrock
Xíimbal k'áax	Yucatec	Walking the woods, sometimes used to refer to the first step of making milpa, when a parcel is selected for burning and planting

Table 3.1 Spanish and Yucatec terms used frequently in this study

than *rejolladas* but nevertheless traps for soil and moisture. The bedrock also creates conditions for seasonal water storage. These include *sartenejas*, or natural hollows where rainwater collects (and which can be used for a kind of natural container-style gardening; see Fedick et al. 2008), and *aguadas*, which are similar but tend to be larger (Figures 3.3-3.5). *Aguadas* usually occur naturally, but sometimes people expand or reinforce them with stones or clay. Finally, some openings in bedrock tap into mineral resources, like pockets of sascab, a white marl powder used for making plaster and

Figure 3.2 Exposed bedrock

Figure 3.3 *Sarteneja* in bedrock at Tzacauil

Figure 3.4 Large *sarteneja* at Tzacauil

Figure 3.5 *Sarteneja* at Tzacauil, possibly modified

mortar. Mines dug into these pockets are called sascaberas. Sometimes chert can be found in small concentrations beneath the bedrock surface, but here in the Yaxunah *ejido* it is generally of poor quality for tool making. All of these kinds of karstic depressions are significant elements in the Tzacauil landscape.

At the same time that bedrock depressions matter so much, the places where bedrock juts out of the ground level in large outcrops or florescences are also significant. Exposed bedrock makes up about half of the ground surface in this part of Yucatán (Ringle 1985; Wilson 1980). While in lots of places bedrock is fairly flat or gently inclined, in others it emerges abruptly and creates outcrops that can reach heights of two or three meters. Often around these large outcrops, the bedrock crumbles off in large chunks; during my work at Tzacauil, I called these areas of huge, crumbling chunks “boulder *laja*” (Spanish for bedrock). These boulders provided a ready

source of construction material, and Tzacauil is covered with such outcrops. These features appear to have played a critical role in people's decisions about where to build, an idea I will discuss in later chapters.

Like elsewhere in central Yucatán, Tzacauil's terrain can be separated, bluntly, into areas where bedrock is exposed and areas where it is not. Where it is exposed, it is either the "boulder *laja*" I just described, that is, large outcrops of limestone that emerge above the ground surface and break into large chunks, or flat expanses called tzekeles. Tzekeles are often exposed but may sometimes have a very thin covering of soil; this soil is usually black, because it is almost entirely recently decomposed organic matter (i.e. leaves). These flat expanses of bedrock are typically where we expect to find various kinds of cavities of all sizes, many of which, like *sartenejas* or *aguadas*, hold water during the rainy season.

Outsiders have long derided northern Yucatán's soils (e.g., Asensio et al. 1898; Chardon 1961) while indigenous Maya cultivate and curate a deep knowledge of these same lands. Soils in Yucatán vary a great deal according to their age, their parent materials, the amount of organic materials and kinds of organisms living in them, rainfall, topography, and atmospheric conditions (Dunning 1991). It is true, as so many outsiders have complained, that soils in Yucatán are extremely thin – they rarely exceed 20 centimeters in depth (Dunning 1990, 1991; Back and Hanshaw 1976) and are often even shallower, to the point where exposed bedrock can often count for up to half of the exposed surface in a given area (Ringle 1985; Wilson 1980). As I mentioned, the Yucatec word for these areas of exposed bedrock is tzekeles. Coaxing crops out of this stony landscape for thousands of years, as the Maya have, requires a deep ecological intimacy and nuanced, highly localized knowledge of the land (Figures 3.6, 3.7). This is reflected in Yucatec Maya's complex terminology of different soil types, which organizes soils based on the factors that will affect agricultural potential, such as color, depth, granularity, and stoniness (Bautista and Zinck 2010; Dunning 1990, 1991; Lundell 1934; Marcus 1982). In the Yaxunah *ejido*, there are predominantly two kinds of soil: box lu'um (also called ek lu'um) and kancab.

Figure 3.6 *Milpa* planted on bedrock and soil

Figure 3.7 Natural container gardening in a bedrock cavity

Box lu'um is a thin, dark brown or black soil with a high quantity of organic material (geologists would classify it as mollisols). Box lu'um is considered to have a much better agricultural potential than other soils in central Yucatán. The Yaxuná archaeological site is predominantly box lu'um. This seems to be a product of that site's

Figure 3.8 Kancab

centuries-long occupation, rather than a reason for its genesis: after hundreds of years of possible agricultural intensification and certainly the sheer amount of household refuse the settlement must have produced, its soils are rich in organic matter. The question of which came first, the black soil or the huge population it supported, remains to be resolved. Either way, the fact remains that even today most farmers from Yaxunah look first to the Yaxuná archaeological zone when scouting a site for their next *milpa*.

Kancab is a red clay soil (what geologists would call calcareous red alfisols) overlying a yellow subsoil. Kancab occurs in low-lying depressions in central Yucatán, and at Tzacauil, forms fairly wide, level expanses; these areas of kancab are locally known as “kancabales” (Figure 3.8). I will often use the word kancabales to describe these areas, but will sometimes refer to them as “soil flats” or “expanses of soil”. Kancab is generally dismissed as a lower-quality soil – when possible, local farmers prefer to cultivate in the dark box lu’um soils like those found in the Yaxuná archaeological site. However, while these black soils might be the easiest to cultivate, kancab and other kinds of red soil are the only soils where farmers practice intensive agricultural strategies (application of manure, manual tillage, and use of herbaceous legumes as cover crops) (Bautista and Zinck 2010) which suggests that the cultivation in *kancab* may be more sustainable than cultivation in black box lu’um soils. Kancab is

by far the most common soil at the Tzacauil archaeological site – essentially all areas that are not exposed bedrock tzekeles are kancabales.

The modern climate of the Yaxunah *ejido*, along with most of the northern lowlands region, is classified as a tropical wet and dry climate or an Aw climate (Vivo E. 1964). Climatic variations are typically moderate, though the peninsula is fairly regularly hit by hurricanes about once or twice a decade.

The yearly round can be divided into a rainy season and a dry season. The rainy season is between May and September, during which the region receives 85-90% of its total annual precipitation (Back and Hanswhat 1976; Dahlin 1986). The Yaxunah *ejido* gets an average of about 1000-1200 millimeters of rain per year (Stanton et al. 2010:33). Temperatures during the rainy season average around 28 degrees Celsius. Dry season temperatures cool to an average of 22 degrees Celsius before reaching the hottest and driest months in March and April (Back and Hanshaw 1976). The mean annual temperature works out to be 26 degrees Celsius, with a range between 35 degrees Celsius as the hottest and 14 degrees Celsius as the coldest recorded temperatures for a typical year in the town of Pisté (20 kilometers from Yaxunah). However, Yaxunah's farmers have noticed the painful effects of increasing temperatures and changing climate patterns associated with larger-scale warming patterns; these changes will be discussed in later chapters.

The ecology of the northern lowlands region is highly biodiverse. Central Yucatán, where the Yaxunah *ejido* is located, is classified as a tropical savanna. Its forests are tropical deciduous or semi-deciduous, and, unlike the high-canopy rainforests of the southern Maya lowlands, can more accurately be described as "scrub" forest (Gómez Pompa 1998; Shattuck 1933). The forest canopy does not exceed heights of 15 meters and is often much lower. The ground is usually covered with dense and thorny brush, which is more or less impenetrable depending on the season. No known primary forest exists in Yucatán since large-scale forest clearance for maize agriculture has been an important part of life here for millennia (Lundell 1934; Leyden et al. 1998). The forest is home to several species of hardwood (chaká, cedar) and fruit-bearing trees. There is diverse arachnid and insect life. Larger animals native to this

region include deer, ocelots, jaguars, spider monkeys, peccaries, raccoons, opossums, bats, rabbits, armadillos, various other rodents, turkey vultures, ocellated turkeys, several other kinds of birds, turtles, iguanas, frogs, and a wide variety of snakes (Götz 2010). The populations of several of these species have diminished or altogether disappeared in this region over the last few centuries.

3.3 Defining households, houses, and houselots for Yucatán

Having discussed the environmental aspects of Yucatán's landscape, it is time to populate it. My discussion of Yucatán Maya society – whether I am talking about Yaxunah today or Tzacauil 2000 years ago – relies on three terms: households, houses, and houselots. The **household** refers to a group of people who usually live together, work together, and share some sort of familial or marital ties, but there are always exceptions to even these basic rules. We can define the household more thoughtfully as a "social unit whose members share in the maximum of daily productive and consumptive activities" (Ashmore and Wilk 1988; Wilk and Rathje 1982). Focusing on households in the Maya area (and beyond) has allowed archaeologists to answer questions about socioeconomic organization (e.g., Flannery 1976; Haviland 1985; Killion et al. 1989; Manzanilla and Barba 1990; Masson and Peraza Lope 2004, 2014; Tourtellot 1988), political and ritual integration (e.g., Arnauld et al. 2013; Canuto and Yaeger 2000; Lemonnier and Vannière 2013; McAnany 1995; Robin et al. 2010), sustainability (e.g., Chase and Chase 1998; Isendahl and Smith 2013), the complexities of social practice and meaning (Ardren 2002a; Hendon 1996; Robin 2013), and the often overlooked experiences and contributions of commoners and lower-class people (Lohse and Valdez 2004; Robin 2012; Robin et al. 2014; Webster and Gonlin 1988). Households are fundamental, dynamic, and highly variable units of social organization.

Archaeologists studying households rely on recovering the physical settings where household activities took place. A **house** is the physical dwelling or group of dwellings (a **house group**) in which residential activities took place (Ashmore and Wilk 1988; Wilk and Rathje 1982). The ratio of households to houses is seldom 1:1 – a single household can occupy multiple houses, and multiple households can occupy a single

house (Blanton 1994; Douglass and Gonlin 2012; Haviland 1988; Wilk 1983). Many household approaches consider the house the primary locus of archaeological investigation. For the Maya and other tropical societies, however, the majority of household activities – gardening, cooking, socializing, relaxing, and more – happen outside. I call these outdoor activity areas between and around houses "**intra-settlement lands**" (see also Ball and Kelsay 1992).

Modeling the relationship between households and intra-settlement lands is pivotal for understanding ancient Maya life at all scales. A starting point for incorporating these seemingly "vacant" areas into household approaches is provided by houselot models (Fisher 2014; Hutson 2010; Robin 1999). **Houselots** consist of all exterior spaces routinely used by a household(s) (Figure 3.9). Ethnographic and ethnoarchaeological studies of modern Mesoamerican houselots have identified specific patterns of material remains that can be used to infer a household's socioeconomic activities (Arnold 1990; Deal 1985; Hayden and Cannon 1983; Hutson et al. 2007; Killion 1990; Redfield and Villa Rojas 1934; Robin 1999; Wauchope 1938). Archaeologists have used these houselot spatial patterns as analogies for reconstructing outdoor activities at Classic (and later) Maya sites (e.g., Alexander 1998; Folan et al. 1983; Hutson et al. 2007; Lemonnier and Vannière 2013; Lohse and Findlay 2000; Magnoni et al. 2012; Manzanilla and Barba 1990; Robin 1999, 2002, 2006, 2012; Smyth and Dore 1992; Smyth et al. 1995). I note that in my discussion of the open areas around Tzacauil houses, I tend to refer to these spaces by the more neutral "intra-settlement" lands rather than as houselots, but the parallels between the two are strong.

3.4 Ethnographic accounts of households, houses, and houselots

In the first half of the 20th century, researchers affiliated with the Carnegie Institution of Washington collected ethnographic data on Maya life. Two of the volumes that came out of this work, Redfield and Villa Rojas' 1934 *Chan Kom: A Maya Village* and Wauchope's 1938 *Modern Maya Houses: A Study of Their Archaeological Significance*, provide detailed descriptions of Yucatec Maya households, houses, and houselots. I use these two sources to provide a baseline of "contemporary" life in

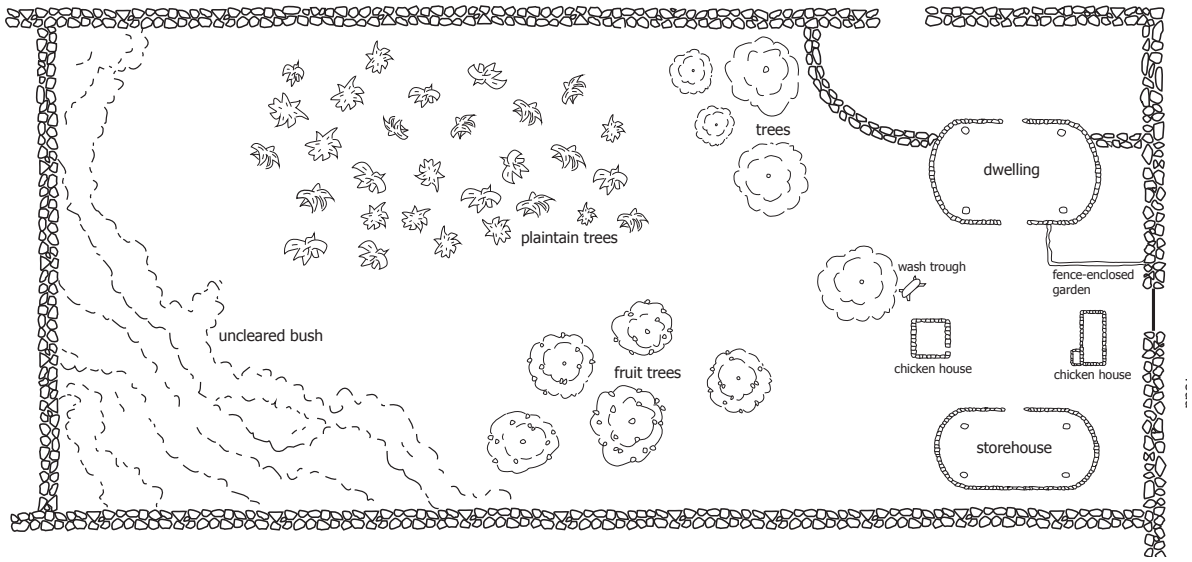

Figure 3.9 Plan of a 20th century Yucatán houselot (redrawn from Wauchope 1938)

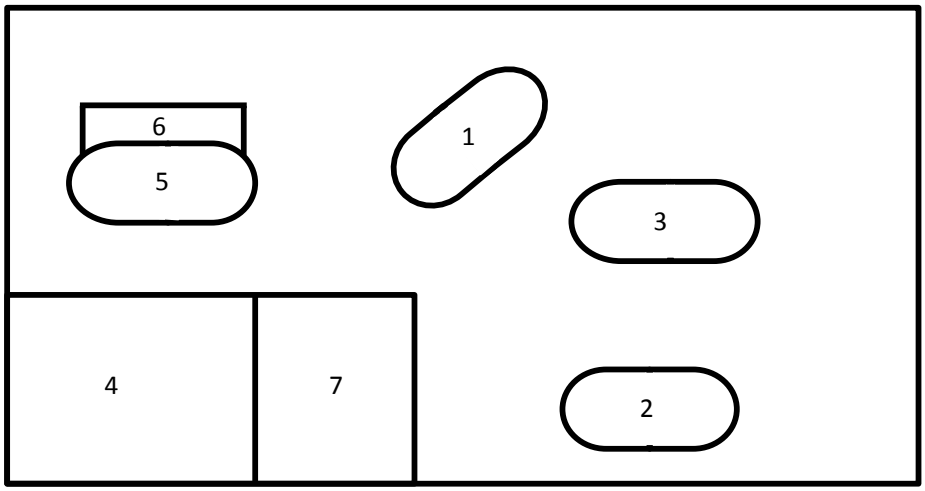

Figure 3.10 20th century Chan Kom houselot (from Redfield and Villa Rojas 1934)

Yucatán with the obvious caveat that many elements of their accounts no longer accurately describe life in Yucatec Maya towns today. In a later chapter, where I bring the history of the Yaxunah *ejido* through the Spanish conquest and into the 21st century, I will discuss how household, house, and houselot have changed in the modern era with particular attention to the case of Yaxunah.

With that said, these early 20th century accounts are relevant because they make explicit connections between (1) the components of everyday life observed by the Carnegie Institution ethnographers, and (2) the material patterns and features of ancient

life being documented, in the same general timeframe and area, by Carnegie Institution archaeologists (see Chapter 1). These connections show that some elements of the residential patterns, subsistence strategies, and material culture of the 20th century Yucatán Maya share a great deal of continuity with the Maya of the more distant past. Some of this continuity persists today.

Households in Yucatec Maya villages consist of one or multiple nuclear families that usually co-reside in the same place; in Chan Kom and other Yucatán towns documented in the early 20th century, household members typically lived on the same houselot, though perhaps in different dwellings (Redfield and Villa Rojas 1934; Wauchope 1938). The various economic tasks of the household are usually organized according to gender roles and age, with men generally managing agriculture and women taking care of childcare, food preparation, and chores around the houselot (Redfield and Villa Rojas 1934:90). When a couple's children grew old enough to be married, marriages were usually arranged and preceded by a trial period where a young man would live and work with his in-laws for a year. After the wedding, the new couple usually relocated to live with the husband's parents. However, even in the early 20th century, Redfield and Villa Rojas noted that the growing mobility of Chan Kom residents was challenging this traditional pattern – and this change has only accelerated since then.

It also needs to be stated that the Yucatec Maya household of the early 20th century bears the residual impact of colonialism. The colonial impact on the Maya household will be discussed in greater detail in Chapter 8, but here suffice it to say that by the early 20th century, the size (in members) of Yucatec Maya households had diminished dramatically from about 9 people (as listed in Colonial period census documents; Roys et al. 1959:205) to 4.8 people (Steggerda 1941). Colonial authorities had long opposed the widespread pattern of multiple families living together and had begun separating Maya households into single family units as early as the 16th century (Roys et al. 1959). However, multiple family households persisted in some places, as observed by Redfield and Villa Rojas at the village of Chan Kom. They noted that 2/3 of households at Chan Kom consisted of a married couple, their children, and some

unmarried relatives of one spouse or the other. The other 1/3 of households (n=10) contained more than one family living in the same houselot property. Of those multiple-family households, the two with the most people were headed by two of the most esteemed and prosperous old men in the village. Redfield and Villa Rojas suggested that the extended domestic family was once more common but was becoming less so due to lasting effects of Spanish land reorganization and more recent technological and economic shifts.

The developmental "life cycle" of these larger Chan Kom households and their associated houselots could be complex and dynamic. Domestic space and structures were added, renovated, repurposed, or neglected as household needs changed. Redfield and Villa Rojas (1934:90) describe the life cycle of one of these large Chan Kom households (refer to Figure 3.10): In 1906 the household patriarch and his wife settled in Chan Kom and built a pole-and-thatch house (1) that was used as a kitchen and for sleeping. Later, when the village's street grid was established, this founding patriarch built another thatched house (2) facing the street and a separate structure for cooking (3). Some of the household's children slept in this separate cookhouse. By 1928 the couple had nine children; two had already married. To accommodate everyone, they built a masonry house (4) back in the corner of the parcel and another, better kitchen (5), but realizing it was more comfortable to sleep in pole-and-thatch houses, the family continued to sleep in structures (2) and (5). The first cookhouse, (3), was left neglected at this point. Meanwhile, an addition (6) was added to the new, updated kitchen (5) to house a recently acquired grinding apparatus. At the time this household's members were interviewed, the founding couple and their unmarried children were sleeping in the thatched house facing the street (2). Another masonry room (7) was halfway built. The two oldest married sons and their wives were sleeping in the masonry house (4) and the youngest household members were sleeping in the newer kitchen (5). All of these changes occurred within the span of a few decades. How complex and dynamic, then, must be the stories of the pre-Hispanic Maya houses that were occupied for centuries!

The domestic saga of this single Chan Kom household and its changing parts sets us up for the next part of the discussion: the physical components of the house group. Much of this information comes from Wauchope's (1938) book, which was written with a careful eye to what might (and might not) preserve archaeologically. These descriptions are followed, in Wauchope's spirit, to a discussion of the explicit material correlates we might expect to find left behind by the many activities that take place around Maya houses.

3.4.1 The building site

Deciding where to build a new house has to take into consideration questions of stability and drainage. Wauchope (1938:14-15) notes that houses are built on top of platforms – but while sometimes this may simply involve digging out the ground around the foundation, builders avoid naturally occurring bedrock outcrops. He goes on to note that houses built directly on the ground drain just as easily as those built on platforms. I have to disagree with him here, as I have personally seen many modern Yucatán houses built on limestone outcrops, and can attest from a perennial problem in my house at our camp in Yaxunah that houses built on the ground are quite susceptible to flooding. As I will discuss in later chapters, decisions about where to build houses seem to have been incredibly important for pre-Hispanic Maya farmers. Changing preferences in residential building site selection can be tied to broader cultural and historical patterns; these will be discussed in Chapter 9.

3.4.2 Dwellings

Houses built in Yucatán tend to follow a set of prescriptions that are widely used and suggest a long history in the area (Figure 3.11). A low foundation of dry-laid stones will be built in the desired shape – most houses in Yucatán today are apsidal – and used to stabilize several wooden posts, which in turn support cross-beams. Most roofs are thatched using palm fronds (*guano*) or grass (*sacate* or *zacate*), but as palm fronds become increasingly difficult to acquire, people are turning to corrugated metal to roof their homes.

In houses where the kitchen is not kept in a separate building (see below), interior space is divided into a kitchen end and an end for sleeping and more private domestic activities – what Wauchope calls the family end. The kitchen end is organized around the hearth or ko'oben, built of three round stones (each usually about 30 cm in diameter) and typically located near the central post of the kitchen end or in the corner. Wauchope noted that this same end of the house would also contain the pottery and maize-grinding stones used for food preparation; today, we would find plastic and metal cooking implements and sacks of pre-ground maize, but the pattern is generally the same.

The so-called family end might be partitioned off by a light wooden frame or simply open to the rest of the interior space. Here there will always be hammocks for sleeping and relaxing, along with a mix of the other stuff of everyday life: baskets, gourds, bags, backpacks, laundry, toys, furniture – and, today, televisions, stereos, and maybe a landline phone. The roof tends to provide more opportunities for storage than the floor in many Yucatán homes, either using attic lofts or by rigging up elaborate constellations of suspended possessions. The family end of the house may also have a small shrine and today might feature framed photographs of family members and special occasions.

3.4.3 Ancillary structures and miscellaneous features

Households often maintain one or more special-function or ancillary structures in the houselot property (Figure 3.12). Often the kitchen is maintained as a separate structure, usually directly behind the main dwelling and identical to it in size, shape, and construction. Sometimes during the "life cycle" of a houselot, dwellings will be converted into kitchens (or vice versa) as a household's needs change over time. Kitchens may be closely associated with outdoor areas dedicated to food preparation and consumption activities (Figures 3.13-3.15). Some of these activities can alter the soil chemistry of the areas where they are repeatedly practiced; for example, nixtamalization, in which alkaline limewater is used for soaking maize and then dumped on the ground, leaves a

Figure 3.11 Houselot garden at Yaxunah

Figure 3.12 Yaxunah houselot with ancillary structures

Figure 3.13 Outdoor kitchen in Yaxunah

Figure 3.14 Hearth and turkeys in a Yaxunah houselot

Figure 3.15 Cooking and eating in a Yaxunah houselot

Figure 3.16 Yaxunah houselot orchard

Figure 3.17 Corncrib in a Yaxunah houselot

Figure 3.18 Limestone extracting pit in a Yaxunah houselot

recognizable chemical signature of elevated carbonates (see Chapter 5 for discussion of soil chemistry analysis).

Many of a houselot's ancillary structures are related to animals. In the early 20th century and before, it was fairly common to raise honeybees right in the houselot (see also Paris et al. 2018), and people built special structures to protect their hives. Now that the native stingless bees are less common in Yucatán and have been replaced with European honeybees, apiculturalists tend to keep their hives away from the home. Many households in Yucatán today will keep a few chickens and turkeys, in the houselot – and these birds are usually provided with small wooden or stone structures to sleep in (Figure 3.14). Households that keep pigs corral them in stone enclosures towards the back of the houselot. A household's animals can usually be found roaming the houselot and often come right into the dwelling.

Other houselot structures and features include storage buildings, granaries (though these are usually kept in the fields), shrines, shelters for washing clothes, wells, ovens (though rarely), tanneries (also rarely), and piles of building materials like *sascab* (limestone marl) (Figures 3.16-3.18).

3.4.4 Boundary markers

Modern houselots in Yucatán are almost always enclosed by stone boundary walls. Limestone rubble is readily available in Yucatán's karstic landscape that, under

Figure 3.19 *Albarrada* houselot wall

Figure 3.20 Orchard and garden in a Yaxunah houselot

Figure 3.21 Container gardening in a Yaxunah houselot

Figure 3.22 *Milpa* in the Yaxunah *ejido*

the right conditions, it would not difficult to acquire enough to build a perimeter wall, sometimes just through the act of cleaning the houselot of loose stones. However, it should be noted that in the 21st century, limestone for *albarrada* construction has become scarcer in some towns in light of land privatization and other factors (Travis Stanton, personal communication 2019). These walls usually abut the sides of the main dwelling (which normally stands at the street) and then extend in either direction to enclose the entire property. They are usually dry-laid (i.e. use no mortar) and rarely exceed heights of 1-1.5 meters. In Yucatán these walls are called *albarradas* (Figure

3.19). Such houselot walls clearly have a long history in the northern Yucatán Peninsula, as they are found at several archaeological sites including Chunchucmil, Mayapán, and Cobá (Bullard 1952; Dahlin et al. 2005; Folan et al. 1983; Hutson 2010; Masson and Peraza Lope 2014; Smith 1962).

3.4.5 Houselot gardens

A significant amount of space in contemporary Yucatán houselots is dedicated to gardens and orchards (e.g., Benjamin 2000; De Clerck and Negreros-Castillo 2000; de la Cerda and Guerra 2008; Flores-Delgadillo et al. 2011; Rico-Gray et al. 1990) (Figures 3.11, 3.20). Situating these holdings close to the home allowed for regular care and convenient collection of fruit and vegetables. Maya households in Yucatán possess specialized knowledge for planting on terrain that many outsiders' would regard as inhospitable; much of this knowledge involves the strategic use of container planting. Container gardening can use natural containers, like the small cavities and depressions in bedrock that trap soil and moisture (Fedick et al. 2008), they can use portable vessels (clay pots, metal cans, plastic jugs), or they can use more elaborate constructions designed to improve plants' growing environments (Figures 3.7, 3.21). At Chan Kom, Redfield and Villa Rojas noted that raised gardens, whether in hollow logs or in beds elevated on wooden poles (kanche), were regularly supplemented with black soil collected from outside the yard (1934:38). Raising the gardens not only allowed for cultivation in richer soils, but also helped protect the vegetables from livestock and even from leaf cutter ants (Steggerda 1941). Gardens at Chan Kom were reported to make only a negligible contribution to overall food production (Redfield and Villa Rojas 1934:54) but were still a reliable and convenient source of food. The ethnographic accounts of vegetable gardens in Yucatán houselots record several kinds of cultigens: onions, peppers, tomatoes, cilantro, garlic, cabbage, epazote, mint, balm-gentle, and squash. They also point out that essentially all households kept decorative gardens – at the very least, a few potted flowers. These ornamental gardens included poppy, rose, margarita, heart of Juanita, clabela, pastora, sweet basil, and tobacco. Many of these plants likely held multiple roles as food, condiments, and medicine. All of these kinds of

garden strategies are observable in Yucatán today; I personally have witnessed all of them practiced in Yaxunah.

Houselot orchards provide both fruit and shade to the household. Fruit trees were the subject of much attention at Chan Kom when Redfield and Villa Rojas were there (1934:47). Every household in Chan Kom grew papayas, and it was not uncommon to see oranges, limes, grapefruit, bananas, custard apples, guavas, pomegranates, guanabanas, and hog plums growing in different combinations in most houselot orchards. Fruit was consumed locally (Redfield and Villa Rojas 1934:54). A survey of daily diet among Maya people published by Benedict and Steggerda (1936) confirms the importance of these fruits and vegetables as nutritious supplements to the staples of maize, beans, and squash.

As I will elaborate in subsequent chapters, I suspect that the open areas around pre-Hispanic Maya houses at Yaxuná and Tzacauil were used much the same way as contemporary Maya houselots, particularly for cultivation and gardening (see also Chapter 2). However, I will often use the more neutral term "intra-settlement land" to describe the open areas between and around house groups, to avoid the risk of pre-supposing these areas' similarities to contemporary houselots or *solares*.

3.4.6 Milpas

Milpa agriculture refers to an extensive, shifting system of polycultural maize agriculture practiced in the tropics, in which a patch of forest is felled, burned, and planted for a few seasons before being left to restore and regrow its forest for several years (Terán and Rasmussen 2009) (Figure 3.22) (see also Chapter 2). It is still the most common way agriculture in practiced in central Yucatán, but among Maya archaeologists it can be a somewhat controversial topic because it is too often assumed that the way *milpa* is practiced today is the way it was practiced in ancient times (e.g., Fisher 2014; Ford and Nigh 2015). I include it here as a houselot component to emphasize that outside observers (including the ethnographers whose accounts I have been relying on here) often underestimated or overlooked maize plants growing in

houselots. Indeed, the remains of maize plants have been identified in Classic period houselot gardens at the site of Cerén (e.g., Farahani et al. 2018).

3.5 Archaeological correlates of houselot activities

How can we determine whether the area around a pre-Hispanic Maya house was used as a houselot? Several kinds of outdoor activities leave material correlates. Below I discuss broad categories of outdoor activities known for the Maya of Yucatán and the expected material correlates of each. These correlates inform my interpretation of what my project recovered from intra-settlement areas around Tzacauil house groups.

Agriculture and gardening near the home is typically characterized by intensive energy inputs (see Chapter 2 discussion of intra-settlement agriculture; see also Netting 1993; Netting et al. 1984; Sheets et al. 2011; Wilken 1971). In Yucatán this means collecting soil from soil traps (e.g., *rejolladas*, *bajos*) and distributing it across cultivation plots or in containers. Raised planting beds like kanche (elevated trays filled with soil) (Roys 1972) provide a solution, as do natural "container gardens" that trap soil in small bedrock cavities (Fedick et al. 2008). Soils could be amended with fertilizer, which would result in elevated soil phosphorus levels. Cultivated plots could be demarcated with low stone walls (*albarradas*) (e.g., Hayden and Cannon 1983; Killion 1992). As part of their frequent monitoring, infield farming householders keep cultivated areas relatively free of inorganic refuse, though an occasional whole or broken tool might be left behind (Robin 1999, 2006).

Arboriculture has long been practiced in many Yucatecan houselots (e.g., Marcus 1982; Roys 1972; Tozzer 1941). Fruit trees in Yucatán grow best in planters that concentrate soil and moisture: limestone cavities (Fedick et al. 2008), chich (fist-sized cobbles) and gravel mounds (Kepecs and Boucher 1996), and large soil traps like *rejolladas* (ibid.) near house groups. With good preservation, fruit tree phytoliths would be expected (e.g., Lentz et al. 2012).

Water management is an integral component of infield agriculture. Yucatecan farmers must adapt by conserving rainwater in the dry season and draining excess rainwater in the wet season. Water collection is accomplished with reservoirs, which

may occur naturally as bedrock depressions or as human-added modifications like walls, as with the *aguada* at Yaxuná. Elsewhere in Yucatán, bell-shaped cisterns called chultunes are dug into bedrock, lined with plaster, and used to store rainwater (e.g., Brainerd 1956; Sabloff et al. 1984). The retention of soil moisture, another concern for farmers, could be achieved by raising crops and trees in soil traps like *rejolladas* as well as by mixing soil with gravel (and/or chich) (Kepecs and Boucher 1996).

To supplement insufficient rainfall, households could collect water from the two closest *cenotes*, 400 m east of Tzacauil. If retrieval from these *cenotes* were common practice, we would expect to find water jar fragments (e.g., Brainerd 1956). When rainfall was too heavy, draining water was necessary. Drains remove excess water from living areas and agricultural plots, and the logical solution is to direct that water into a cistern. This could be done with canals cut into bedrock (Lohse and Findlay 2000), or by constructing berms to divert runoff (Kunen 2004; Lemonnier and Vannière 2013). Similar manipulation of terrain might be expected at Tzacauil if this kind of household water management was taking place.

Tzacauil households may have used the land surrounding their house groups for non-agricultural economic activities.. Food preparation would have been an important and constant task for Tzacauil households. Excavations of a royal kitchen at the site of Kabah have yielded data on outdoor food preparation (Toscano H. and Novelo R. 2012, 2015). Scaling those data down gives an idea as to the culinary equipment expected for Tzacauil. Maize processing requires grinding tools (e.g., *manos* and *metates*). Butchering animals and preparing plant-based foods requires chipped-stone knives, blades, scrapers, and axes. Cooking, serving, and storing food require diverse kinds of ceramic vessels. Features associated with food preparation (e.g., bedrock water basins, hearths, pit ovens; see Simms et al. 2013) are also expected. Food preparation leaves chemical signatures in soil: high phosphate levels from organic matter (Ball and Kelsay 1992; Manzanilla and Barba 1990), and elevated carbonates from dumping lime-rich water during maize processing (nixtamalization) (Toscano H. and Novelo R. 2015) (see Chapter 5 for further discussion of soil chemistry analysis). Even if households had indoor kitchens, all of the activities described above take place outside.

Resource procurement may have occurred in Tzacauil's intra-settlement lands. Possible procurement activities include limestone quarrying and *sascab* mining (sascab is limestone marl used for mortar). Limestone quarries may be found in close association with house groups (Gallareta Negrón et al. 2008; Kestle 2012). *Sascab* is mined from features called sascaberas and, in some modern houselots, kept in piles as a ready building supply (Wauchope 1938). Burnt lime production may have taken place in pit-kilns dug into bedrock (Seligson et al. 2017, 2018).

Craft production could have taken place outside house groups. Though many crafts involve perishable materials (e.g., woodworking, basketry), preservation at Tzacauil favors the identification of crafts that used stone and pottery. Chipped-stone tool production on a household level results in high concentrations of chert debitage and assemblages characterized by variable tool types and use-wear (VandenBosch et al. 2010). Ceramic production leaves behind ceramic wasters in addition to firing facilities or kilns, though open firing would leave only ash accumulations (see Arnold 1990). Textile production could be inferred from spindle whorls, bone awls, and bone needles (e.g., Chase et al. 2008). If households were involved in producing building materials beyond their own needs, semi-worked blocks, burned limestone, and stone-cutting tools would be expected (Abrams 1994; Carmean et al. 2011). Other kinds of craft production, like pigment-grinding (e.g., Triadan and Inomata 2004) or shell-working (e.g., Masson and Peraza Lope 2004), would also leave distinctive material patterning.

Households may have constructed perishable outbuildings near their residences. These might include apicultural containers for producing wax and honey (Paso y Troncoso 1939; Redfield and Villa Rojas 1934), like those identified on Cozumel through distinctive stone disc beehive covers (Flores H. and Pérez R. 2002). Storage facilities may also have been built near house groups. Many modern Yucatec farmers store maize and other harvested products in houselot granaries (Redfield and Villa Rojas 1934; Wauchope 1938). These are often less formal than other ancillary structures, and might appear archaeologically as chich (limestone cobbles) piles or postholes cut into bedrock (Lemonnier and Vannière 2013; Wauchope 1938).

While ethnoarchaeological study of contemporary houselots has provided encouraging leads for documenting past domestic activities in intrasettlement areas, it is important to remember that these material patterns are seldom– if ever – left intact for archaeologists to find them, centuries later. Natural formation processes as well as the nature of abandonment itself complicate our chances of neatly associating material traces to past activities (e.g., Cameron and Tomka 1993; Hutson et al. 2007). I should note that while I began intrasettlement investigations at Tzacauil with high hopes of finding, say, discarded agricultural tools, storage pits, and even drains cut right into the bedrock, the reality I encountered was quite different. I will discuss what we actually found in the following chapters, but I introduce these caveats here as grains of salt. Reconstruction of past land use activities is a complicated endeavor in the thin soils of central Yucatán, but one I still consider worth pursuing in concert with other lines of evidence.

3.6 Chapter summary

We have now established a working foundation of the northern Yucatán landscape and its diverse human and on-human components. Developing this foundation began with the ecological boundaries of the northern Yucatán Peninsula, discussing aspects of geology, bedrock, water, soil, climate, and biodiversity. Then we pulled in information from the approaches of household archaeology to define the household, house, and houselot and rounded out these definitions with data derived from 20th century ethnographic accounts. The chapter concluded with a discussion of how we might connect specific land-use practices and houselot activities to material correlates that might be recoverable archaeologically. As we move forward, I want to acknowledge that this kind of view of the landscape might lead us to thinking of it as a "frozen" phenomenon – an ahistorical entity. Much of the rest of this study can be regarded as challenging this view, making the case for landscape as an inherently dynamic, distinctly historical record of the mutual interactions between people and their local environment. The information provided here gives us a baseline to work with as we move both backward and forward in time. To emphasize that the landscape is

historically contingent, the next chapter delves into the specific culture history of Yaxuná and the northern Maya lowlands more generally. This culture history and its embeddedness in the landscape is critical for building a historical-ecological analysis of agricultural sustainability of the hinterland farmers at Tzacauil.

Chapter 4
Tzacauil in Context: Yaxuná and the Northern Maya Lowlands

4.1 Introduction

To understand the landscape of Tzacauil as a recording of human-environmental interactions, we have to situate that landscape within the greater historical context of its surroundings. First and foremost in this task is to recognize the importance of Yaxuná, the largest and politically most important archaeological site located in the *ejido* of the modern Maya town of Yaxunah. The extensive archaeological research conducted at Yaxuná (see Chapter 1) makes it a well-placed window from which to view the dynamic transformations that characterized ancient Maya history in the northern lowlands (Figures 1.9, 1.10, 1.15). As such, this chapter revolves around the culture history of Yaxuná. I rely on Yaxuná to tell the story of the northern Maya lowlands, but for times when the archaeological record is quieter or more obscured at Yaxuná (e.g., pre-Formative), I will pull in additional information from other sites in the region.

The information provided here is not meant to be exhaustive; rather, it is meant to propel us forward into a more specific examination of Tzacauil (for more thorough coverage of Yaxuná, see e.g., Collins 2018; Stanton et al. 2010, Tiesler et al. 2017). With that in mind, I have made a few decisions about my focus here. First, I devote quite a lot of attention to the Formative period at Yaxuná, and I will also pull in data from other Formative northern sites. That is the period for which we have the most information at Tzacauil, and therefore the period that requires the most background to fully understand. When I do turn to the Classic period, I double down on my focus on Yaxuná as a conscious decision. The bulk of archaeological work conducted in the northern Maya lowlands – and the whole of the Maya area – has taken place at Classic period sites, and I would direct the reader to those works for additional information (e.g.,

Ardren 2015; Folan et al. 1983; Hutson 2010; Shaw 2008). For my purposes here, Classic Tzacauil can be understood in relation to Classic Yaxuná, without the need to draw extensively from other parts of the northern lowlands.

I conclude this chapter with a brief comparative discussion of the archaeological site of Komchen, located in the northwestern corner of Yucatán. Komchen deserves its own space in this chapter because it bears strong parallels to Yaxuná in the Formative period, in settlement pattern, house group architecture, and monumental public complexes. Above all, though, Komchen has Tamanche – a small, secondary center located a short walk away, with some monumental architecture of its own. We could describe Tzacauil's relationship to Yaxuná in the same way. The analogy between these two pairs of sites helps to frame the Tzacauil data and build our understanding of Late to Terminal Formative hinterland agricultural communities.

4.2 History at Yaxuná, ca. 1000 BC – AD 1000

4.2.1 Pre-Formative origins

Archaeological data at Yaxuná go no further back than the Middle Formative (ca. 1000-300 BC), but this does not automatically mean that people were absent. It remains a frustrating reality that most of what we know about the early northern lowlands goes back only about 3000 years, to the beginning of the Middle Formative period. There was almost certainly an Early Formative occupation in the Maya area, as there was elsewhere in Mesoamerica (e.g., Flannery and Marcus 1994, 2005), but we have yet to learn how to detect it. Earlier periods are similarly elusive (Andrews and Robles Castellanos 2018).

Our scant knowledge of Paleoamerican people in Yucatán derives from only a few finds of megalithic faunal and human remains in caves and cenotes (Mercer 1975 (1896); Velázquez Valadez 1980). More recently, archaeologists recovered the skeletal remains of a teenage Paleoamerican girl and now-extinct megafauna in a submerged cave system in Yucatán (Chatters et al. 2014). The Paleoamerican girl, known as Naia, lived and died around 12-13,000 years ago. This find is remarkable for its potential contribution to the study of ancient DNA among the first Americans, but unfortunately on

its own does not significantly advance our understanding of Paleoamerican settlements or lifeways on the Yucatán Peninsula. Traces of Pleistocene-era fauna and human activity have also been identified in underwater cave systems off the coast of Quintana Roo (González et al. 2008a, 2008b).

As we move forward in time, the Archaic period in the northern lowlands is has been similarly vague, but recent and ongoing work is beginning to clarify our understanding of these early periods. Archaic components have been documented in Belize and Quintana Roo when archaeologists have looked for them deliberately (Andrews IV et al. 1974; Lohse 2010; Lohse et al. 2006; MacNeish 1986). Maya archaeologists are somewhat notorious for preferring the excitement of civilization and pyramids over the vague traces of pre-ceramic peoples, so our historical mystification over the Archaic period could simply be a product of our own study biases. While possible that there was a real and meaningful absence of people living in the northern Lowlands at this time, emerging data are beginning to show that there likely were mobile populations of hunter-gatherers living here in the Archaic (Brown and Bey 2018). These new insights are challenging and refining past arguments about how and when the northern Maya lowlands were settled (e.g., Andrews 1990).

Ongoing work, particularly focused on E-Group monumental complexes, is beginning to suggest that Formative period ritual centers may have been founded on top of Archaic period sites (Brown and Bey 2018; Freidel et al. 2017). In fact it seems that sometimes the very act of preparing the building sites for Formative ritual places could involve cleaning bedrock of all traces of earlier Archaic occupation. Practices like this would, of course, challenge our ability to understand the Archaic period archaeologically.

While we lack clear archaeological contexts, there are other, subtler indications that people were here in the northern lowlands before the Middle Formative. In the eastern part of the peninsula, coring in the Cobá lake system has recovered evidence for forest clearing dating as far back as 1650 BC, and maize cultivation (identified by pollen) as early as 850 BC (Leyden et al. 1998). These data point to a peninsular human presence – one that was already engineering the landscape through forest

clearing and agriculture – before the Middle Formative begins. Clearly this is a question that deserves more attention, but in the meantime we can only say that while there are traces of human occupation in the northern peninsula before ca. 1000 BC, we do not have a clear and coherent picture of what life was like here until the Middle Formative begins. As more research has targeted this question in recent years (Brown and Bey 2018) and continues to do so, we can expect to continue clarifying and enhancing our view of the pre-Formative human presence in the northern lowlands.

4.2.2 The Middle Formative (ca. 1000-300 BC)

For much of the early history of Maya archaeology, the origins of sociopolitical complexity were thought to be situated firmly – and exclusively – in the southern Maya lowlands. The south continues to be a vibrant source of knowledge about early Maya history, and for many reasons we can continue to consider it one of the major cradles of Maya civilization. But it has become increasingly clear that people and communities of the northern Maya lowlands were active engineers of and participants in Formative-period (ca. 900 BC – AD 250) sociopolitical complexity. And, as more research is being done on early contexts throughout the Maya lowlands (north and south), we are learning that much of the sociopolitical complexity formerly associated with the Classic period first emerged in the Middle and Late Formative (e.g., Brown and Bey 2018).

The ongoing refinement of ceramic chronologies has been key to many of the recent advances in our understanding of the Maya Middle Formative. Integral to this process has been the reworking of the ceramic phase formerly thought to have been the oldest in the Maya lowlands, called the Mamom. In the first half of the 20th century, archaeologists believed that Mamom ceramics were the first in the Maya lowlands, corresponding to the late Middle Formative period, or about 600-300 BC (Smith 1955). Yet as more projects were launched throughout the Maya lowlands, archaeologists began to find ceramics that were clearly older (i.e. based on secure stratigraphic contexts) than Mamom (Willey 1982; Sabloff 1975). Now, this so-called pre-Mamom ceramic phase is well documented throughout the Maya lowlands, effectively placing the risee of ceramic manufacture and associated cultural developments (i.e. monumental

construction, village life) centuries earlier into the early Middle Formative, or about 1000-600 BC (e.g., Andrews et al. 2018; Collins 2018; Inomata et al. 2015). Debates over whether the Mamom ceramic phase developed from the pre-Mamom or supplanted it (and what these scenarios might imply for human migration and interaction) are ongoing (e.g., Andrews 1990; Brown and Bey 2018; see also Neivens 2018 for detailed discussion of this debate).

Pre-Mamom sherds have been found at Yaxuná. While they turn up occasionally in fill, the most reliable context in which pre-Mamom ceramic sherds have been found at Yaxuná was in excavations of the E-Group Plaza. These sherds were found in the deepest sealed strata of the plaza's floor sequence, and, using associated radiocarbon samples, were dated to 900-700 BC (Stanton and Collins 2017). This means that initial plaza construction at the E-Group began centuries earlier than would have been previously assumed. I will return to Yaxuná's E-Group in a moment, after first saying a little more about the context in which our understanding of the Middle Formative has evolved.

The first inklings of the northern Formative presence began with Carnegie Institution projects. Though Carnegie archaeologists identified traces of what they called the "Old Empire" at places like Yaxuná and Acanceh (Brainerd 1958; Proskouriakoff 1968; Smith 1971; Thompson 1945, 1954), the implications and further investigation of this presence remained relatively dormant as work was dedicated to Classic and Postclassic period sites.

The field's interest in the north was renewed with pioneering systematic research at Dzibilchaltún in the 1960s (Andrews and Andrews 1980). Excavations there and at other northern sites provided enough early ceramics for archaeologists to rough out and then refine a ceramic chronology for the Formative northern lowlands (Andrews 1988; Ball 1977; Joesink-Mandeville 1970; Smith 1971). With an early ceramic sequence worked out, archaeologists could begin to unlock the early history of the northern Maya lowlands.

Research has accelerated in the past few decades. Archaeologists working in the northern lowlands have identified Middle and Late Formative components nearly

everywhere they have looked: in the Puuc hills of western Yucatán (e.g., Gallareta Negrón et al. 2005; Smyth and Ortegón Zapata 2008), the dry coastal corner of the northwestern peninsula (Anderson 2011; Andrews and Robles Castellanos 2004; Peniche May 2012), in the northeast (Bey et al. 1998; Bond-Freeman 2018), in the wetter eastern coast and northeastern corner (Glover and Amador 2005; Glover et al. 2011), and, of course, in the peninsula's center, where Yaxuná ruled as regional capital in the Middle and Late Formative periods (Stanton 2000; Stanton and Ardren 2005; Stanton and Collins 2017; Stanton and Freidel 2005; Stanton et al. 2010). From their efforts and those of many others, we can assemble a picture of Formative period dynamics in the northern lowlands. It is this larger story within which Tzacauil's own dynamics have to be situated to understand its local story of social and environmental change.

Whether they were indigenous to the northern lowlands, migrants from the south, or (most likely) some combination of the two, the northern Maya of the Middle Formative enter the story already showing signs of considerable sociopolitical complexity (Robles Castellanos and Ceballos Gallareta 2018). Likewise, from the first available evidence we see that they were active participants in a cultural identity with undeniable affinities to the southern lowlands. Northern Middle Formative Maya communities were prestate societies, what some would call chiefdoms or chiefly societies, meaning that markers of social complexity like inherited rank and settlement hierarchies were present (Ball 1977, 1978). That this complexity appears to burst so suddenly onto the scene lends further support to the suspicion that there were (as yet unrecognized) Early Formative antecedents *and* cultural contact with the southern lowlands. As I have said, the recent advances in our understanding of the pre-Mamom ceramic phase continue to lend greater nuance to our picture of the earliest Maya in the peninsula (Brown and Bey 2018).

One way we can see this early complexity is through hierarchical differences between Middle Formative sites. In their survey of the northwestern peninsula, Andrews and Robles Castellanos (2004; see also Anderson et al. 2018) identified a substantial number of previously unknown Formative period sites, many of which had Middle

Formative sherds on the surface. Alone these survey data cannot support assertions about site size hierarchies, but subsequent excavations confirm that some northwestern Middle Formative sites had both large populations and considerable monumental architecture including ballcourts, pyramids, causeways, and plazas (Anderson 2010; Medina Castillo 2005). Similarly, extensive settlements and incipient public architecture have been identified and linked to the Middle Formative at sites like Izamal (Quiñones Cetina 2006), Komchen (Andrews 1988; Andrews and Ringle 1992; Ringle 1985; Ringle and Andrews 1988); Xcoch (Smyth and Ortegón 2008), Xocnaceh (Gallareta Negrón et al. 2005), and, as we will see below, at Yaxuná (Stanton 2000; Stanton and Ardren 2005; Stanton et al. 2010). The presence of early monumental architecture at these sites points to the existence of leaders who were able to organize labor and integrate fairly dispersed communities (for more on monumentality in the Maya area, see e.g., Doyle 2012; Inomata 2006).

The monumental architecture at northern Middle Formative sites also provides some of our strongest evidence for cultural connections and exchange between the northern and southern lowlands. Architectural forms commonly associated with the southern lowlands start showing up at certain places in the north by the Middle Formative. This pattern continues and evolves for centuries. At least one example of an E-Group, a kind of architectural complex with astronomical associations first identified at Uaxactún and found throughout the southern lowlands, was created in the northern lowlands, specifically at Middle Formative Yaxuná (Collins 2018; Doyle 2012; Ricketson and Bayles Ricketson 1937; Ruppert 1940; Stanton and Collins 2017). It stands somewhat as an outlier, a southern lowlands style complex stranded in the middle of the northern lowlands, but makes sense given the strong possibility that Yaxuná occupied a place on a major trade route connecting the southern lowlands to the salt flats of the northern coast (Stanton 2012, 2017). Similarly, this would help explain the proliferation of monumental triadic groups in Yaxuná and its surroundings, including at Tzacauil. We will focus on how these forms arise at Yaxuná below, but suffice it to say that this is a widespread pattern in the northern lowlands.

Beyond the sharing of architectural styles, the northern Maya were also participating in trade and exchange networks by the Middle Formative. Olmec-style greenstones have been reported from Middle Formative contexts at several sites in Yucatán, including Chacsinkin (Andrews 1986, 1987), Yaxuná (Suhler 1996), Tipikal (Peraza Lope et al. 2002), and Paso del Macho (Parker et al. 2018). Ceramic data suggest that Middle Formative regional centers in the northern Maya lowlands maintained exchange relationships not only with the Gulf Coast and also with centers farther afield in Central Mexico (Andrews 1986, 1987; Stanton and Ardren 2005). These trade data, along with what we can glean from survey and test excavations in monumental architecture, suggest that the northern Maya were participating in larger Mesoamerican dynamics while also developing their own brand of sociopolitical complexity.

Yet we are somewhat limited in understanding northern Middle Formative social dynamics because, to date, all of the Middle Formative settlements we have identified were occupied, renovated, and modified well into the later centuries of the Formative period. In the thin soils of the northern Yucatán peninsula, this fact of continuous occupation over centuries can thwart our attempts to untangle single (and especially earlier) periods of occupation. For figuring out the Middle Formative antecedents of monumental public architecture, this poses difficulties; for figuring out the Middle Formative antecedents of residential architecture and settlement patterns, it poses near impossibilities. Even with large-scale horizontal excavations, as I did at residential platforms in both Yaxuná and Tzacauil, later occupations almost always preclude our ability to obtain “pure” Middle Formative household contexts. And in fact, many studies of Formative northern lowland “commoner” residential architecture and settlement patterns extrapolate their conclusions from survey and test pit data – in other words, from handfuls of sherds that are rarely if ever in their primary contexts (e.g., Anderson 2010, 2011; Ringle 1985). While there have been a few exceptions to this – for example, the extensive excavations directed by Concepción Hernández Hernández at Flor de Mayo (Hernández Hernández 2005, 2016; Hernández Hernández and Arias López 2003) – there is a general lack of published data for large-scale excavations of

Middle Formative settlements. This leads me to view Middle Formative population estimates and settlement reconstructions with skepticism.

Leading with that caveat, what can we say about how most people were living in the Middle Formative northern lowlands? The co-occurrence of two trends provide some clues: first, the existence of Middle Formative monumental architecture that would require considerable labor to build; and second, the relative paucity of substantial Middle Formative houses in association with that monumental architecture. Some have interpreted this as evidence for co-existing sedentary and mobile populations (Inomata et al. 2013; Stanton and Collins 2017).

This interpretation makes sense given that the transition to full-time agriculture was a gradual process in the Maya lowlands, as elsewhere in Mesoamerica (e.g., Flannery 1986). Likely, Middle Formative Maya were experimenting with horticulture in a few places within their landscape, while still moving around fairly frequently and continuing to rely heavily on wild resources. As more and more people began to commit to agriculture, some people may have started to live directly in the places where they and their ancestors had been practicing an early form of agriculture or horticulture during previous generations. This may have been how the earliest villages formed in the northern lowlands. I will return to this idea later in the context of Tzacauil specifically. It stands that in the Middle Formative, most people lived in perishable houses made of wood and thatch that have left very few traces in the archaeological record. What does remain, however, is the pottery they were using at this time and perhaps their stone tools (but these can rarely be dated securely in domestic contexts, since the majority of Middle Formative ceramics are found mixed with later fill deposits). Stone architecture was, as far as we can tell, not used in most Middle Formative houses (but see possible exceptions in elite contexts, as with Yaxuná's 6E-30 Group, discussed below).

Stone masonry was, however, used in Middle Formative public architecture. The existence of these public complexes points to the appearance of political leaders and their ability to coordinate labor (e.g., Brown and Bey 2018). At the same time that sedentary, semi-sedentary, and mobile people co-existed in the landscape, community leaders began to emerge. These leaders or collectives of leaders organized the labor

needed to construct public gathering places. They also likely orchestrated the periodic gathering of people in those places, drawing them in from across the landscape for various economic, social, and ritual functions. Such gatherings integrated an increasingly sedentary, increasingly agricultural population in the northern lowlands.

We see evidence of all of these vibrant Middle Formative dynamics happening at Yaxuná. That Yaxuná was a hotspot of early activity is probably in part a product of its strategic location. Yaxuná is located right in the middle of the Yucatán Peninsula. This location – along with the presence of southern lowland Maya architectural forms and portable goods found at Yaxuná – suggest that it may have been settled as an advantageous point along a trade route connecting centers in the southern lowlands with the coastal resources of the northern peninsula (Stanton et al. 2010; Stanton 2017; Tiesler et al. 2017).

Yet details about that Middle Formative settlement are difficult to nail down, because of the limits created by central Yucatán's thin soils and the centuries of occupation that followed. Surface collection and test pits in and around residential architecture at Yaxuná will almost always recover Middle Formative sherds (Fisher 2014b, 2015; Stanton et al. 2010) but associating clear architectural contexts with those sherds is rarely possible. Nevertheless, these sherds indicate that a considerable population was living here in the Middle Formative in perishable houses. Fortunately, Yaxuná does have a few clear cases where we can associate architecture with Middle Formative construction dates. These examples offer us windows into what was going on at the site in its earliest occupation.

Perhaps the most important of Yaxuná's Middle Formative components is its E-Group (Figure 4.1). As I mentioned above, E-Groups are a typical southern lowlands architectural complex consisting of (1) a plaza, which has at its western side (2) a radial pyramid and at its eastern side (3) a longer range structure (see Freidel et al. 2017). The position of the radial pyramid and range structure reflect astronomical orientations and indicate that these complexes may have served, in part, as places for rituals based

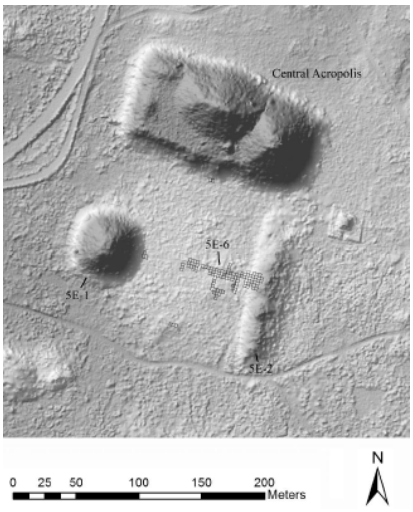

Figure 4.1 LiDAR image of the Yaxuná E Group (from Collins 2018)

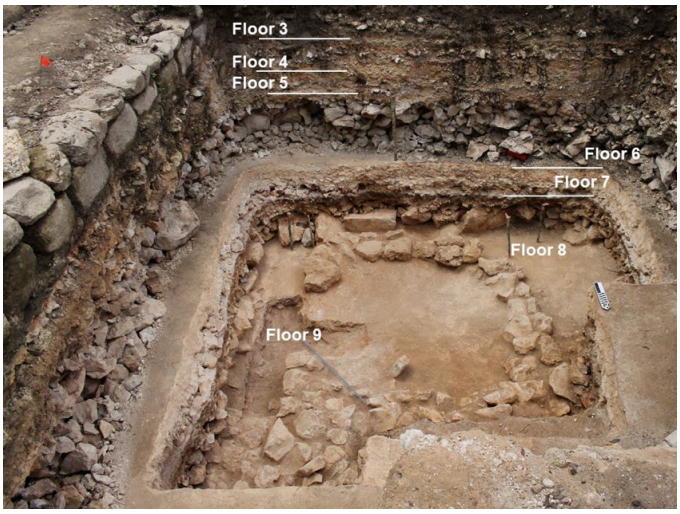

Figure 4.2 Floor sequence in the Yaxuná E Group Plaza (from Collins 2018)

Figure 4.3 Incised cross in early plaza floor at the Yaxuná E Group (from Collins 2018)

in the calendar, the agricultural cycle, and the passing of time more generally. As I said, E-Groups are typical of the southern lowlands – that one shows up this far north at Yaxuná is evidence for strong interregional connections, perhaps related to a north-south trade route.

Yaxuná's E-Group was investigated by the Proyecto de Interacción Política del Centro de Yucatán (PIPCY) from 2013-2016, with Ryan Collins directing excavations focusing on the plaza for his doctoral dissertation work (Collins 2018). Travis Stanton, one of PIPCY's co-directors, has worked to fit Yaxuná's E-Group into broader models of northern lowland Maya political complexity and incipient urbanism. PIPCY archaeologists excavated in the E-Group Plaza, and strategically excavated into the plaza's layered floors to get cultural material associated with various renovation episodes. From these analyses we know that Yaxuná's E-Group was an important public gathering place going all the way back to about 1000-800 BC (Collins 2018; Stanton 2017) (Figure 4.2). As I described above, the recovery of pre-Mamom ceramic sherds in some of the deepest sealed strata of the Yaxuná E-Group plaza excavations is consistent with the emerging picture of social complexity in the early Middle Formative (Stanton and Collins 2017; Brown and Bey 2018).

Beginning as a tamped earth floor in the early Middle Formative, Yaxuná's E-Group Plaza was raised and renovated several times over the following centuries. It seems that even from its earliest iterations, the plaza had important ritual associations linked to the agricultural calendar as interpreted by Stanton and colleagues Karl Taube and Collins (n.d.). They suggest that the placement of bedrock offerings in the earliest construction episodes at the plaza are similar to planting ceremonies conducted in contemporary Maya communities to dedicate new *milpas*. The act of embedding offerings in the ground prior to construction, Stanton and colleagues propose, would have transformed this venue into "domesticated" space, standing apart from the surrounding wilderness. In a major expansion and renovation of the plaza at the end of the Middle Formative, ancient Yaxuneros carved a large cross into the surface of the plaza floor (Figure 4.3). Stanton and colleagues interpret this as an act of reaffirming the plaza's role as a maize field (see also Doyle 2012). In this view, Yaxuná's early E-Group plaza was an important locus for practices of integration that brought in and affirmed connections among dispersed populations of varying mobility. As more and more people took up agriculture over the generations, knowledge of time and the seasons became increasingly important. Stanton, Taube, and Collins suggest that emerging elites would

have leveraged their ability to "know" time and mark its cyclical passing as a way of legitimizing early status differences and integrating communities. While at the E-Group, people perhaps would have participated in the exchange of goods and other kinds of social and economic interactions, in what we could consider an early iteration of later religious fairs known throughout Mesoamerica (Stanton and Freidel 2003).

While the E-Group seems to have been the central focus of Middle Formative Yaxuná, there was also substantial building activity occurring in the southern part of the site. There, two adjacent architectural groups, 5E-19 and 6E-30, suggest initial construction episodes in the Middle Formative. The 6E-30 Group in particular has been posited as the residence of an incipient Yaxuná elite social group or sodality during the Middle Formative (Stanton et al. 2010; Stanton 2017). Before this early elite residence was built, the bedrock was first cleaned of all soil. Then a layer of fill, containing high quantities of organic matter, broken ceramics, nonlocal chipped chert, shell reduction flakes, and malachite fragments, was deposited on top of the prepared bedrock surface before construction of the residential group began (Stanton and Magnoni 2014; Torres Ochoa 2017). The ceramics in this fill suggest that the deposit was placed in the centuries immediately following initial construction of the E-Group Plaza. Stanton (2017) has suggested that the particular mix of materials found in this fill deposit could be a direct byproduct of the on-site manufacturing of symbols of power using materials charged with meaning (e.g., shells, malachite). If true, this would mean that the act of manipulating these symbolically charged items at the selected building site could have been an important step in consecrating this place for occupation. Alternatively, though, this fill could have been a Middle Formative midden that was collected and deposited, without much fanfare, on the bedrock to create a level surface before construction began. Regardless of the circumstances, the presence of non-local materials in this early fill deposit emphasizes the importance of interregional trade in the Middle Formative.

4.2.3 The Late Formative (ca. 300 BC – AD 1)

With the beginning of the Late Formative period (ca. 300 BC – AD 1), life in the northern lowlands changed rapidly. The transformations of the Late Formative were many and closely interrelated, and seem to have been catalyzed, at least in part, by farming practices. The shift towards full-time sedentary farming seems to have reached a tipping point, perhaps due to successful experimentation with niche construction and agricultural intensification. In turn, the higher yields and food security created by this innovation ushered in long-lasting outcomes.

Of these outcomes, one that has been the subject of ongoing archaeological investigation is the appearance of huge public monumental architectural complexes. This trend occurred throughout the Maya area, and in fact, the largest Maya pyramids ever constructed, in Guatemala's Mirador Basin, are Late Formative (e.g., Hansen 1990). The same Late Formative preference for flamboyance seen in the southern lowlands holds in the northern Yucatán Peninsula. Following and expanding on the southern lowland stylistic connections of their Middle Formative antecedents, many examples of northern Late Formative monumental architecture embraced the architectural forms of the southern lowlands. The cultural affiliations suggested by northern lowland Late Formative monumental architecture are reinforced by Late Formative ceramic assemblages, which similarly show strong stylistic connections to ceramic wares from the Petén region (i.e. southern lowland and northern Guatemala specifically).

Of all the Late Formative monumental forms borrowed from the southern lowlands, Triadic Groups in particular seem to have held special significance for the northern Maya. These groups follow a basic template: a raised, flat platform topped with a principal structure flanked by two smaller structures (or groups of structures) (Hansen 1998). Triadic Groups originate in the southern lowlands. But in the Late Formative they become ubiquitous in certain "hot spots" within the northern lowlands, specifically in places believed to have been located along trade routes connecting the southern lowlands to the coastal regions of the northern Yucatán Peninsula (Anderson 2011; Stanton 2017; Stanton et al. 2010). I will spend more time discussing Triadic Groups and what we can make of their Late Formative proliferation when I move on to Yaxuná's

specific case,. Right now we can just say that the appearance of Triadic Groups indicates a shift in elite political and ritual culture during the Late Formative (e.g., Freidel et al. 1993; Hansen 1998; Taube 1998).

This proliferation of monumental architecture is one signal to us that hierarchical political institutions were in place by the Late Formative. The nature of those institutions remains somewhat of a mystery in the northern lowlands. Political leaders at southern lowlands sites were already using the symbols and architecture associated with kingship by the Late Formative, the same iconography that would continue to define southern royalty well into the Classic period. We do not have quite the same level of textual and iconographic references to divine kingship or royal dynasties from northern sites in the Late Formative, but there are some indications that powerful individuals did exist. These include a Late Formative image of a Maya king found in a cave in the Puuc region of the western peninsula (Stanton 2012) and a possible throne found in an elaborate Late Formative residence at a site near Mérida (Peniche May et al. 2009). Later on in the Classic period, some northern centers did carve and erect monuments celebrating kings, much like the royal monuments recorded at southern lowland sites. For the most part, however, the corpus of available evidence suggests that many northern centers had their own traditions of rulership distinct from their counterparts in the southern lowlands. The southern lowland emphasis on dynastic seats, royal courts, and powerful individual rulers is not recognizable at many northern lowland Maya centers, but this does not mean that such institutions did not exist. For now this issue remains under investigation.

Demographic shifts are perhaps the most salient transformations of the Late Formative. We see changes in how people were living as well as great increases in population. First, northern Maya people began building and living in houses that incorporated stone masonry for the first time. In a place like Yucatán, limestone is ubiquitous and so building materials would not have been difficult to obtain, but they seem to have been largely left out of earlier Middle Formative houses. And Late Formative houses are distinct from the houses that would be built in later periods as well. In later periods, the architects of domestic groups were often content with single-

course stone foundation braces and fairly simple building techniques. Houses in the Late Formative, in contrast, reflect a strong and shared desire to build big. Boulder-lined platforms were constructed around natural florescences or outcrops of bedrock and filled to raise their surfaces above their surroundings (Stanton et al. 2010; Ringle 1985). On top, these platforms supported the stone foundation braces for perishable superstructures, often several of them. The decisions and motivations to build these kinds of houses have implications for understanding the Late Formative agricultural system. This is one of the major arguments of the rest of this study, but in short, these houses are materializations of households' autonomous investments in creating a permanent (by which I mean multi-generational) presence on and claims to specific lands and resources within the local environment.

Another direct outcome of increased agricultural yields was a subsequent and dramatic rise in population. Centers throughout the northern lowlands show signs of rapid demographic growth in the Late Formative (Glover 2006; Glover et al. 2005; Quintal Suaste 1993; Stanton 2000). The Late Formative population boom was felt all over the Maya lowlands, from the south to the north (e.g., Hansen et al. 2008). Centers where populations had aggregated expanded, and likewise even "rural" (if we can impose such a dichotomy) areas were occupied by small hamlets and homesteads during the Late Formative (Andrews and Robles Castellanos 2004; Glover 2006; Hernández Hernández 2005; Hernández Hernández and Arias 2003; Peniche May et al. 2009; Ringle 1985; Ringle and Andrews 1990). Monumental architecture, which was typically concentrated in the largest settlements, may have served to pull people from these scattered settlements into regional centers for periodic gatherings.

It is important to note that these large Late Formative populations were not replicating the settlement pattern of earlier Middle Formative villages. Instead, it is at this time that we see the beginnings of a dispersed, or low-density, settlement pattern that would go on to define the majority of Maya settlements – even urban settlements – through the end of the Classic period. This dispersed or low-density pattern maintained open space between and around residential platforms, often to a radius of several dozen meters. These open spaces, which I call intra-settlement areas, appear to us as

vacant but likely served important functions within the household and community economy and subsistence system. As discussed in Chapter 2, archaeological study shows that ancient intra-settlement areas bear strong similarities to historical and contemporary Maya houselots: they were probably used for a variety of domestic activities including, but not limited to, gardening and intensive agriculture. This shift from fairly nucleated initial villages to later extensive, dispersed settlements has been documented at K'axob (McAnany and López Varela 1999), Cerros (Cliff and Crane 1989; Robertson and Freidel 1986), and Komchen (Ringle and Andrews 1988) (but see also Hammond 1991). While we do not have a clear idea of how Yaxuná's Middle Formative settlement was distributed, we can see by the Late Formative that it too had adopted a pattern of widely-spaced boulder lined platforms and ancillary structures separated by significant tracts of unbuilt space. So we can say with some certainty that northern Maya settlements increased in number (more sites), size (more people), and extent (more dispersed) in the Late Formative period.

Yaxuná exemplifies these Late Formative dynamics. As elsewhere in the northern lowlands, the Late Formative at Yaxuná was a time of rapid innovation and exponential growth – in terms of population, settlement, and public architecture (Figure 4.4).

In Late Formative Yaxuná, old monumental forms were revamped and new monumental forms were introduced. As it had earlier, the E-Group plaza continued as a locus for integrative ceremonies. But whereas in the Middle Formative the E-Group had been the *only* clearly public architecture, the Late Formative saw a flurry of monumental building projects throughout Yaxuná and the central Yucatán region. A pair of large platforms was built east of the E-Group plaza, shortly after the plaza's major construction episode at the end of the Middle Formative. These platforms were excavated by the Selz Project and found to have labyrinth-like configurations of chambers and passages inside them (Suhler 1996). The passages, it was suggested, could have allowed ritual performers to appear and disappear at will from the visible stages of the platform, and perhaps to guide private ceremonies once inside, hidden from view. They are often referred to as "dance platforms" in the Yaxuná literature.

Multiple Triadic Groups were built on the Yaxuná landscape in the Late Formative (Figure 4.4). As I said, these are a southern Maya lowland architectural form consisting of a large acropolis or platform accessible by stairs. On top of the platform at the opposite end of the stairs, there is always the tallest superstructure, which is then flanked by lower superstructures on either side. Triadic groups in the southern Maya lowlands have been interpreted as royal architecture and thus linked to the emergence of kingship (Hansen 1998). The appearance of Triadic Groups at Yaxuná, along with Yaxuná's continued use of Petén style ceramics, show that the interregional connections forged in the Middle Formative were sustained into the Late Formative.

During the Late Formative at Yaxuná we see that up to four Triadic Groups were built in the site center, with two that were further afield (one of which is at Tzacauil). These include the East Acropolis, which was built right near the "dance platforms" (Figures 4.5, 4.6), the North Acropolis, as well as two smaller architectural groups (5E-30 and 5E-19 Groups; see Stanton and Ardren 2005) that followed the triadic pattern. The Central Acropolis, located near the E-Group, likely also was renovated during this time but unlike most of the monumental public architecture at Yaxuná, it has not been systematically tested. Often these groups were paired with raised limestone causeways, or sacbes, that connected them with other architectural groups, or occasionally, went nowhere in particular (at least as far as we can tell today; another possibility is that they were simply never finished). Sacbe systems seem to have been an important component in the suite of Formative building practices and regional integration (e.g., Hutson and Welch 2014; Stanton and Freidel 2005). Archaeologists who have worked at Yaxuná have argued that the layout of the Late Formative Triadic Groups and their associated sacbes formed symbolic axes, using a cross-like plan of ritually charged architecture to organize the landscape into quadripartite space (Freidel et al. 1993; Stanton 2000; Stanton and Freidel 2005; Stanton et al. 2010).

So we know that Triadic Groups became suddenly popular in the Late Formative at Yaxunah, but what were they actually used for? True, the evidence seems to suggest they went along with early kingship, but the question of their more specific function and meaning remains unresolved. This is further complicated by the fact that later re-use of

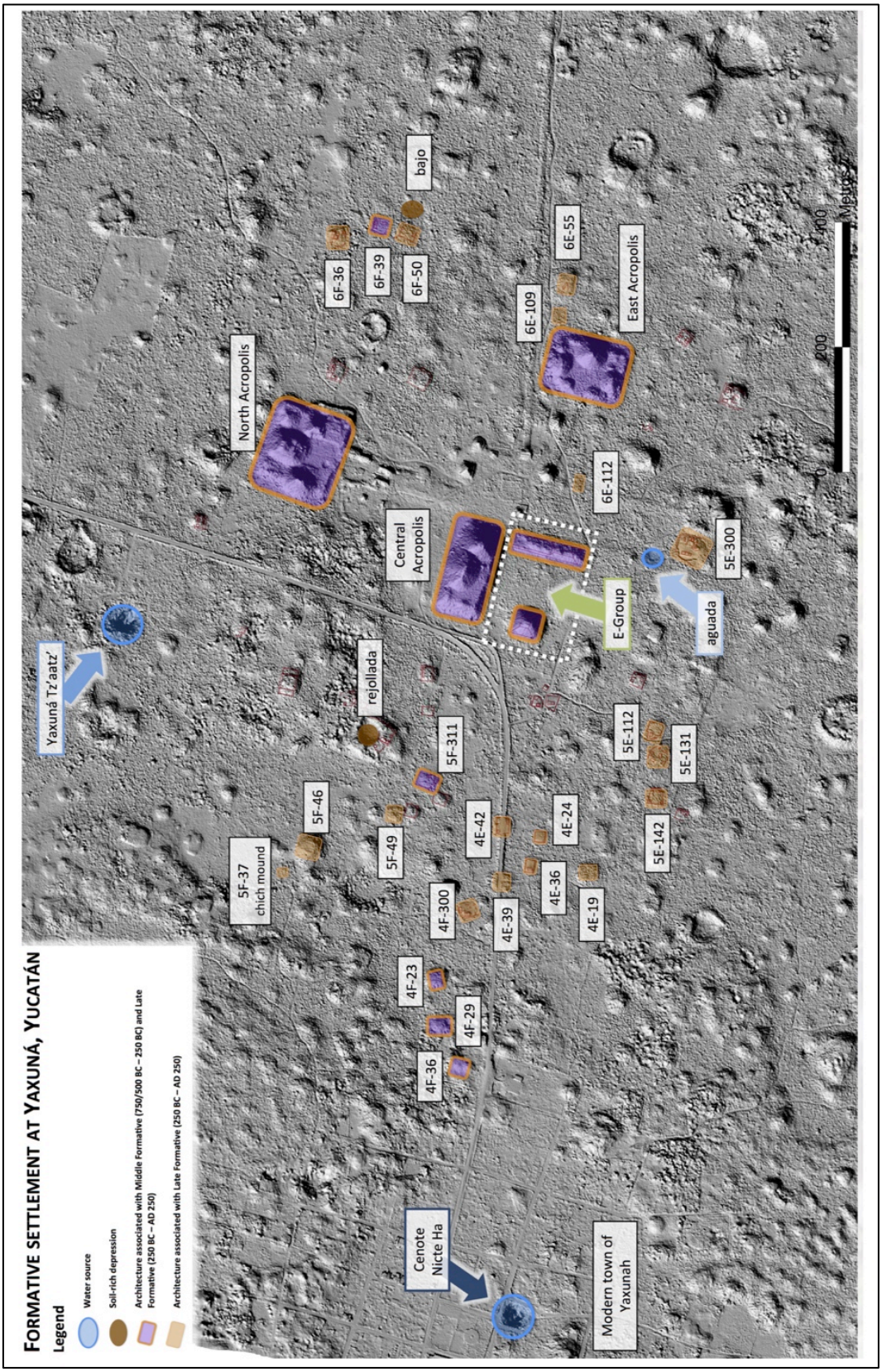

Figure 4.4 Formative settlement and monumental architecture at Yaxuná

Figure 4.5 Yaxuná East Acropolis

Figure 4.6 Plan of the Yaxuná East Acropolis showing location of 2013 test pit (from Stanton and Magnoni 2014)

the Triadic Groups at Yaxuná has made it difficult to associate specific activities or ritual practices with them. Maya monumental architecture is often compared to nesting dolls – successive building episodes often enclosed earlier constructions within a shell of new architecture. This makes it risky and expensive to recover information about earlier constructions using excavation – as well as downright destructive.

We do have some insights about the placement of Triadic Groups based on Nelda Marengo Camacho's excavations of a refuse area found alongside the North Acropolis (Marengo Camacho 2013; Stanton and Marengo Camacho 2014). She found that Yaxuná's North Acropolis had been built adjacent to (perhaps even partly on top of) a cave. Caves are important locales for ritual activity in the central Yucatán landscape (e.g., Slater 2014), and so this place may have been selected deliberately for its association with this feature. Marengo Camacho found that the roof of the cave collapsed at the end of the Formative period; the depression it left seems to have been used as a dump by elites using the North Acropolis later in the Classic period.

As has already been stated, Tzacauil has its own Triadic Group. It is usually called the Tzacauil Acropolis, and it also dates to this time period and has an associated sacbe. The Tzacauil Acropolis will be discussed in Chapter 6, but for now I just want to draw out two patterns from the Yaxuná Triadic Groups that will be important for

understanding Tzacauil's. PIPCY archaeologists implemented a program of test pitting Yaxuná Triadic Groups in the 2013 season (Stanton and Magnoni 2014). These test pits were placed to be as non-invasive as possible, digging into center of the raised platforms while avoiding the structures built on top of them. In this way, the test pits excavated through the successive flooring episodes, recovering sealed fill contexts between floors that could then be reasonably dated. The first pattern to note is that no Middle Formative ceramics were recovered from these fill contexts. We would not expect any "pure" Middle Formative fill layers since we associate the construction of Triadic Groups with the Late Formative, but it is still somewhat strange that there are no earlier ceramics mixed in with the fill. We *do* see this earlier mixing in the Tzacauil Acropolis.

Second, excavations in Yaxuná's East Acropolis, directed by César Torres Ochoa in 2013 (Stanton and Magnoni 2014), noted a construction technique that I found replicated in Tzacauil domestic architecture (Figures 4.6, 4.7). Torres Ochoa found that during a construction episode at the East Acropolis, the builders placed vertical slabs of bedrock at intervals, and then roughly "sealed" these off with horizontal slabs. Doing so produced construction cells that raised the level of the pre-existing architecture very efficiently, without requiring the transport of rubble and soil. This is a sophisticated architectural technique. During excavations at Tzacauil, we found precisely the same kind of vertical-slab cells used in a renovation of Tzacauil's most elaborate domestic structure, the Jach Group.

Yaxuná's Late Formative public architecture gave order to a rapidly growing settlement. For the first time, significant numbers of stone residential platforms were built throughout the site (Figure 4.4). During the Selz Project years a test-pitting program began targeting Yaxuná's domestic groups (Stanton et al. 2010). Archaeologists found that large boulder-lined platforms at the site invariably revealed construction that dates to the Late Formative, with the deepest strata often containing a mix of Late and Middle Formative sherds over bedrock (Figures 4.8-4.10). Not all Late Formative structures were boulder-lined platforms, however; in some cases, smaller structures built on the ground surface also revealed Late Formative components.

Figure 4.7 Construction cells in fill of the Yaxuná East Acropolis

Figure 4.8 Boulder-lined platform at Yaxuná

Figure 4.9: Boulder-lined platform at Yaxuná

Figure 4.10: Boulder-lined platform at Yaxuná

From these preliminary investigations, the Selz archaeologists were able to see that Late Formative residences, or at least the boulder-lined platforms that dominated the settlement of that time, were aggregated into loose clusters throughout the site (Stanton et al. 2010). These loose clusters may have been associated with kin-based or descent groups. The qualifier “loose” is important because these platforms maintain ample open space between and around them. They are dispersed, similar to what was found at Komchen. These loose clusters seem to have developed in discrete areas of the site, with the area west of the E-Group seeming to be one of the earliest hot spots of permanent settlement. Later settlement makes it difficult to be sure, but it seems that there may have been two clusters roughly northwest and southwest of the E-Group, and another further west at the boundary of the Yaxunah Campamento (the archaeologists’ camp at the far eastern edge of the town of Yaxunah). It remains a strong possibility that

Late Formative people were living where the modern village of Yaxunah is today. Other boulder-lined platforms sprang up in the eastern part of the site (about 500 m from the E-Group plaza) and southwestern part of the site. When trying to figure out why these boulder-lined platforms were built where they were, I noted that their locations show a preference for proximity to the monumental core of the site and access to soil-rich areas (e.g., *rejolladas* and *bajos*) rather than proximity to permanent water sources (Fisher 2015). We will see these same preferences reflected in Tzacauil's Late Formative settlement.

In PIPCY's 2015 season I directed excavations of a pair of boulder-lined platforms, 6F-50 and 6F-39, at the eastern edge of the Yaxuná core area mapped by the Selz Project. This pair of platforms is about 500 m east of the E-Group, situated at the edge of a *bajo* where soil and moisture would have collected. After a season of surface collections with fellow PIPCY archaeologists Dan Griffin and Stephanie Miller in 2014 (Fisher 2014), I had identified these two platforms as a likely place to recover intact Late Formative domestic deposits. But excavations in the 2015 season found that later Classic period occupation of the platforms had heavily disturbed earlier contexts, making it extremely difficult (if not impossible) to get a clear sense of the Formative householders who had first lived here (Fisher 2016). About all we learned with certainty is that the boulder alignments date to the Late Formative and that the platforms were raised and renovated multiple times before the Classic period. There may be Late Formative houses at Yaxuná that were never reoccupied and may yet give us some answers about early life here. But the site's long continuous occupation and prominent role as a regional capital has meant that unoccupied areas did not remain unoccupied for long at Yaxuná.

As it is difficult to find "pure" Formative domestic contexts in Yaxuná, it is even harder to make interpretations about agriculture and land-use practices. We have to rely on indirect evidence. We see that the boulder-lined platforms, the diagnostic Late Formative residential structure, do tend to be fairly dispersed. While later settlements make it challenging to know if areas really were open or not, it does seem that Late Formative households maintained open space around their homes. We also see that

many of these Late Formative groups favor soil-rich traps or deposits, known as *rejolladas* or *bajos* (Fisher 2015; Stanton et al. 2010). These soil traps conserve water and have deeper soil, forming microclimates on the landscape where arboriculture and gardening can be practiced (see further discussion in Chapters 2 and 3). Furthermore, the materiality of these boulder-lined platforms themselves suggest strong multigenerational claims over particular places on the Yaxuná landscape, and reflect a familiarity with local resources like limestone and sascab. This strong presence on the landscape is quite possibly associated with increased investment in agricultural intensification in the surrounding areas.

Beyond that, we are limited about what we can say about specific Late Formative houses and agriculture because contexts are often mixed and most investigation has focused on test pitting. The likelihood of being able to associate differences in soil chemistry to Late Formative land-use practices is similarly low, given that Yaxuná has been continuously farmed for centuries. And since no Late Formative human remains have ever been found at Yaxuná (or at Tzacauil for that matter), we lack bioarchaeological data that could indicate diet patterns.

Late Formative population increases noted at Yaxuná were also felt in its surrounding area (Figures 4.11, 4.12). PIPCY archaeologists conducted survey of archaeological sites around known cenotes in the Yaxunah *ejido*, as well as in the *ejidos* of several other towns in the central Yucatán study region, including Chimay, Yokdzonot, Popola, and Miguel Hidalgo (Stanton and Magnoni 2011). Surface collection of ceramics was conducted along with this survey, and from these data we are able to see that Late Formative settlements were popping up around the region. Tzacauil is one and the best known of these outlying sites, but there are several places where Late Formative sherds were identified. It appears that, though sparsely populated in most places, the area was beginning to fill in with sedentary farmers.

Not enough work has been done at these outlying sites to clarify what they would have been like in the Late Formative. Surface collection can only tell us that people were leaving materials there. At the very least, the presence of sherds suggests people were visiting these areas, and most likely living there too. None of these sites rivals

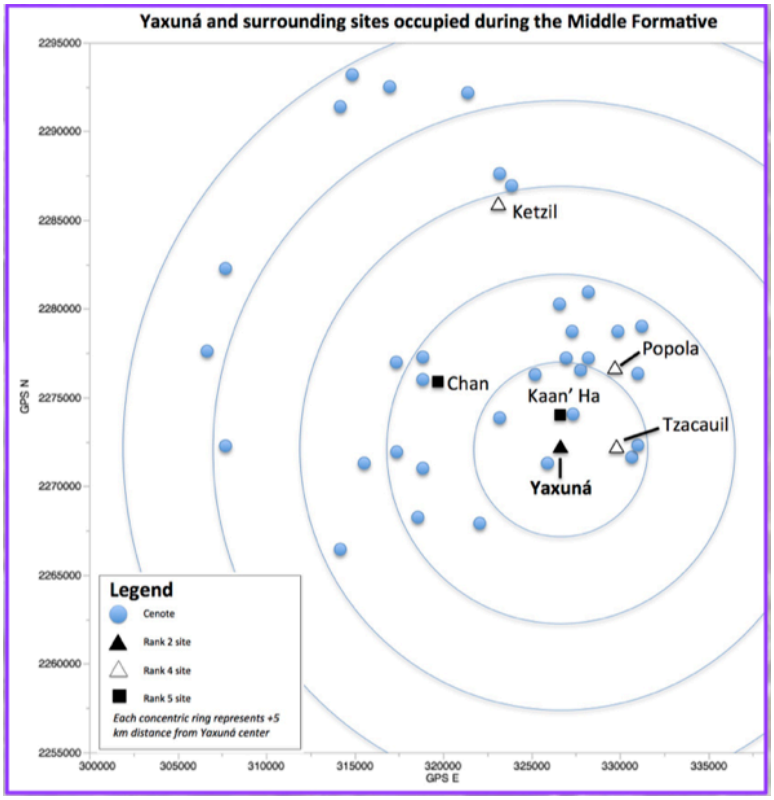

Figure 4.11 Middle Formative sites in the Yaxuná hinterland

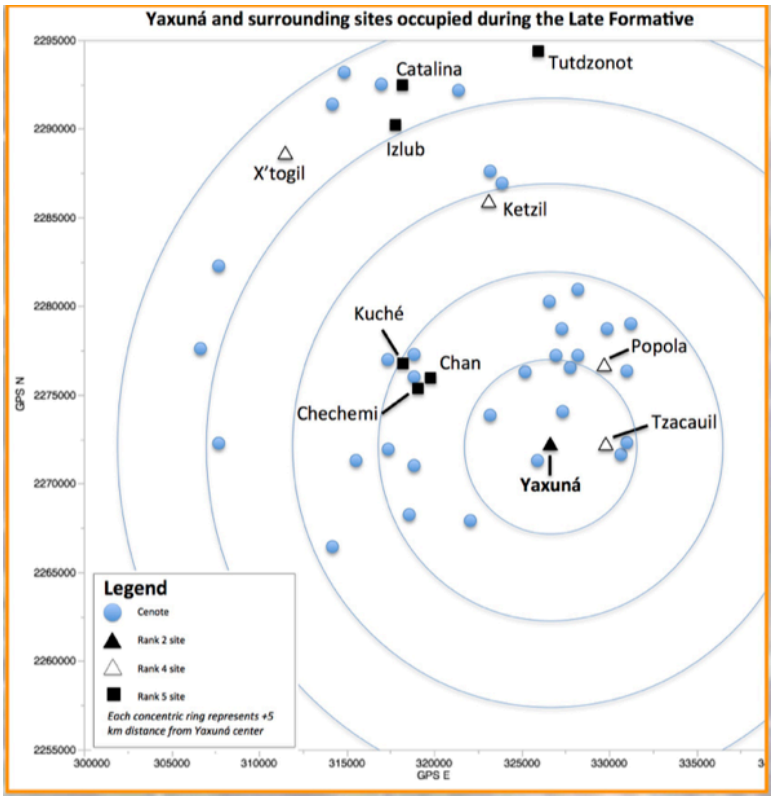

Figure 4.12: Late Formative sites in the Yaxuná hinterland

Yaxuná in terms of settlement or public architecture. This lends further support to the idea that Yaxuná played a centralizing role in the Formative, periodically drawing in scattered communities for rituals of integration.

Tzacauil, too, stands out among these Late Formative settlements for its Triadic Group and sacbe; no other monumental architecture has been dated to the Late Formative outside of Yaxuná and Tzacauil. Yet while Tzacauil is second only to Yaxuná, let us be clear that it is a far second. Yaxuná is exponentially larger in settlement area, number of house groups, and volume of monumental architecture. Even still, the presence of clear Late Formative boulder-lined platforms and monumental architecture at Tzacauil mark it as something different from the other outlying settlements around Yaxuná. This will be important for thinking about Tzacauil's changing role from the Late Formative to the Late Classic.

4.2.4 The Terminal Formative (ca. AD 1 – 250)

During the final decades of the Formative period, Maya lowland centers in both the south and the north were abandoned (Glover and Stanton 2010). While perhaps not as famous or as large-scale as the decline that came at the end of the later Classic period, this Terminal Formative depopulation is still the kind of major transformation we might call a collapse. Paleoenvironmental data suggest that a sustained, severe drought may have exacerbated the environmental and social strains associated with high population density (Hansen et al. 2002; Webster et al. 2007). The following Early Classic period continued to be a time of low population density in the Maya lowlands. As we will discuss below, Yaxuná maintained low levels of population through the Early Classic, but Tzacauil appears to have been abandoned in the Early Classic. At both sites, the flurry of building activity and landscape modification that began in the Late Formative seems to have persisted into the Terminal Formative, before coming to a seemingly sudden halt in the Early Classic.

It is important to remember that the paucity of stone masonry, ceramics, and aggregated population centers in the Early Classic does not mean that people had left the area completely. The majority of people living at the settlements may have simply

dispersed out to the forest to continue living and farming in scattered households or clusters of households, but if they did we have yet to recover the archaeological traces of such dispersal. Historical data from the early contact period suggest that this is what happened after the Classic period Maya collapse (Farriss 1984), and so it is reasonable to see these oscillations of aggregation and dispersal as fairly cyclical in the Maya area. These periods of coming together, and coming apart, are important for how we think about the idea of sustainability in Maya food systems. What seems like a collapse at one scale can be considered an adaptive, resilient strategy at another.

When we take a step back, we can characterize the stages of the Formative period with a few basic trends. First, semi-sedentary groups in the Middle Formative began, perhaps, to form attachments to particular places on the landscape through seasonal and/or annual rounds. Over time, there was a gradual shift to relying more and more on those particular places as agriculture became more productive. A tipping point was reached at the beginning of the Late Formative. We can imagine that perhaps some exponential agricultural advance was made, at which point individual households formalized their long-standing claims to particular places through a variety of ostentatious strategies. These strategies acted in concert with landscape modifications and investments in the local environment to materialize multigenerational claims to land. The result was aggregated communities of fairly dispersed households, living in houses that were quite large and incorporated stone masonry. There were various ways that these communities were integrated, involving public ritual and participation in regional trade networks. This flurry of activity came to a fairly abrupt end at the end of the Formative period, perhaps exacerbated by a drought. While some places persisted or recovered, others never quite returned to the state they had been in during the Formative.

These Terminal Formative dynamics are observable in the archaeological record of Yaxuná. There is a shift to the so-called Flaky Ware tradition of ceramics; these flakier ceramics are thought to be locally made and come to dominate the western and central northern plains of the peninsula in the Terminal Formative (Glover and Stanton 2010). Another change is the apparent cessation of monumental building projects. The

public architecture constructed in the Late Formative seems to have been allowed to fall into disrepair. Test pitting in the core of the Yaxuná settlement suggests that population levels dropped (Stanton 2000). As we saw in the overview of the previous section, this is consistent with what was happening elsewhere in the Maya lowlands, northern and southern alike: a sort of collapse similar to the one that would later alter Maya civilization at the end of the Classic (Dunning et al. 2012; Gill 2000; Hansen et al. 2002; Masson 2012; Willey 1974; see Chapter 2). But ultimately Yaxuná was able to recover in the Early Classic.

4.2.5 The Early Classic (AD 250-550)

Like many other centers in the Maya lowlands, Yaxuná experienced a population decline in the Early Classic. Nevertheless, there are signs that population was continuous at Yaxuná, even during this brief lull. Furthermore there are signs that Yaxuná was implicated in larger regional politics that were beginning to gain momentum in the Early Classic. Though Yaxuná's involvement in these pan-peninsular political dynamics would continue into the Terminal Classic, invariably it played the role of a pawn in feuds between bigger and more powerful rivals. Yaxuná's former Formative glory, when it seems to have stood out as the most important center in the central Yucatán region, was eclipsed in the Classic.

During the first part of the Early Classic, from about AD 250-400 (Yaxuná IIa), archaeological data suggest that Yaxuná was able to maintain its status as a prominent regional center, but that its grip was loosening (Freidel et al. 2003; Suhler 1996). There was an overall rejection of the previous expressions of kingship and authority, and experimentation and embrace of new ways of proclaiming power. Excavations from some of the most prominent monumental architecture at Yaxuná – the E-Group, the East Acropolis, the Central Acropolis, the 5E-30 Group, and the 5E-19 Group – suggest that these complexes were allowed to fall into ruin in the Terminal Formative and Early Classic. Even as these buildings were neglected, there is evidence that new conceptions of local kingship – and a vocabulary for expressing kingship – were emerging at Yaxuná.

Excavations in an elaborate residential complex in the southern part of the site center (5E-50 Group) and in the North Acropolis show that early Early Classic Yaxuná kings were developing novel ways for legitimating their rule. This elaborate residential complex was built in a formerly open area just south of the E-Group, and the builders added a raised limestone causeway connecting the residential complex to the North Acropolis. Perhaps recognizing the symbolic weight of the North Acropolis, which itself was already ancient by this time, these Yaxuná leaders interred their royal dead (Burial 23) in the North Acropolis. Stanton and Freidel (2005) have interpreted this action as the rulers working to merge the veneration of royal ancestors with the residual reverence commanded by the North Acropolis. They further manipulated the pre-existing landscape of Yaxuná by adding the causeway connecting the North Acropolis to their residence. These changes, to Stanton and Freidel, suggest that this new iteration of kingship at Yaxuná may represent an emerging new political faction, one that had a different way of symbolizing rulership than that of the Late Formative kings. Bioarchaeological analysis of the individual interred in the royal tomb (Burial 23) found in the North Acropolis suggest that this faction was non-local, potentially from the southern lowlands (Tiesler et al. 2017).

But around AD 400-550, there appears to be a shift in Yaxuná's position in peninsular politics. Unfortunately most of our understanding of this shift is currently dependent on somewhat scarce ceramic data, but we can glean an idea of political change from the available data. In the early part of the Early Classic, the period of AD 250-400 (Yaxuná IIa), ceramic styles continue to exhibit many of the types of the preceding Terminal Formative period, with strong modal ties to Petén ceramic styles maintained. But around AD 400-550, a shift to different ceramic preferences (Yaxuná IIb) marks new ties to the center of Oxkintok, in the Puuc region of western Yucatán, and to a distinctly northern Maya lowland ceramic tradition more broadly. These stylistic links have been interpreted as evidence that Oxkintok was imposing control – perhaps militarily – during these years (Suhler and Freidel 1998).

These ceramic data hint at violence, and those hints are substantiated by other lines of evidence. During the Yaxuná IIb period, when ceramics suggest that Oxkintok

may have asserted control over Yaxuná, a peripheral settlement, known as Xkanhá, is established two kilometers north of Yaxuná. Excavations at Xkanhá, directed by Traci Ardren (1997), strongly suggest that this settlement served a military function, like that of a fortress. Ardren interprets the Xkanhá fortress as evidence for a regime change or inter-faction volatility. And in Yaxuná, a mass burial found in the North Acropolis dating to this time period includes twelve individuals with strong indications of perimortem violence and fresh wounds (Stanton et al. 2010; Tiesler et al. 2017). To date, no construction activity has been linked securely to this time period at Yaxuná, either in the site center or in the surrounding settlement zone. Together these lines of evidence tell us that the Early Classic was a turbulent, uncertain, and potentially violent time at Yaxuná.

4.2.6 The Late Classic (ca. AD 550-700)

Yaxuná revived in the Late Classic, but seemingly not of its own accord. It was in this period that the longest road the ancient Maya ever built, the 100 km Sacbe 1, was constructed connecting Yaxuná to Cobá, in the Mexican state of Quintana Roo. This road has been interpreted as evidence for a hegemonic relationship, in which Cobá incorporated Yaxuná into its kingdom (Shaw 2008; Stanton and Freidel 2005; Stanton et al. 2010). Whereas earlier hypotheses had envisioned that this action was taken in response to the growing threat posed by Chichén Itzá, investigation of Sacbe 1 indicates that it pre-dates Chichén Itzá by a significant amount of time. Nonetheless, Yaxuná may have been prized territory thanks to its strategic location on the trade route connecting the southern lowlands to the north coast of the Yucatán Peninsula. Unlike when Chichén Itzá would later incorporate Yaxuná into its territory (see below), there is little evidence of violence associated with Cobá's intervention at Yaxuná. This does not mean no violence occurred, but it does caution interpretations that would cast this as a straightforward conquest.

Based on hieroglyphic evidence from Cobá, it seems that likely that Sacbe 1 was commissioned under the reign of Cobá ruler Lady K'awiil Ajaw. This queen often celebrated her military accomplishments in monuments, and she seems like a probable

candidate for either conquering Yaxuná or consolidating control over it through the construction of Sacbe 1 (Guenter 2014) (Figure 1.17). Sacbe 1 may have allowed Cobá's military forces to march quickly into the central northern lowlands, with Yaxuná serving as their base for military campaigns on this side of Cobá's territory (Andrews and Robles Castellanos 1985; Freidel 2007). Investigation of Sacbe 1 and the settlement around it currently underway by PIPCY archaeologists Stephanie Miller, Travis Stanton, and Traci Ardren (discussed in PIPCY's excavation report of the 2016 season; see Fisher 2017). While little of the Cobá presence is observable in the archaeological record of Tzacauil, it is worth noting that the final kilometers of Sacbe 1 as it enters Yaxuná pass just south of Tzacauil. The implications of this proximity will be explored in Chapter 7.

Aside from Sacbe 1, there is currently little documented evidence of monumental or public construction at Yaxuná in the Late Classic. This lends further support to the idea that Cobá (possibly like Oxkintok before it) had displaced local political structures (Stanton and Freidel 2005). Interestingly, it appears that Cobá may have only maintained control of Yaxuná for a century, perhaps less. After this we begin to see the proliferation of architectural styles coming from the Puuc region of western Yucatán, suggesting that other polities were vying to incorporate Yaxuná into their territories. We will hold off on the Puuc influence at Yaxuná until the Terminal Classic, because there is some controversy about when exactly this influence begins.

Investigations of Yaxuná's settlement suggest that population levels had increased in the Late Classic. These data largely derive from excavations (mostly test pits) conducted by the Selz Project (Shaw 1998; Stanton et al. 2010), but we are hoping to get more detailed data from ongoing PIPCY horizontal excavations of residences associated with Sacbe 1. A few general patterns can be observed in the available data. First, Late Classic houses at Yaxuná predominantly favor raised platforms (usually pre-existing Late Formative platforms) or natural bedrock outcrops (Stanton et al. 2010:262). The Selz Project excavated test pits in six Late Classic residences and found that most consisted of humble structures, simple foundation braces made of single courses of unworked stones. They also conducted horizontal excavations of a

more elaborate Late Classic structure (Str. 5E-75) that had three rooms and walls measuring 4-6 courses high. A vaulted structure, likely an elite residence, was also tested and dated to the Late Classic. Across all Late Classic houses investigated, the Selz archaeologists found that floors were quite thin and lacked well-prepared gravel sub-floor ballasts. Burials were quite common in Late Classic houses, and were found to lack formal crypts and to be buried directly into architecture during construction episodes. Individuals in these graves often had modified and inlaid teeth, and were buried with grave goods like ceramics, modified jaguar teeth, greenstone, and bone bloodletters (Ardren 2002b; Stanton et al. 2010; Tiesler et al. 2017).

The survey conducted by PIPCY archaeologists (Hutson et al. 2012a, 2012b; Stanton and Magnoni 2011) also recovered evidence of rural Late Classic settlements. These settlements often went on to be occupied, and likely to grow, in the subsequent Terminal Classic period. A small group, perhaps a few farming families, resettled at Tzacauil, and settlements either sprang up anew or grew in places like Ikil, Joya, and Popolá (e.g., Johnson 2012).

Overall, the Late Classic saw Yaxuná deepen its participation in pan-peninsular politics, though perhaps not on its own terms. Even as Yaxuná was implicated in the power struggles of more dominant polities, its population began to recover and increase. There are strong indications of a growing settlement, which, while they fall short of allowing us to make any certain claims about density or agricultural practice, do permit us to say that Yaxuná was developing a different kind of urbanism than it had had in the Late Formative. Building large, flamboyant residences – or monuments – no longer seems to have been the vocabulary through which land tenure was expressed. Rather, we seem to see a shift towards personal and interpersonal expressions of land tenure and political affiliation. At Yaxuná, this is observable through the emergence of new mortuary traditions. Households began to inter their dead in their domestic architecture, which may have allowed families to express intergenerational connections to land (e.g., McAnany 1995). This corresponded with the interment of royal burials in pre-existing monumental architecture. This shift will be important for understanding the Classic period occupation at Tzacauil.

4.2.7 The Terminal Classic (ca. AD 700-1100)

The centuries of the Terminal Classic period saw Yaxuná reach its greatest population peak, even while the center continued to change hands among more powerful competing polities.

Monumental construction resumed at Yaxuná's site core – though not at the same scale as earlier building projects – and reflects changing regional political dynamics as Yaxuná aligned with a polity (or confederation of polities) in the Puuc region. One such Puuc-style construction was added onto the North Acropolis. This structure (6F-68) includes Puuc-style iconography and has been interpreted as a council house (Stanton et al. 2010). On the ground just south of the North Acropolis, a complex of buildings known as the Puuc Group similarly shows stylistic affinities with the Puuc region of the western peninsula (Ardren et al. 1994; Novelo Rincón 2012; Toscano Hernández et al. 1998). Gustavo Novelo Rincón directed inspired excavations of this group during the INAH project years at Yaxuná. These investigations led him to conclude that these buildings express a non-local Puuc aesthetic using locally developed construction techniques (Novelo Rincón 2012). This strong stylistic shift in architecture is accompanied by the adoption of Puuc ceramic wares, known as Yaxuná IVa ceramics (Ambrosino et al. 2003; Stanton et al. 2010). Together these lines of evidence suggest that Cobá's control of Yaxuná had been eclipsed by a rising center (or confederation of centers) based in the western peninsula, sometime around AD 700.

The Yaxuná settlement changed dramatically in the Terminal Classic. Areas of the site that had previously been left unsettled – particularly areas adjacent to the old ceremonial core – were now filled with houses. As recently as the Late Classic, Yaxuná residents had preferred to situate their homes on elevated surfaces, either bedrock promontories or pre-existing Late Formative platforms. Now, though, they built their homes wherever they could find space, even if that meant living at ground level. The settlement became denser.

Residential construction techniques of the Terminal Classic illustrate how dramatically domestic preferences had changed since the Late Formative. In addition to settling on the ground as well as on rises, Terminal Classic people built fairly simple

houses of single-course foundation braces. These foundation braces might be double-lined (i.e. two parallel rows of stone, leaving a gap where perishable walls could be situated) and could be apsidal, square, or rectangular. Fancier Terminal Classic houses might have core-veneer stone masonry (i.e. worked stones concealing rubble fill cores) but most consisted of simple foundation braces. The Selz Project's test excavations in the Yaxuná settlement recovered numerous Terminal Classic burials dug into houses. Of the 18 burials found in ten Terminal Classic residences, all were interred in intrusive subfloor crypts, lined with vertical stone slabs and roughly sealed by capstones (Ardren 2002; Stanton et al. 2010). Bioarchaeological analysis of these skeletons suggests a mostly vegetarian diet relying heavily on maize, squash, and beans, supplemented occasionally by terrestrial animals (Tiesler et al. 2017).

Outside of Yaxuná proper, the rural surroundings reflect a similar rise in population and the proliferation of many new settlements (Stanton and Magnoni 2011). Tzacauil, as we will see in Chapter 7, had been resettled in the Late Classic and continued to expand in the Terminal Classic. Other settlements were founded or grew in Yaxuná's hinterlands, but most lacked monumental architecture (though see Hutson et al. 2012b). The in-filling of the landscape carries with it implications for how agricultural systems were being managed, but as these implications derive from my work at Tzacauil, they will be discussed later.

The drastic changes of Terminal Classic Yaxuná have led to speculation that its inhabitants were non-local, perhaps even displaced southern lowland Maya migrating north after the Classic Maya collapse (Stanton et al. 2010). I tend to be skeptical of this as the sole explanation of the Terminal Classic population peak, though I do agree that this was undoubtedly a time of interregional migration and exchange. Whether or not the Terminal Classic inhabitants of Yaxuná had ancestral connections to the area or not, there does seem to be a fundamental reworking of what it meant to live here.

Yaxuná was incorporated into the territory of its rising neighbor, Chichén Itzá, later in the Terminal Classic. That this was not a peaceful incorporation is suggested by the construction of hastily-built fortifications on top of the North Acropolis, the razing and burning of the Puuc-style council house, and the destruction of a royal woman's burial in

the North Acropolis (Suhler 1996; Stanton et al. 2010). Together these acts of violence suggest that the Itzá conquerors went after not only Yaxuná's living, but also its royal dead as a way of desecrating the center's ancestral power. It is difficult to know to what degree this incorporation can be thought of as an outright conquest, but it does seem to have been associated with violence directed at least towatds Yaxuná's ruling class.

Through Yaxuná's earlier incorporation into Cobá, the center had remained occupied. But this was not the case with the Itzá conquest. This could be a product of Yaxuná's proximity to Chichén; the conquered Yaxuneros probably either dispersed to farm in the forest or relocated to Chichén Itzá. Those that did remain around Yaxuná were likely part of the mass effort to feed the rapidly expanding urban center of Chichén Itzá (Toscano Hernández and Ortegón Zapata 2003). Likewise, PIPCY survey in the central Yucatán study region has recovered several small sites with Sotuta ceramics (a diagnostic of the Chichén era) that have been interpreted as farming hamlets (Stanton and Magnoni 2011, 2014). The scant – but present – evidence of late Terminal Classic activity at Tzacauil is likely part of this phenomenon.

4.2.8 The Postclassic (ca. AD 1100-1400)

There is very little evidence of sustained activity at Yaxuná during the Postclassic. Even as this was a dynamic time for many Maya cities in the northern lowlands (e.g., Cobos 2006; Masson and Peraza Lope 2014), the landscape of Yaxuná and its environs is quiet compared to earlier periods. There is archaeological evidence that people continued to come to Yaxuná to participate in rituals, leaving offerings at shrines that were added to earlier architecture (Ardren 2015). Apart from this, there is scant evidence for any human activity at Yaxuná until the early Colonial period (see Chapter 8).

4.3 Comparative perspectives from Komchen, Yucatán

The narrative I just described is one known throughout the Maya lowlands, but rounding it out with greater details and chronological control can get tricky in the northern lowlands. This is because the key settlement pattern studies in the northern

Maya lowlands have had to extrapolate conclusions from fairly limited sampling strategies. My saying this is not meant to be critical; without these studies we would have little to no sense of the Late Formative at all. Instead my aim is to draw attention to the ways that Tzacauil can refine and contribute to the ways archaeologists have previously thought about Late Formative household and community organization. Tzacauil is the first northern Maya site where extensive horizontal excavation of a substantial sample of relatively well-preserved Formative houses was conducted. It is important to situate Tzacauil within what has previously been said about Formative Maya settlements. With that said, before getting to Yaxuná I want to discuss one of the keystone research projects that has tackled this topic: Komchen.

The archaeological site of Komchen is located in the northwest region of the Yucatán Peninsula, just a few kilometers inland from the coast. This area's annual rainfall is the lowest in the peninsula. At the same time, the water table in the northwest is quite high – even with crude stone tools, people could dig into the bedrock and reach freshwater fairly easily. Soil cover is thin, often less than 10 cm, and in places exposed bedrock makes up 50% of the ground surface.

Komchen has a substantial Formative occupation. After archaeologists first identified Formative materials in this region of the peninsula (Shook 1955), systematic work began at the site of Dzibilchaltun, a site not far (6 km) from Komchen. As part of that research program, archaeologists reported significant Formative contexts not only there, but also at one of Dzibilchaltun's outlying centers (the Mirador Group), and at nearby Komchen (Andrews and Andrews 1980; Kurjack 1974, 1979). E. Wyllys Andrews V launched a research project at Komchen in 1980, and he was later joined by William Ringle; it is from their pioneering investigations of the Formative component at Komchen that the field really first came to appreciate the significance of these early northern sites (Andrews 1988; Andrews et al. 1980; Andrews and Ringle 1992; Ringle 1985; Ringle and Andrews 1990). The Komchen data provide clues and comparisons for thinking about Formative communities.

It is important to note that since Komchen was excavated, Maya archaeologists have made significant advances in our understanding of Middle Formative ceramic

sequences. I summarized this development regarding Mamom and pre-Mamom ceramic phases earlier in this chapter, but it warrants a brief reminder here. Archaeologists now realize that Komchen's Middle Formative history goes back much earlier than was previously thought (Andrews V et al. 2018). However, for my purposes here, I am most interested in the developments associated with Late Formative Komchen. I simply reintroduce the idea of the pre-Mamom presence here to emphasize that there remains much to learn about this fascinating period at Komchen and elsewhere in the lowlands. With this said, we can turn back to thinking about the site's Formative settlement.

At its core, Komchen has a large rectangular plaza flanked by two long range structures on either side. A raised limestone causeway or sacbe terminates at one of these structures and runs about 250 m to the northeast, with a platform at its other end. A settlement extends out in a roughly circular shape from the monumental architecture of the site core. Based on a mapped sample, the number of structures in the Komchen settlement is estimated at about 1400; over 90% of those structures are located within 900 m of the site center.

The structures of the Komchen settlement are mostly basal platforms of varying sizes. Basal platforms are typical for many northern lowland settlements and seem to have been the preferred residential arrangement at many sites in the northern peninsula, particularly in the northwest part. They differ from the *plazuela* group arrangements (structures oriented around a shared patio) and *albarrada* group arrangements (structures and open areas enclosed by a low boundary wall or *albarrada*) preferred elsewhere in the Maya lowlands. As at Yaxuná and Tzacauil, Komchen's basal platforms were built by "boxing in" natural outcrops of bedrock with rough alignments of stones and then adding fill (medium and large rocks, soil, and chich) to level them out. Then a final cap of gravel or chich would be added to finish the platform's surface.

The project at Komchen noted that quite often, the basal platforms used boulders for the walls "boxing in" bedrock outcrops. A concentration of these boulder-lined platforms was found clustering together in an area only about 150 m southwest of the site center. All tested showed evidence of Formative occupations. This tight association

between boulder-lined platforms, proximity to public architecture, and (probably Late) Formative occupation seen at Komchen is consistent with what has been found at Yaxuná and Tzacauil (Stanton et al. 2010). Boulder-lined platforms are “a good Formative diagnostic” in the northern lowlands (Ringle 1985:104).

Aside from basal platforms, there are also a lot of chich mounds (they call them “chich piles”) at Komchen. These often-amorphous piles of fist-sized stones have long perplexed archaeologists working in the northern lowlands. At Komchen they become more plentiful the further you get from the site center, but they are found in all areas of the site. Often they are found clustered near larger buildings, yet are just as likely to be found unassociated with other structures. Test pits in chich mounds at Komchen rarely found ceramics or other artifacts, limiting our ability to assign them any special function. Chich mounds have been suggested to have served as foundations for ancillary structures, though other archaeologists have ventured that they might have functioned as tree planters (Stanton et al. 2010:243). Chich mounds clearly had some significance to ancient life at Komchen but since we cannot assign them a date or a clear function, that significance continues to elude us.

Komchen’s settlement gives us some clues about Formative community, agriculture, and political organization. First, it seems that access to water may have been organized at a supra-household level. I mentioned that it is fairly easy to dig wells at Komchen because of the high water table. About one well per 19 structures was reported for the site, suggesting that households may have shared not only water access but also duties of well maintenance. Wells were not associated with any particular kind of architecture, nor were they confined to the vicinity of the more elaborate platforms; some were in areas with no visible settlement at all. Additionally, Ringle and Andrews (1990:22) reported a structure density of 5.8 structures per hectare at Komchen, the same density reported by Anderson (2011:308) for the Formative settlement at Xtobo. While they note that this is actually more dense than known for sites elsewhere, it should be emphasized that even if true, this ratio leaves ample unbuilt space throughout the settlement.

This combination of (1) low-density settlement and (2) the sharing of wells across households to me suggests the co-existence of household and supra-household economic practices. Spaces were maintained between and around residential groups: house groups, it is reported, show little to no regard for their neighbors in their orientation or arrangement (Ringle 1985). As Formative (likely Late Formative) Komchen households began investing in permanent (i.e. multigenerational) residences, they simultaneously staked out claims to the landholdings surrounding their houses. Such claims appear to have been mutually respected between neighboring households.

At the same time, there is not a 1:1 ratio of house groups to wells at Komchen. Wells provided water for drinking, cooking, washing, and preparing building materials, but their water was also possibly used for pot irrigation, a rather simple (but not insignificant) form of agricultural intensification (Ringle 1985). The distribution of wells at the site, and the fact that the possibility of rain-fed agriculture alone would be limited, strongly suggest supra-household organization of at least some facets of the community's early agricultural system. Other facets – likely the garden plots and infields around houses – seem to have been handled autonomously by individual households. Together these patterns suggest that the sharing of water – along with common material culture and participation in rituals at public venues in the site's core – served as a mechanism of integration among the fairly autonomous households of Komchen's early agricultural community (for discussions of how water management integrates Maya communities, see e.g., Faust 1998; Isendahl 2011; Lucero 1999, 2006; Lucero and Fash 2006; Marcus 2006; Scarborough 1994, 2003; Scarborough and Lucero 2010).

Before we turn back to Yaxuná and Tzacauil, I want to highlight one particularly striking parallel reported for Komchen and its surroundings. Settlement at Komchen drops off quite a bit as you get about a kilometer away from the site core. Further out, there are a few minor outlying centers. The inter-site areas between Komchen and those smaller centers were less occupied, but still show signs of the occasional house or group of houses. Ringle and Andrews (Ringle 1985; Ringle and Andrews 1990) have proposed a three-tier settlement hierarchy for the study region, consistent with what many archaeologists would call a chiefdom or chiefly society. In this scheme, Komchen

is at the top as the first-tier center, with its monumental core and extensive (though aggregated) settlement. At the other end of the spectrum is the third or simplest tier: basically just clusters of mounds with no ceremonial architecture. These include the sites of San Antonio Dziskal and the Xculul Group at Dzibilchaltun. These smallest sites are close to Komchen, just an hour or a couple hours' walk from Komchen's site core.

The middle or secondary tier of centers around Komchen have settlements – not as large as Komchen's but still considerable – and they also have public architecture. Two of Komchen's so-called secondary centers, Tamanche and the Mirador Group at Dzibilchaltun, have monumental architecture measuring about a fourth to a third of the size the monumental architecture at Komchen. Tamanche, in particular, boasts a small sacbe system and a large platform (see also Santiago Lastra and Acevedo Chin 2003). These second tier sites are located just outside a radius measuring 4-6 km from Komchen's site core. This radius is also what Ringle (1985) calculated to have been the necessary agricultural sustaining area for Komchen. While this calculation perhaps overemphasizes analogy with 20th century *milpa* practices (e.g., Steggerda 1941), it still raises some interesting questions about where (and where not) secondary centers would form.

Before wrapping up this brief discussion of Komchen, I want to acknowledge some of the limitations to this study. These limitations are shared by other foundational projects studying northern lowland Formative settlements (Xtobo, see Anderson 2011; Yaxuná, see e.g, Stanton et al. 2010), and are understandable given the scope of work they would require to resolve.

First, archaeologists working at Komchen relied on a research program of survey and strategic test pitting. Through their testing in structures, they found that the majority of platforms in the Komchen settlement date to the Formative, but their rooms (which include superstructures on top of those platforms as well as small structures built directly on the ground) date to the Late Classic and Postclassic periods. Though attempts were made to refine this chronology by comparing ratios of earlier Formative and later Formative sherds found in test pits, conclusions derived from these attempts are unreliable given that most or all of those sherds were deposited as fill. Sherds were

not in primary contexts but in mixed fills, and so do not automatically clarify when platforms were built and/or occupied. While Komchen was undeniably active as a community during the Formative, differentiating contexts *within* the Formative is challenging, if not impossible, using current methods. Similar issues were encountered at the site of Xtobo (Anderson 2011).

Test pits and survey simply cannot be the end-all be-all in studying Formative (or any period) community organization. However, large-scale horizontal excavations are costly – and in sites the size of Komchen, Xtobo, and Yaxuná, it would be difficult to excavate enough to have a viable sample size. This is why Tzacauil stands to clarify what we can know about Formative household and community dynamics. The site had four Late Formative platforms (each of which showed signs of prior Middle Formative occupation) that remained relatively untouched during subsequent periods; each of these was horizontally excavated. What we see at Tzacauil will contribute back to these foundational studies of Formative community life in the northern lowlands.

As we leave Komchen for now, we will finish by highlighting some of the parallels between the central Yucatán case of Yaxuná and Tzacauil, and the northwest Yucatán case of Komchen and its smaller outlying centers like Tamanche. In both cases, extensive dispersed settlement rises dramatically in the Late Formative. In both cases, Late Formative householders construct and occupy basal platforms (often boulder-lined) and ancillary structures; in each place they make use of natural bedrock outcrops and locally available limestone. In both cases, there appears to be hierarchical differences in which Late Formative primary centers (Yaxuná and Komchen) have categorically greater monumental architecture and settlements than surrounding sites. In both cases, smaller Late Formative outlying centers (Tzacauil and Tamanche) develop a short walk (3.2 km and 4.2 km, respectively) away from the primary centers. These outlying centers are like smaller reproductions, in settlement and public architecture, of what was going on at the primary centers.

4.4 Chapter summary

Tzacauil has been linked to Yaxuná in every chapter of the story told in the following chapters, and so it is imperative that we keep the larger regional context in mind as we consider that story. In this chapter, I discussed the culture history of the northern Maya lowlands with a focus on how Yaxuná fits into and informs the larger regional history. Because so much of the data that emerged from Tzacauil dates to the Formative period, I devoted particular attention to what we know about early Maya farming and settlements in the northern Maya lowlands. I similarly lay the groundwork for comparative parallels between Yaxuná-Tzacauil and the linked Formative sites of Komchen-Tamanche in the northwestern peninsula of Yucatán in this chapter. This context provides the structure for understanding what was found at Tzacauil. With this background in place, we can turn now to a discussion of the methodologies I employed to be able to "read" Tzacauil's landscape as a recording of ongoing interactions between hinterland farmers and their local environment.

Chapter 5
Assembling a Methodology of Landscape at Tzacauil

5.1 Introduction

When people imbue a place with meaning, that place takes on social significance. As time passes, those meanings accumulate – some may be remembered, others actively obscured, others simply forgotten, but their history is there in that place nevertheless. The framework of historical ecology invites us to think of a landscape as the cumulative expression of how a place is given meaning over the course of generations. If sustained over enough time, this process of creating and interacting with landscape leaves material traces; the place is physically changed as a result of its social significance. This is where archaeological methods enter the story.

An archaeology of landscape shifts the way we view a site like Tzacauil, and in turn shapes the methodologies appropriate for its investigation. Rather than viewing Tzacauil as a static ruin, we can instead see it as a landscape: a cumulative expression of generations of social meaning grounded in a particular place, which is part of an ongoing process of historical change that continues today (e.g., Ashmore and Knapp 1999; Bender 1993; Tilley 1994). To document and interpret the material traces of these changing social meanings, my research at Tzacauil combined ethnoarchaeological and archaeological methods. Ethnoarchaeology – the study of living people for archaeological reasons – eases the boundary between ancient and modern, and in so doing, allows us to consider landscape as an ongoing phenomenon. At Tzacauil, my ethnoarchaeological work with members of the nearby modern Maya community of Yaxunah both (1) alerted me to archaeological and ecological features that may have been important to past people's land-use practices, and (2) demonstrated how the site and its surroundings continue to be a meaningful part of their environment today. Then, more traditional archaeological methods of excavation of house groups, the spaces

around house groups, and monumental architecture, supplied insights into the decision-making and environmental interactions of the generations of people who lived here one thousand and two thousand years ago. Analysis of material culture and of soil chemistry lend further nuance to the survey and excavation data. This chapter discusses how ethnographic, archaeological, and laboratory methods were leveraged to read Tzacauil's landscape as a history of human-environment interaction.

5.2 Ethnographic methods

Tzacauil is one of several archaeological sites located within the *ejido* – collective landholding – of the modern town of Yaxunah. For the people of Yaxunah, the comings and goings of archaeological projects have been a perennial part of life since the late 1980s (e.g., Stanton and Magnoni 2011; Stanton et al. 2010; Toscano Hernández et al. 1998). My project, like the others, was tied to Yaxunah. I lived in the town for a cumulative total of about 15 months during five seasons of fieldwork (2013-2017), three seasons of which were spent conducting research at Tzacauil (Fisher 2016, 2017). I hired workers from a rotating pool of *ejidatarios* – those men (and/or occasionally their sons or other close male relatives) who hold hereditary ownership of the *ejido* and exercise rights to use its resources – and came to know some of them and their families quite well over our months working together.

This experience of living and working alongside members of the Yaxunah community became for me, in many ways, more enlightening than the excavations themselves. Though Yaxunah is unmistakably a 21st century town, there are still many practices in Yaxunah that share threads of continuity with those practiced by the people who were living around here a thousand or two thousand years ago. These continuous practices become clear in conversation with Yaxuneros, especially in conversations that happen during archaeological work, when some vestige is uncovered that suddenly ignites a sense of familiarity: this is how *we* build walls; this is how *our grandparents* collected water; this looks like where *my* animals live; this is how *my mother* set up her kitchen. I only really started being invited to these conversations in my fourth year of work. After reflecting on these conversations as I prepared to return for my final and

longest season of work at Tzacauil, I realized that what these threads of continuity all shared in common was a central role of locally available resources. In other words, these practices of deep time were all fundamentally grounded in the land itself.

The ethnographic component of my work at Tzacauil took two forms. First and most importantly was a weeklong project I conducted in April 2017 where six members of the Yaxunah community and I intensively surveyed, assessed, and talked about Tzacauil's intra-settlement landscape. The name those six participants gave to this work, and the name I use to describe it here, is xíimbal k'áax, or "walking the forest." Second and more informal was a series of visits I made to houselots in Yaxunah during the 2015 field season with other archaeologists. These visits admittedly provide anecdotal rather than systematic data, but they were an important part in building conversations about generational and historical changes in land-use.

5.2.1 Xíimbal k'áax / Walking the forest

I came to Tzacauil with this premise: if landscape is a social construction of place, then an archaeological approach to landscape must engage with the living voices of the people who have "inherited" that place. Those people are the ones who know it most intimately. They grew up in it. It is for them and through them that the sum total of environmental elements – stone, bedrock, soil, trees, water, ruins – continue to co-combine and emerge as a socially meaningful place. By walking alongside those living inheritors, we are more likely to understand the ancient landscape than if we – as archaeologists, as outsiders – were to walk it alone. So it followed that I needed to walk the landscape of Tzacauil with its living inheritors, the *ejidatarios* of Yaxunah.

I met with local authorities explaining that I wanted to assemble a group for what we loosely called "*exploración*", a week of work before beginning the season's excavations. I explained that we would mostly be walking and talking, with a little bit of clearing bush when necessary, and all participants would be paid the project's regular weekly wage for workmen. The authorities selected four men from the pool of *ejidatarios* who had signed up for work on the archaeological project that season. The selection was not entirely random: the men who were selected had either a strong interest in the

region's archaeology and history or a more recent connection to the portion of the *ejido* where Tzacauil was located, or both. I had worked with all four men multiple times in my previous seasons on the project and knew them quite well.

But from the beginning I had known that I wanted not just men, but women, to be involved in the landscape study. This was to be a study specifically of what I call the intra-settlement landscape, the open areas between and around houses that were such critical areas for subsistence and economic activities in many Maya sites. Now and in the past, these areas have been strongly associated with women's domestic activities. I wanted to know what both women and men would see when we walked Tzacauil. In the decades of archaeological research in the community's *ejido*, women from Yaxunah had never been hired for fieldwork. My proposal to include women was initially met with resistance from the *ejido* authorities, who were all men. The other branch of local government, which deals with municipal affairs and since 2016 has been headed by the town's first female *comisaria*, expressed support. Yet because the whole process of rotational labor associated with the archaeological project is an *ejido* matter, this enthusiasm was welcome but could do little to facilitate the process. I continued to meet with *ejidal* authorities to discuss their concerns that women would get too tired in the field, would complicate the work with gossip, or would simply not be interested in working. To this last point, we issued an invitation to the relatively few women who hold rights as *ejidatarias* to come to a meeting and hear my proposal. Six women attended the meeting. With the *ejidal* authorities as facilitators, we eventually agreed that, if the women wanted, they could sign on for one week of *exploración* fieldwork. All six expressed interest, but in the end it was two that came to work when we began the following week. They were the first Yaxunera women to do fieldwork on an archaeological project in over three decades of near-continuous research.

Though the team members themselves were the most important component of this study, technology allowed me to translate their insights into spatial data. Planning this study, I knew that I wanted to embed our collective observations and conversations into a visually accessible, spatial repository. I used the application FieldMove,

downloaded onto an iPad, to record data[5]. Developed for geological research, FieldMove allows users to record notes, photos, and sketch drawings in the field directly into geo-referenced maps. I loaded the application with LiDAR (light detection and ranging) imagery of the Tzacauil site and its surrounding area. Line drawings of the site's architecture, collected as ArcGIS data when the site was originally mapped by PIPCY, was overlaid on the LiDAR imagery. By connecting the iPad via Bluetooth to a GPS (BadElf), I was able to get sub-meter accuracy when in the field at Tzacauil. In this way, photographs, notes, and sketches made in specific spots throughout the site could be immediately logged and georeferenced into the site map. The iPad would also serve to photograph and record video of participants' observations, explanations, and conversations with each other as related to features we encountered[6].

Timing was another concern. I knew that the landscape investigation would be most productive in the dry season, when ground visibility is at its highest and the forest is easiest to move through. The rainy season in Yucatán usually begins in June and lasts until September. We completed this work in the first week of May 2017, at the very beginning of a five-month field season otherwise dedicated to excavation.

I wanted the workflow of this study to develop somewhat organically among the participants themselves. However, I knew that I wanted our walking to be structured by the house groups that represented the central focus of my larger research goals. So rather than wandering around aimlessly, we would center our efforts on one house group at a time, walking and talking about the area around each house group within a radius of 30-50 meters (see Robin 1999). Beyond that I was open to seeing how the participants would organize our approach. With this in mind when we arrived at Tzacauil on the first day of the study, I gathered the six participants and explained that I was interested in anything that stood out to them as we walked the areas around each of the house groups. I asked them to consider each house group as if they were going to live there – and with this in mind, which elements of the surrounding area would serve what

[5] Getting started with this equipment and overall approach, I was helped a great deal by the UCR GeoPad Digital Field Mapping System guidelines published online (https://geopad.ucr.edu/) by Nicolas Barth.
[6] The six participants signed waivers at the end of the week's work allowing the distribution and publication of their images and videos.

Figure 5.1 Tzacauil survey team at Yaxuná

purpose in their hypothetical houselot, which features would be advantageous and which might constitute drawbacks. I emphasized my own unfamiliarity with the *monte* (forest) as an outsider, and urged them to tell me about *anything* that stood out to them, no matter how obvious or inconsequential it might seem to them. Then we walked to the first house group and began.

We started tentatively but over the course of the week we developed a pattern that we applied to each of the nine house groups (Figures 5.1-5.19). We would first go to the house group itself and get a sense of its size and construction – and I note that this is a somewhat rare advantage afforded by archaeology in Yucatán, where soil accumulation is so thin that in the dry season you can see ancient architecture on the ground surface, with little to no clearing required. We would then pick a direction to begin, and the men would arrange themselves at intervals between the house group

Figure 5.2: Tzacauil survey team

Figure 5.3: Tzacauil survey team

Figure 5.4: Tzacauil survey team

Figure 5.5: Tzacauil survey team

Figure 5.6: Tzacauil survey team

Figure 5.7: Tzacauil survey team

Figure 5.8: Tzacauil survey team

Figure 5.9: Tzacauil survey team

Figure 5.10: Tzacauil survey team

Figure 5.11 Tzacauil survey team

Figure 5.12: Tzacauil survey team

Figure 5.13: Tzacauil survey team

Figure 5.14: Tzacauil survey team

Figure 5.15: Tzacauil survey team

Figure 5.16: Tzacauil survey team

Figure 5.17: Tzacauil survey team

Figure 5.18: Tzacauil survey team

Figure 5.19: Tzacauil survey team

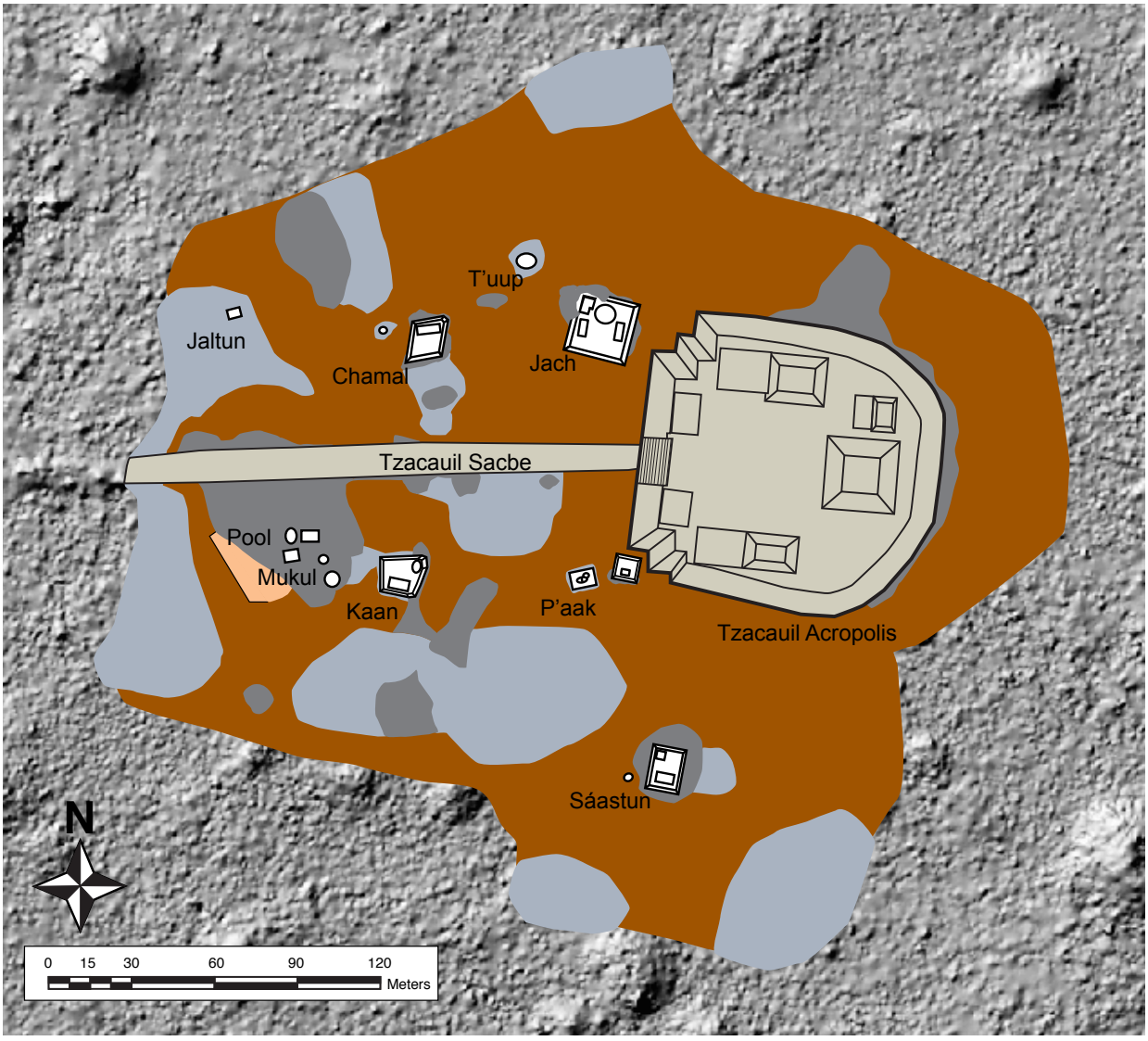

Figure 5.20 Map of Tzacauil showing kancabales (soil rich areas; orange-brown) and tzekeles (exposed bedrock; boulder bedrock is in dark grey, flat bedrock is in light grey)

and a distance of 30-50 meters away, depending on the terrain and vegetation. The women and I usually remained closer to the house group as this was happening, and I would use this time with them to discuss their initial observations of the area. I found over the course of the week that they were more comfortable talking openly with me when it was just the three of us, so this bit of lag time as we got set up became an important part of the routine. Once the men had set themselves up, we would all begin to walk clockwise around the house group, combing through the forest. This more formal kind of walking would last until one or more participants would call me over to see something, at which point we would all convene to talk about it and make recordings. Then we would move on in a circle, periodically dispersing and converging as the participants encountered new elements.

To preserve as much as possible the voices of the participants themselves, I filmed many of the conversations that the six Yaxuneros had among themselves and with me when we would all converge to discuss a particular feature. Though all six could converse with me in Spanish at differing levels about what they were seeing, when we stopped for longer discussions, one man and both women preferred to speak in Mayan. In these cases, I would film the speaker (in Mayan) followed by a translation into Spanish provided by one of the three men who were more comfortable speaking Spanish.

We were able to finish walking the entirety of Tzacauil's intra-settlement areas like this in three days. With the two remaining days of the workweek, we visited the neighboring archaeological site of Yaxuná to get comparative commentary on the landscape there. We also visited the major landmarks between Yaxuná and the area around Tzacauil, including three *cenotes* (limestone sinkholes and sources of freshwater) and one *rejollada* (large depression where soil and moisture accumulate) and its associated caves and rockshelters. This provided a larger regional context for the micro-observations we made for the Tzacauil settlement.

From walking the entirety of the Tzacauil archaeological site with the Yaxunah *ejidatarios*, I was able to transform our on-the-ground observations into a mosaic map recording the site's terrain (Figure 5.20). Most importantly, this map emphasizes areas

that are predominantly soil – kancabales – and areas that are predominantly bedrock – either boulder outcrops or flat expanses of bedrock. These designations, along with more specific data collection on features were used to evaluate each house group's intra-settlement area and varying agricultural potential (see Chapters 6 and 7).

5.2.2 Houselot visits

In Yaxunah today, most people maintain houselots around their homes. These habitually-used outdoor areas are the setting for diverse domestic activities including gardening, storage, food preparation, craft production, resource processing, animal husbandry, relaxing, entertaining guests, and waste disposal. Many of these activities, when repeated over long periods of time, leave material traces that have been found to correlate with archaeological patterning around ancient houses (these ideas are discussed in greater detail in Chapter 3; see Figures 3.11-3.21). This suggests that houselots have a deep history and importance in central Yucatán, and the Maya area and Mesoamerica more broadly.

Houselots in Yaxunah were the subject of ethnoarchaeological research conducted by Héctor Hernández Álvarez (2014), and this research has been an important resource for my work. To place this approach in the specific context of my own research questions, I made a series of informal visits to Yaxunah houselots during the 2015 season with other archaeologists working on the regional project, PIPCY. These visits, though not providing any sort of standardized data, were an important part in my learning to recognize the different components of a houselot and visualize how they might preserve (or not) archaeologically.

5.3 Archaeological methods

Archaeological methods were used to collect evidence of how people at Tzacauil lived in and interacted with their intra-settlement environment in the past. This involved horizontal excavations of Tzacauil's house groups, trench excavations of the spaces between and around house groups, and test excavations in the Tzacauil Acropolis.

Excavations at Tzacauil followed the protocols used by the regional project *Proyecto de Interacción Política del Centro de Yucatán*, or PIPCY. PIPCY and affiliated projects, like this one, have investigated dozens of sites in the central Yucatán region. By employing the same excavation standards, the data from Tzacauil can be inserted into a larger regional context. This brief outline of excavation procedures can be used to clarify the provenience coding system used in the excavation descriptions included in Appendix E.

Before diving into the specifics of grids and lots, I want first to address the roles of archaeologists and local people in the excavations. Sometimes I was assisted by other archaeologists, who helped supervise excavations or occasionally excavated themselves, but I was often the only archaeologist working at Tzacauil. While I (and, when present, the other archaeologists who helped me) handled paperwork, photos, drawings, artifact labeling, measurements, and overall decision-making, the bulk of the excavating was done by men from Yaxunah. As I have already described, there is a long-standing agreement between archaeological projects and the local community of Yaxunah to hire workers from a pool of eligible *ejidatarios* (those with inherited rights to the collectively owned landholding, or *ejido*, of which Tzacauil is a part) on a weekly rotating basis. Some of these men are old enough to have worked on the first major archaeological project in the *ejido*, the Selz Foundation Archaeological Project, in the 1980s and 1990s; most have worked for multiple seasons with PIPCY; some had no excavation experience. Per the request of local authorities, labor was organized into pairs of older, experienced excavators – *maestros* – and younger, less experienced apprentices – *secres*. This system allowed for the older generations of *ejidatarios* to pass on their considerable knowledge of archaeological excavation to younger generations.

There are several *ejidatarios* that have highly specialized knowledge of ancient building practices and local resources. I frequently relied on their knowledge. Often during complicated excavations, we would assemble for *consultas* (consultations) to discuss possible strategies and interpretations as a group. Though I maintained the final say in what we did, I cannot overstate the contribution of the *ejidatarios*, particularly a

core group of interested and experienced individuals, to the archaeological investigations at Tzacauil.

With that said, we can turn now to the logistics of excavation. At the broadest level, investigations at Tzacauil were organized into a series of operations and sub-operations. Operations designated different kinds of excavations that were undertaken during the three seasons of research (2015-2017). All excavated areas were divided into grids of 2 x 2 meter square units. Each grid was assigned arbitrary coordinates, and then each unit was named by the coordinates of its southwest corner. Vertical measurements (i.e. heights and depths) were measured using an absolute datum point for the site. This "Datum 0" corresponded with the highest point of the largest house group (Jach Group, Structure 1). Other datum points measuring from this Datum 0 were distributed throughout the site using a plastic hose filled with water, a reliable technique used by Yaxunero masons, and marked by placing nails in trees. These arbitrary grid coordinates and datum points were later referenced in absolute space thanks to total station mapping data collected at the site in 2008.

Excavations followed a system of levels and lots. The first excavation in each unit was described by the name of the unit, followed by the designation of Level 1 Lot 1. Levels represent culturally significant contexts: a change in construction fill or soil color would merit the changing of the level designation. Within culturally meaningful levels, lots are used to arbitrarily distinguish excavated areas and were typically changed at arbitrary 20 cm intervals. This system works well because it allows the archaeologist to quickly discern between the culturally meaningful information coded by level numbers, while having the flexibility to explore within those levels as afforded by arbitrary lots. Every time a level and/or lot was closed, the artifacts that had been found in that lot were sealed in bags and labeled according to their provenience. Digital photographs were taken before and after the excavation of every lot. Measurements were also taken before and after all excavations. Separate paperwork – PIPCY lot sheets – were kept for each lot, and included information about starting and closing depths, soil color, features, and general descriptions.

Drawings were perhaps the most important kind of data recorded during excavations at Tzacauil. All house group architecture was drawn in plan and profile view, with separate detailed drawings made for any features encountered during excavation. Plan drawings recorded the locations and dimensions of walls and noted areal differences in surface construction for all the house groups investigated at the site. Profile drawings followed *corte* conventions whenever possible. This means that rather than drawing profile views of isolated excavation units, profiles that spanned entire house groups were drawn to provide a more holistic view of platform and structure construction. Typically, multiple *corte* drawings were created along several axes of each house group. I should also note that these *corte* drawings were started before excavations began and added to over the course of each house group's investigation – they were not done at the end, but rather were an important part of the ongoing decision-making of excavations. Apart from house group excavations, excavations of intra-settlement trenches were drawn in profile. All drawings were digitized.

Artifact analysis also followed PIPCY protocol. All excavated soil was screened through 3/8" wire mesh to recover artifacts; artifacts were also recovered *in situ* during excavations. As mentioned earlier, all artifacts were collected by their provenience, which allows them to be considered in the specific context of the level and lot within which they were found. Artifacts at Tzacauil can be broadly broken down into ceramics, ground stone, chipped stone, and other artifacts. Ceramics were washed and labeled according to their provenience. They were analyzed according to the type-variety system for ceramics of the Yucatán Peninsula, which examines attributes such as paste, slip, and temper to assign ceramic sherds to types affiliated with specific periods within an overall chronological sequence. Sherds that included sections of vessel rims or bases were drawn in profile. Some ceramics were reserved, unwashed, for residue analysis (described in greater detail below). Lithic artifacts were photographed, measured, and weighed. All other artifacts – mostly a few rare instances of shell or particularly unusual stones – were registered the same way.

Having introduced the protocols my team and I used at Tzacauil, the rest of this section will discuss the three kinds of archaeological excavations that I supervised over

three seasons. First are the house group excavations, which explored the mounds that once supported the perishable houses and ancillary buildings of the Tzacauil settlement. Then I turn to exploratory excavations of the monumental Tzacauil Acropolis. I finish with the trench excavations that explored the intra-settlement spaces between and around Tzacauil house groups.

5.3.1 House group excavations

Archaeological excavations of house groups at Tzacauil were primarily designed to generate a construction history for each group. I wanted to establish when each house group was first built, how many times (if any) it underwent major renovations and when those renovations date to, how many structures it had and the order in which those structures were built, and the distinct kinds of construction techniques used at each group. Because the house groups at Tzacauil show a great deal of outward variation, I had to employ different strategies to determine the construction history of each. These strategies can be divided into two categories, those used to excavate house groups with superstructures built on large basal platforms and those with structures built directly on the ground surface. Where house groups comprised both kinds of structures, both strategies were employed.

Basal platforms at Tzacauil followed a predictable pattern, which made it easier to excavate them the same way (Figure 5.21). All were built over natural outcrops of bedrock. All were raised using substantial amounts of boulder and/or large-stone fill, which, when necessary, were retained by boulder alignment walls that formed the perimeter of the basal platform. This large-stone fill was time-consuming to excavate completely and mostly provided redundant data. So, while investigations on top of basal platforms used horizontal excavations, investigations on the side of the basal platforms used axial excavations. At least two axes, one running north-south and the other east-west (plus additional axes when necessary to capture architectural features), would be excavated. These maximized the amount of information – particularly in the form of *corte* drawings, which provide a full-profile view of the entire structure – while minimizing costly, redundant excavations in large-stone fill. Meanwhile, excavations on top of the

Figure 5.21 Excavating a boulder-lined platform at Tzacauil

basal platforms opened up wide, horizontal areas and included the full excavation of superstructures when possible. These horizontal excavations on top of the platforms generally only investigated the top fill layer, where artifacts associated with activities on the platform could be recovered. A few units on top of the platform would be selected for deeper excavations in order to complete the *corte* drawings of the axial excavations that crossed the sides of the platforms.

Structures built directly on the ground surface were simpler to excavate. As a general pattern, excavations would begin by first excavating the areas immediately exterior to the structure's foundation braces. Once these walls were defined, then excavations would shift to the interior space of each structure. In most cases, bedrock was quite close to the surface (and often even visible) at these structures and so excavations finished quickly. In a few exceptional cases, however, bedrock proved to be much deeper than expected. Nevertheless, whenever possible these excavations went to bedrock.

House group construction histories give us a picture of how households began to express physical claims to specific places at Tzacauil and how those claims were

maintained or altered over subsequent generations of households. Architectural renovations and expansions suggest the growing size and/or resources of a household over time. Changes in construction techniques point to greater or lesser investment of skill, time, and materials as well as evolving relationships between people and local resources. Of all the data that came out of house group excavations, these construction histories were the most essential to tracing generational changes in the Tzacauil landscape.

Often during investigations at Tzacauil, the members of the Yaxunah community working on the excavation teams would identify the construction materials we were finding using Mayan terms. Many of these techniques are still in use today, and reflect continuity in building technology using locally available materials. Sometimes Spanish words were used to describe construction techniques that have no easy translation (e.g., *albarrada*), and so I have preserved these terms in my descriptions as well. These terms communicate a lot with a single word or phrase, and I quickly adopted them as a way of describing construction histories and techniques. I provide a table of these terms in Table 3.1 and will also go over them here.

Bahpek is a surface made by packing small stones and soil into a tightly compact layer, often used to prepare a building site or as sub-floor ballast. Chich are small, fist-sized cobbles of limestone that are often used in construction fills as well as to prepare sub-floor ballasts and bahpek surfaces. We would use the term microchich or chichitos to refer to small stones, similar to gravel. Sascab, as has been discussed in Chapter 3, is crumbly or powdery limestone that can be mined in naturally-occurring pockets in bedrock called *sascaberas*; sascab was often used to prepare a mortar-like substance, as well as mixed with soil (tierra sascabosa) to use in fill or to create finished surfaces. Cal refers to burnt lime, which was used in construction as a mortar-like substance (see Seligson et al. 2017, 2018). *Albarradas* are dry-laid (i.e. no mortar) multicourse walls created by arranging irregularly shaped limestone rocks into roughly interlocking arrangements; some of the structures at Tzacauil were built in this style. I will also use kancab to refer to the soil at Tzacauil and kancabales to refer to soil expanses found

throughout the site (see Chapter 3). The ubiquity and usefulness of these terms suggests the longevity of building techniques in Yucatán.

Artifacts are another kind of data that emerged from house group excavations (see Appendices A, B, C). These include pieces of broken pottery (sherds), various groundstone tools made from locally available limestone, some chipped stone tools made of chert and obsidian, and a few rare instances of other items like shell and greenstone. However, artifacts need to be treated cautiously - particularly when used to ascribe specific household activities to the house groups where they are found. The majority of all artifacts found in house group excavations at Tzacauil come from construction fill. This means that, rather than representing the activities that took place, for example, inside a given structure, they instead represent the act of gathering soil and rubble from some other context – likely a nearby midden or refuse area – and depositing that material during a construction episode. Hundreds of years of intrusive rodent burrows, tree roots, and other formation processes further complicate matters by churning up the top layers of house group architecture; typically, those top layers would offer the best chance of being able to "reconstruct" household activities based on artifact patterning. This means that artifacts found in the top 20 centimeters of a structure at Tzacauil includes a mixture of (1) discarded artifacts that were gathered from somewhere else and thrown in as construction fill, as well as (2) artifacts that were actually utilized by the people who occupied that structure. Because it is impossible to distinguish the two contexts with current archaeological methods, it is absolutely critical that this caveat be recognized when discussing the artifacts found in house group contexts.

5.3.2 Test excavation in the Tzacauil Acropolis

The Tzacauil Acropolis looms over the small settlement scattered around its base. At nine meters tall and covering a footprint of some 8000 square meters, the acropolis is by far the largest ruin in this part of the Yaxunah *ejido*. It stands out so much so that Yaxuneros do not call Tzacauil, "Tzacauil" – they call it Xnoojmu'ul, which literally means "big mound". Clearly whatever was going on "up there" on top of the

Tzacauil Acropolis was an important part of what was happening in the settlement, at least ostensibly so. But given the sheer magnitude and costs of excavating (not to mention consolidating) monumental architecture, as well as my prevailing interest in the people living "down below", minimal excavations were made in the Tzacauil Acropolis.

A 4 x 2 meter test pit was excavated on top of the Tzacauil Acropolis, in the open, elevated plaza space framed by its superstructures. This strategy came directly from previous PIPCY excavations in similarly sized monumental architecture at Yaxuná (Stanton and Magnoni 2014). By avoiding superstructures altogether, these kinds of test pits pierce through the sequence of flooring episodes in the main body of an acropolis, giving a general view of the construction and renovations over time. Perhaps most importantly, the well-built floors often associated with monumental construction create sealed stratigraphic layers. Ceramics found in the floor between fills can be used to date specific construction events. These kinds of secure contexts are rare in central Yucatán, particularly in domestic contexts. Test excavations in the Tzacauil Acropolis, then, offered the possibility of a comprehensive ceramic sequence for the site.

The test excavation in the Tzacauil Acropolis recovered evidence of three major construction episodes. For each of these construction episodes, my team collected data on (1) what construction techniques were utilized and (2) roughly when each episode dated to, based on the kinds of ceramics included in construction fill. These data help round out the story of what was happening in the community down below at different points in time.

5.3.3 Intra-settlement excavations

The spaces between and around Tzacauil's house groups were also targeted for excavations. If these open areas were the houselots (habitually-used outdoor activity areas surrounding residences) associated with adjacent house groups, then we would expect to recover residues of the activities that repeatedly took place there.

The first step in planning these excavations was to consider the intra-settlement terrain and how it articulated with the locations of house groups. During initial explorations of the intra-settlement zone with six members of the local community

(xíimbal k'áax, or walking in the woods; described in previous section), I registered our observations about the soil, bedrock, vegetation, and other ecological and archaeological features. Tzacauil's intra-settlement areas can be broken down into two broad categories based on these observations: (1) terrain characterized by expanses of exposed bedrock with little to no soil (tzekel), and (2) terrain characterized by flat expanses of deeper, reddish brown soil (kancabal). Kancabales surrounding house groups were then selected for intra-settlement excavations.

Intra-settlement excavations were dug in trenches that either radiated out from house groups into open areas away from the settlement, or that spanned the open areas between two neighboring house groups. Again, the areas selected were all in kancabales. This explains why certain areas of the site appear undersampled: those areas are predominantly exposed bedrock tzekeles, rendering excavation unnecessary. As with most excavations, the trenches were excavated along a grid of 2 x 2 meter square units; unlike most excavations, only areas measuring 2 x 1.5 meters were excavated in each square, leaving 50 cm baulks between each excavated unit. This allowed the excavations to move more quickly and preserved unexcavated areas for additional sampling, if necessary.

These excavations generated several kinds of data that can be used to reconstruct intra-settlement land-use practices. Patterning in these data correlates with specific kinds of outdoor activities, a topic I discuss in greater detail in Chapter 3; here I briefly recapitulate it.. First, whenever possible, excavations reached bedrock. This gives a picture of soil depth, which has implications for the kinds of vegetation that can grow. Before beginning I had thought bedrock features (e.g., cisterns, storage pits, drains) would be found during these excavations, but such buried features were essentially absent. I attribute this to the slow rate of soil accumulation in central Yucatán. In all cases where intra-settlement trenches excavated non-architectural areas, artifacts were only found in the initial 20 cm of the excavation. The first several trenches my team excavated occasionally included units that reached 60 cm or more, with no signs of bedrock – in these cases, the soil was bright red, C-horizon sterile soil. This suggests that the intra-settlement terrain of Tzacauil was more or less stable since

people first started living here. Because these deep pockets of sterile soil were so compact and difficult to excavate – and yielded no archaeological information – I readjusted our strategy to "abandon" such units when they penetrated this layer of sterile soil.

Objects recovered during the excavation of these trenches provide additional information about intra-settlement land-use. Artifacts of different kinds (e.g., ceramics, stone tools) provide information about the kinds of activities that might have taken place in particular areas, as does the density at which these artifacts occur. Other intentionally deposited objects, like gravel and rubble, found in intra-settlement areas can also aid in interpreting land-use patterns, and so they were carefully recorded.

Finally, soil samples were taken from all units excavated in intra-settlement trenches for soil chemistry analysis. The material signatures of outdoor activities are not always so obvious. For instance, in the case of intensive gardening and agriculture, the *absence* of artifacts is typical since these areas were kept fairly clean of inorganic matter. Soil chemistry is therefore an important indicator of land-use patterns. Samples were taken after clearing away the initial few centimeters of leaf litter and humus, and always within the top 20 cm of soil (again, since all archaeological material was restricted to this superficial layer). The samples were collected using stainless steel spoons that were washed with distilled water after each sample, and bagged in sterile WhirlPak bags that were labeled according to the sample's provenience. These samples were analyzed for pH, phosphate, nitrite, and carbonates at the ethnobotanical laboratory of the Universidad Autónoma de Yucatán in Mérida (see below).

5.4 Laboratory analysis of artifacts and soil samples

5.4.1 Artifact analysis

Artifacts were analyzed on an ongoing basis after the 2015 and 2016 seasons, but the majority of analysis took place after the final field season in 2017. All artifacts were transported to Mérida for analysis.

Ceramics were analyzed for chronological and vessel form markers by Mtra. Iliana Ancona Aragón (Universidad Autónoma de Yucatán), who was employed as a

consultant for this project using funds from the Wenner-Gren Foundation and National Science Foundation (Appendix A; see also Table 6.3, Figures 6.46, 6.47, 7.13). I drew diagnostic rim and base sherds, but given that virtually all of the sherds found at Tzacauil come from secondary contexts (i.e. construction fill) these data are not introduced here; ceramics are used primarily to date construction episodes and to compare changes in vessel form over broad periods of time. Ancona Aragón assigned Type:Variety designations to all diagnostic sherds, to which I then assigned a specific temporal period from the Yaxuná ceramic chronology (Stanton et al. 2010). As of 2017, PIPCY is moving to a new naming system for the Yaxuná chronological periods. Some of the date ranges have also been adjusted, particularly for the Terminal Formative, based on ongoing work and revision of the available data (personal communication, Stanton 2018). These changes can be consulted in Table 1.1. With this said, it is possible that some of the date ranges proposed for Tzacauil's occupational and ceramic sequence will change with ongoing research. No carbon or other dateable material was recovered from secure contexts during our excavations and so we have to work with the vagaries of ceramic dating for now. Fortunately, absolute dating has been possible at Yaxuná (e.g., Stanton and Collins 2017) and this work provides us with reliable chronological "anchors" for the ceramic sequence at Tzacuail.

The lithic assemblage from Tzacauil consists mostly of (relatively) crude tools made from locally available limestone (Appendices B and C; see also Table 5.1). Several of them were ambiguous, and the most ambiguous were left out of analysis. Very few, aside from the grinding stones, resemble what would normally get collected on archaeological projects in Yaxuná, where collected lithic assemblages consist of finished and broken tools made of non-local stones (e.g., obsidian). But with obsidian and chert virtually absent, the excavation team and I took to combing over all suspicious limestone fragments and ended up finding many that bear signs of human modification. However, this assemblage has to be treated cautiously, which is why I chose to simply group lithics by possible function, rather than assign them specific tool type.

Grinding stones were the easiest to identify and included metate fragments (usually broken "feet" used to stabilize the grinding surface), one molcajete fragment

(the “foot” from a smaller grinding vessel, used for preparing spices and sauces), two-hand grinding stones (manos used for grinding with a metate), one-hand grinding stones (used for grinding in a basin or bowl shaped metate), and indeterminate grinding stones (inconclusively either one- or two-hand). I assign a maize-grinding function to these tools based on comparable research in the Maya area (e.g. Stromsvik 1931, 1937; Toscano Hernández and Novelo Rincón 2012; Toscano Hernández et al. 1998) but it is also possible that their function may have changed over time. Some or many could have been used in construction activities for polishing and smoothing surfaces, for example. This remains an open question, but for the time being I tentatively assign a maize-grinding function to these lithics.

One of the interesting differences between Tzacauil and Yaxuná is that Yaxuná’s settlement is littered with large boulders that have been converted into trough-shaped metates (sometimes called pilas, which can suggest a change in function from grinding to water collection). These are found in association with houses, sometimes with several alongside a single house group. We found no such stones at Tzacauil. This raises interesting questions about the portability of maize grinding equipment, and by extension, the mobility of laboring maize grinders (probably women).

The ratio of one-hand to two-hand grinding stones we found at Tzacauil also point to interesting patterns in maize grinding. In her study of maize-grinding tool types, Glynns Duffy (2011) reports that a reciprocal back-and-forth motion is the most efficient way to process large quantities of maize. This kind of grinding uses flat (for wet maize) and trough (for dry maize) metates and two-hand manos. But Glynns Duffy notes that one-hand manos are also common, and are linked to rotary-motion grinding in basin and concave type metates. Most of the metate fragments we have are feet and so they do not give us an idea of the grinding surface they would have once had. But in the rare cases when grinding surface was visible (e.g., a piece of a broken metate found in the fill of the Jach Group), they appear to have been flat. I propose that one possibility explaining why one-hand grinding stones are so common at Tzacauil is that people were using basins worn directly into the bedrock outcrops where their houses were built. No such basins have been identified, but they likely would be indistinguishable from

House Group	Grinding					Polishing	Scraping	Chopping	Cutting	Perforating	Stone-working (includes debris)	Filing	Total
	Metate fragments	Molcajete fragments	Grinding stone two-handed	Grinding stone one-handed	Grinding stone indeterminate								
Jach Group	6			5	1	3	4	6			38		63
P'aak Group	3	1	7	3	2	7	19	5	1	5	9		62
Sáastun Group													
Basal platform (Str. 3, 3A, 3B)	7		12	14	2	10	19		3	3	12	1	83
Ancillary structure (Str. 3C)	1			2		2	3		1		1		10
Chamal Group													
Basal platform (Str. 8, 8A, 8B)	2	0	3	5	1	2	3	2	1	1	29		49
Ancillary structure (Str. 8C)	3	0	2	3	0	0	0	0	2	0	7		17
Pool Group	1	0	5	31	3	1	3	2	0	1	26		73
Kaan Group	0		3	8	5	5	3	3	5	1	15		48
T'uup Group	0	0	0	0	0	0	0	0	0	0	0		0
Jaltun Group	0	0	0	0	0	1	0	0	0	0	2		3

Table 5.1 Stone tool counts by proposed function

natural cavities in bedrock after centuries of erosion. I will discuss this idea from time to time when talking about the lithic assemblages of Tzacauil house groups, but this is currently just a hypothesis and will not be used to make any definitive conclusions about foodways differences. But at the very least, the ratios of one-hand to two-hand grinding stones suggests that different strategies of food preparation and resource processing were occurring at Tzacauil.

The other functional categories noted in the Tzacauil assemblage included tools for polishing (usually small ground-stone pebbles or small stones), scraping (flat stones with an edge), chopping (wedge shaped tools usually with an edge, probably used for either splitting wood or breaking up soil), cutting (usually small tear-drop shaped stones with an edge), perforating (pointed stones), stone-working (usually chipped stone debris, of either limestone or potentially non-local chert), and filing (a single lithic of a type of limestone used for filing today). All of these categories suggest the processing of

"soft" materials (e.g., wood, leather, vegetables, meat) that have not been preserved archaeologically. Counts of these proposed tool types are listed in Table 5.1.

There are no major differences in the assemblages of Tzacauil house groups of the same time period, but there are differences across time periods in the access to non-local stone. Classic period houses (e.g., Pool Group; see Chapter 7) had a few tools of high-quality, (probably) non-local chert and greenstone. There were also a few isolated instances of obsidian flakes found throughout the site. These invariably came from off-mound and/or surface contexts, and even when found on Formative basal platforms cannot convincingly be linked to Formative occupations. Instead, as I will discuss in Chapter 7, I see these isolated instances of obsidian (along with Classic sherds found throughout the site) as evidence that Classic people were moving freely through the site, rather than concentrating their efforts around their houses as had occurred in the Formative (see also Chapter 9).

5.4.2 Soil chemistry analysis

I conducted soil chemistry analysis at the paeloethnobotanical laboratory of the Universidad Autónoma de Yucatán in Mérida with the guidance and assistance of Mario Zimmermann (Washington State University and Universidad Autónoma de Yucatán). Zimmermann and I followed the protocols outlined by Luis Barba and colleagues (Barba and Córdoba 1991; Barba et al. 1991, 2014; Manzanilla and Barba 1990; Middleton et al. 2010) to analyze soil samples for pH and carbonates. Phosphates and nitrites were measured using handheld meters (Hanna checkers).

Measurements of pH indicate concentrations of hydrogen ions in a solution; lower values indicate acidity and higher values indicate alkalinity. A small amount of soil from each sample was ground and mixed with distilled water. The pH of this suspension was then read using a handheld meter for every sample. Household activities may raise the pH of soils in residential areas through the regular disposal of wood ash, lime, or calcium hydroxide used during maize processing (Barba and Córdoba 1991; Middleton et al. 2010). Wood ash is both a household waste product (e.g., of cooking, burning refuse) as well as a known fertilizer that can be used to enhance soil fertility.

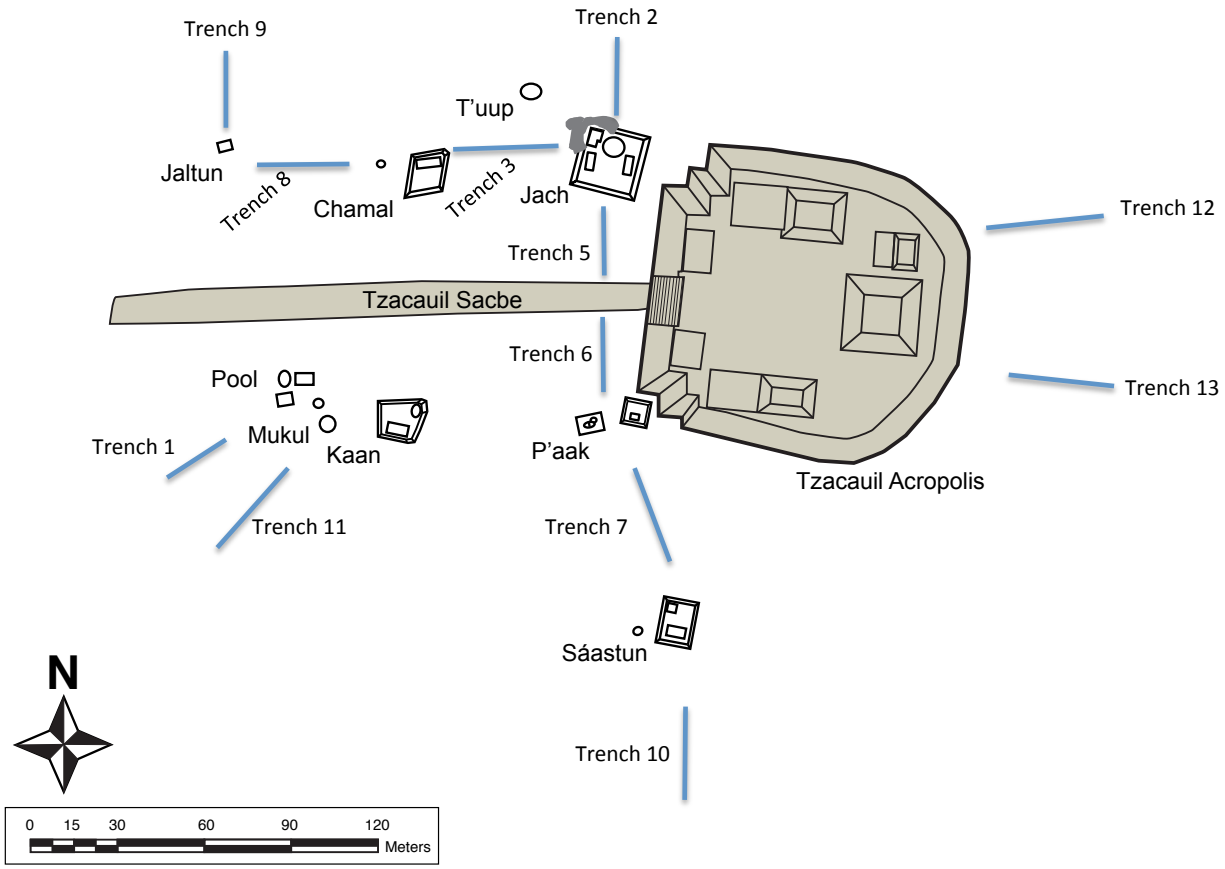

Figure 5.22 Location of intra-settlement trenches at Tzacauil (not to scale)

Carbonate levels were measured in soil using "spot test", a semi-quantitative interval scale outlined by Barba and colleagues (1991). A small amount of hydrochloric acid is added to the soil substrate and allowed to react. Based on the level of effervescence as the acid reacts with carbonates in the soil, a number is assigned. Carbonate levels were fairly low at Tzacauil and there were many "0" values. A "1" is assigned when slight fizzing can be detected audibly but not visually. A "2" is assigned when there is audible fizzing and visible formation of small bubbles. Values increase as there is more and more rapid bubbling observed in the sample. These tests are, of course, semi-quantitative and somewhat subjective but they provide a quick and reliable assessment of relative quantities of carbonates across the sample universe. Ethnoarchaeologically, elevated carbonates have been spatially associated with residences, washing areas, and latrines in Yucatán (Barba et al. 1995). A particular source of carbonates in soil is the regular dumping of limewater used to process maize

during nixtamalization. Carbonate enrichment observed archaeologically can be linked, then, to repeated actions of nixtamalization and washing more generally (Barba et al. 1995; Middleton et al. 2010).

For phosphates and nitrites, Zimmermann and I decided to use a methodology that he has been developing using handheld digital meters. The advantage of these meters, as opposed to the spot-tests often used in Yucatán (Barba et al. 1991), is that they provide continuous as opposed to interval values. These continuous data can then be manipulated statistically. We used a high range phosphate colorimeter (Checker®) produced by Hanna Instruments to measure soil phosphates. The colorimeter utilizes techniques outlined in the *Standard Methods for the Examination of Water and Wastewater, 20th edition*, ascorbic acid method. A reagent is added to a suspension of soil substrate and distilled water, and the reaction between phosphates and the reagent causes a blue tint in the sample. The colorimeter measures the "blueness" of the sample and generates a reading in parts per million (ppm). (The values listed in Appendix D are given in parts per million.) Sources of soil phosphate enrichment include organic matter and human metabolic byproducts (i.e. waste) (Middleton et al. 2010). Based on comparative work in Mesoamerica (summarized in Manzanilla and Barba 1990), elevated phosphates are associated with areas where food is consumed and/or organic matter (e.g., refuse from food preparation, night soil) regularly disposed. As with ash, these repeated occurrences of these waste management strategies will have a long-term effect of enhancing soil quality.

Interpretation of the results from the nitrite analysis is ongoing, and for the most part, I leave the nitrite data out of my interpretations. More work will occur with this measurement in the future, but for now it is enough to say that Zimmermann is undertaking this work on an experimental basis, using a Hanna Instruments nitrite colorimeter (Checker®). The method is an adaptation of the ferrous sulfate method of measuring nitrites, and the values generated by the colorimeter are in parts per million (ppm). Elevated nitrite concentrations in soil may be linked to human urine. Urine is rich in potassium, nitrogen, and phosphorus – all of which can be used by plants, and urine is known to be used as a fertilizer for its soil-enhancing abilities (e.g., Beler-Baykal et al.

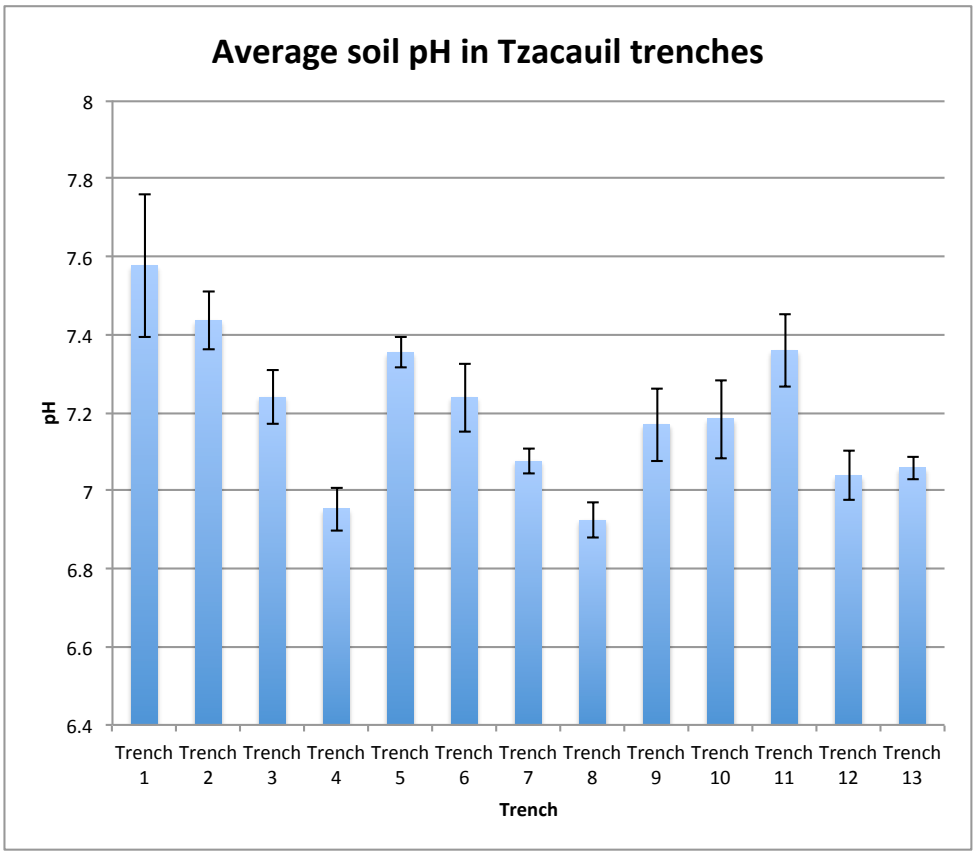

Figure 5.23 Average soil pH in Tzacauil trenches

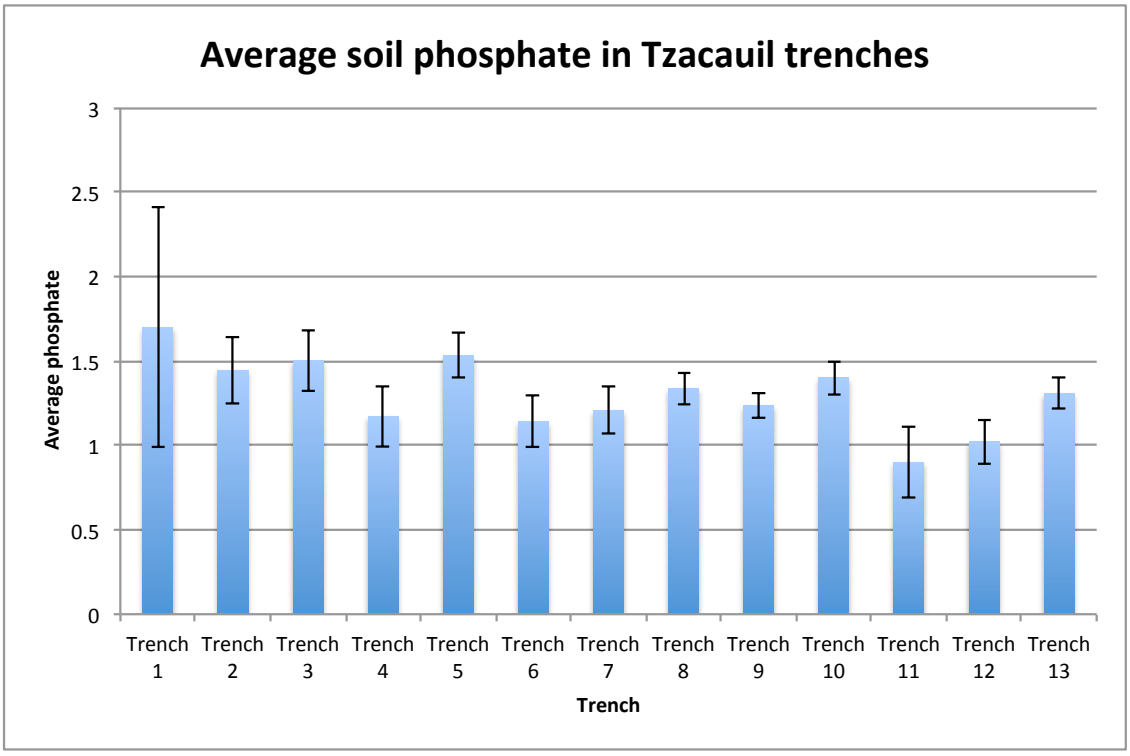

Figure 5.24 Average soil phosphate in Tzacauil trenches (error bars indicate standard error)

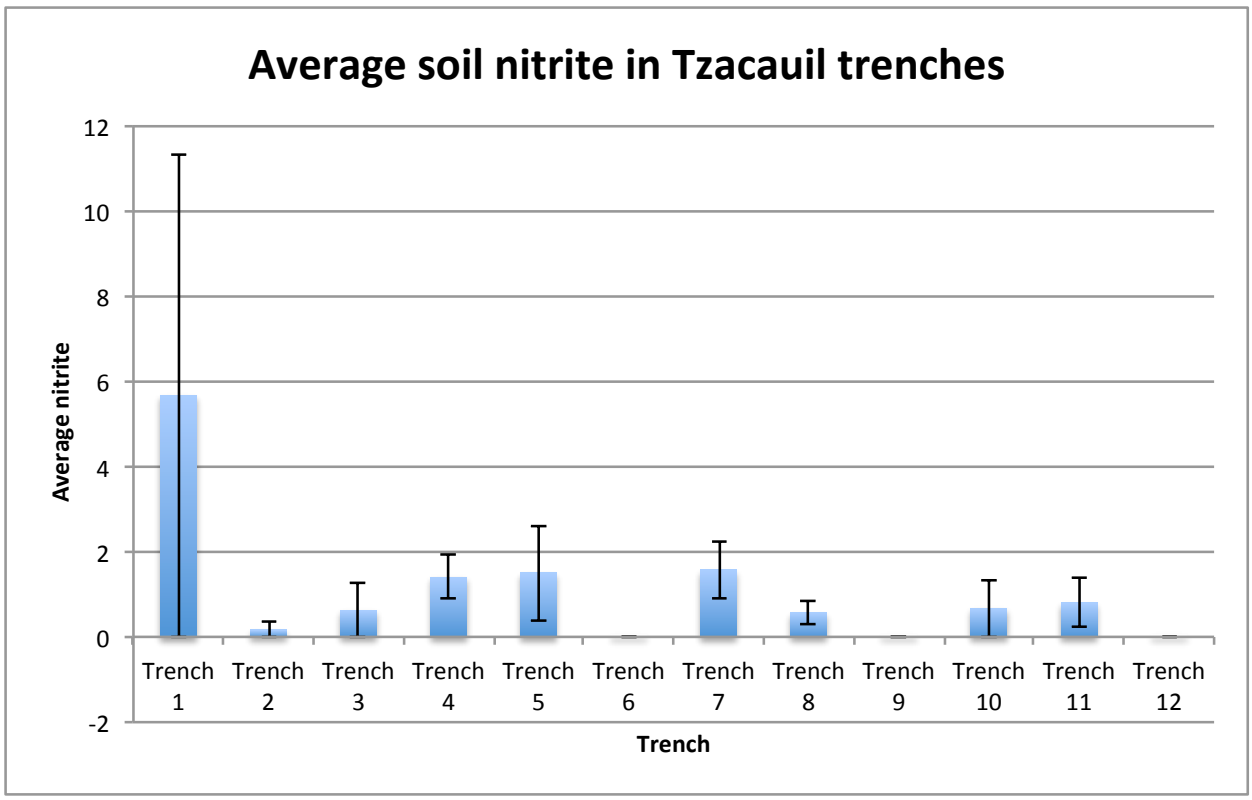

Figure 5.25 Average soil nitrite in Tzacauil trenches (error bars indicate standard error)

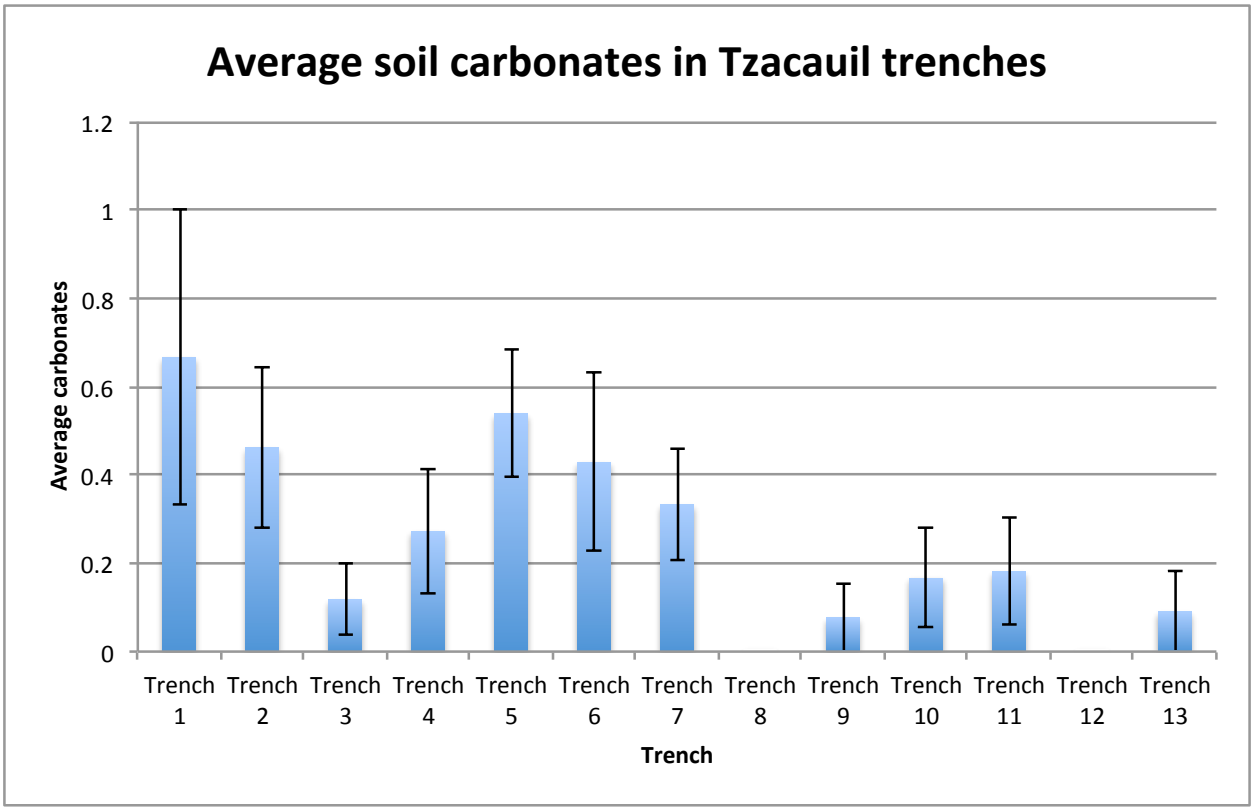

Figure 5.26 Average soil carbonates in Tzacauil trenches (error bars indicate standard error)

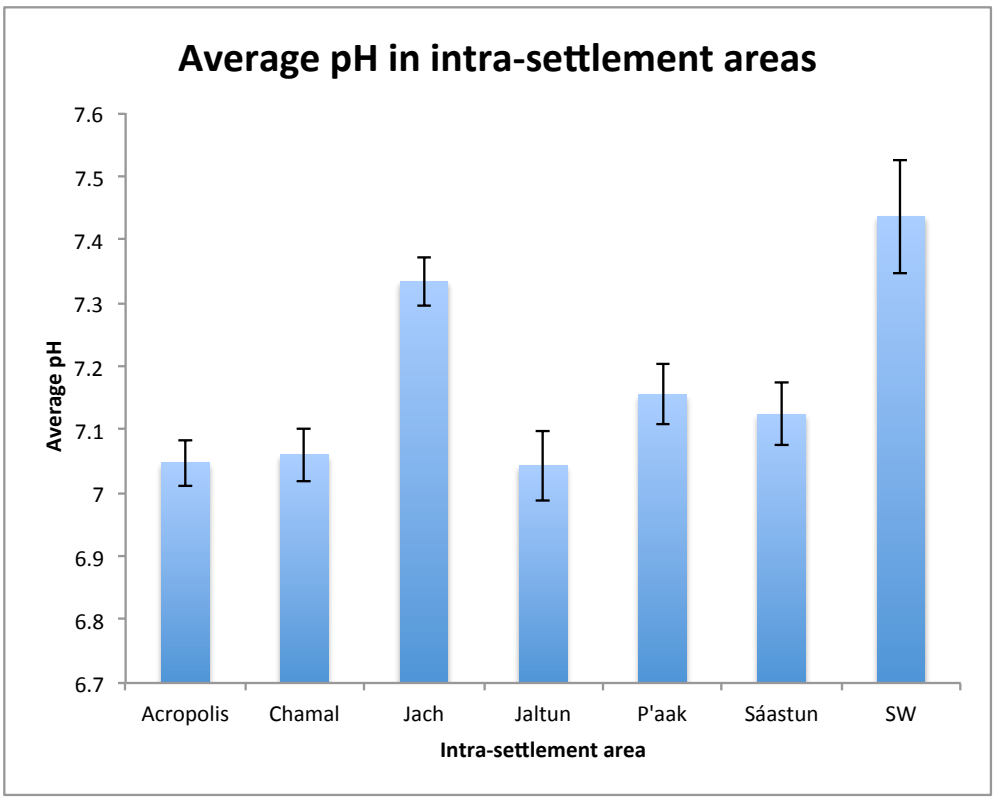

Figure 5.27 Average pH in intra-settlement areas (error bars indicate standard error)

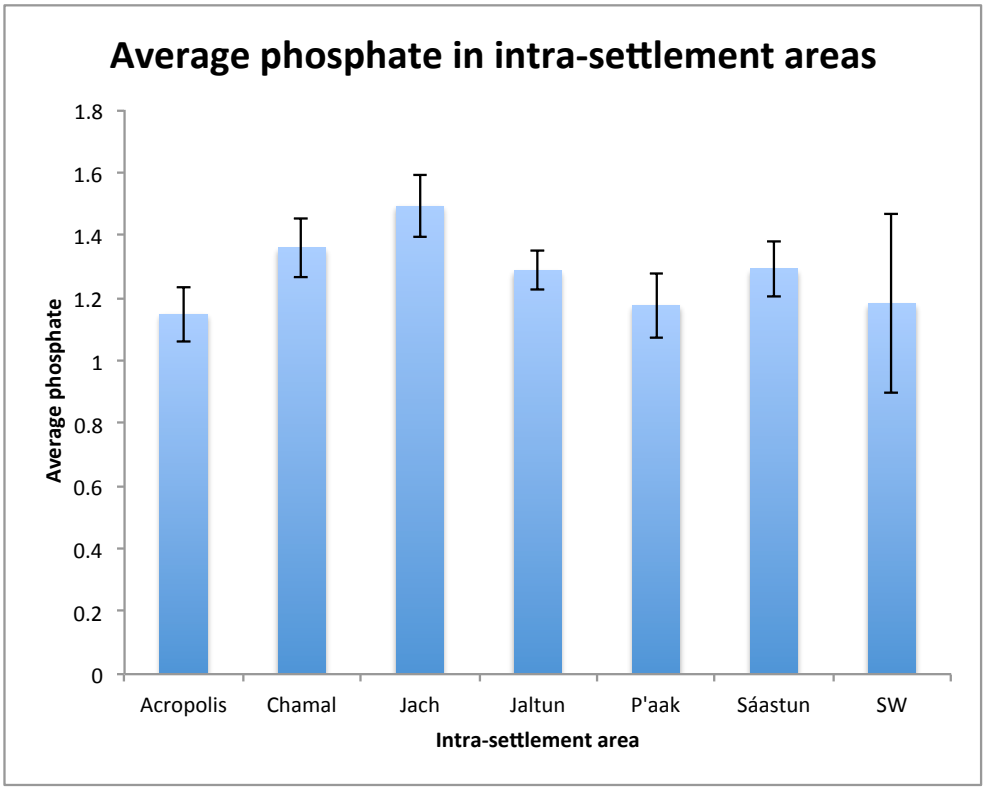

Figure 5.28 Average phosphate in intra-settlement areas (error bars indicate standard error)

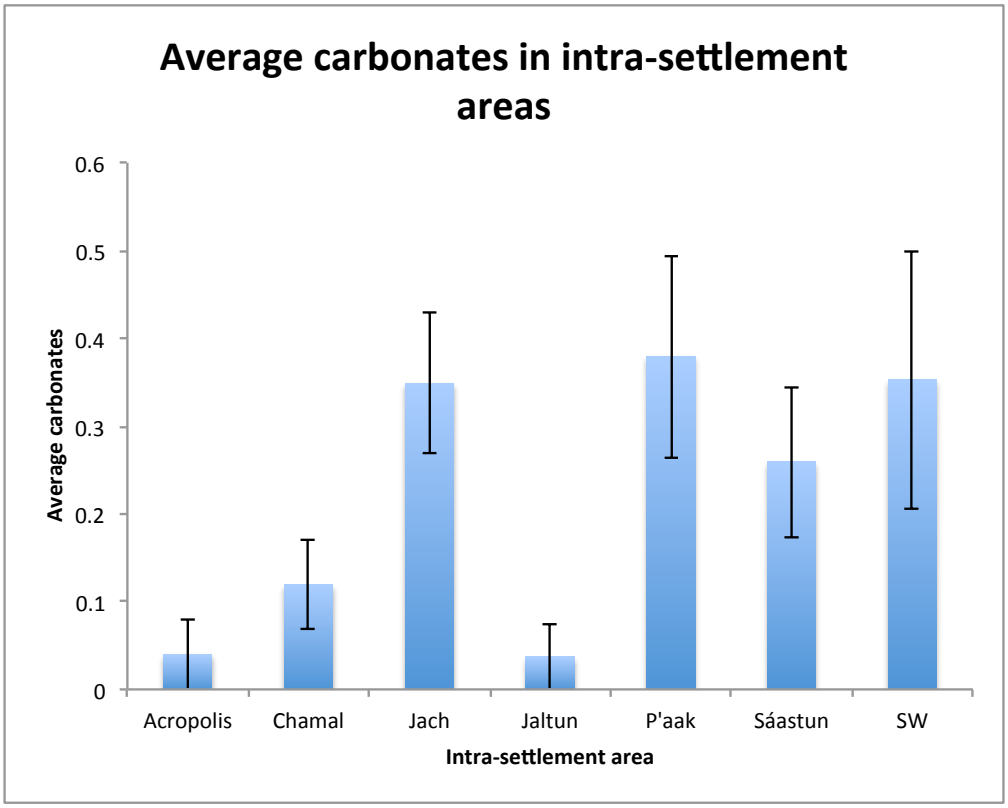

Figure 5.29 Average carbonates in intra-settlement areas (error bars indicate standard error)

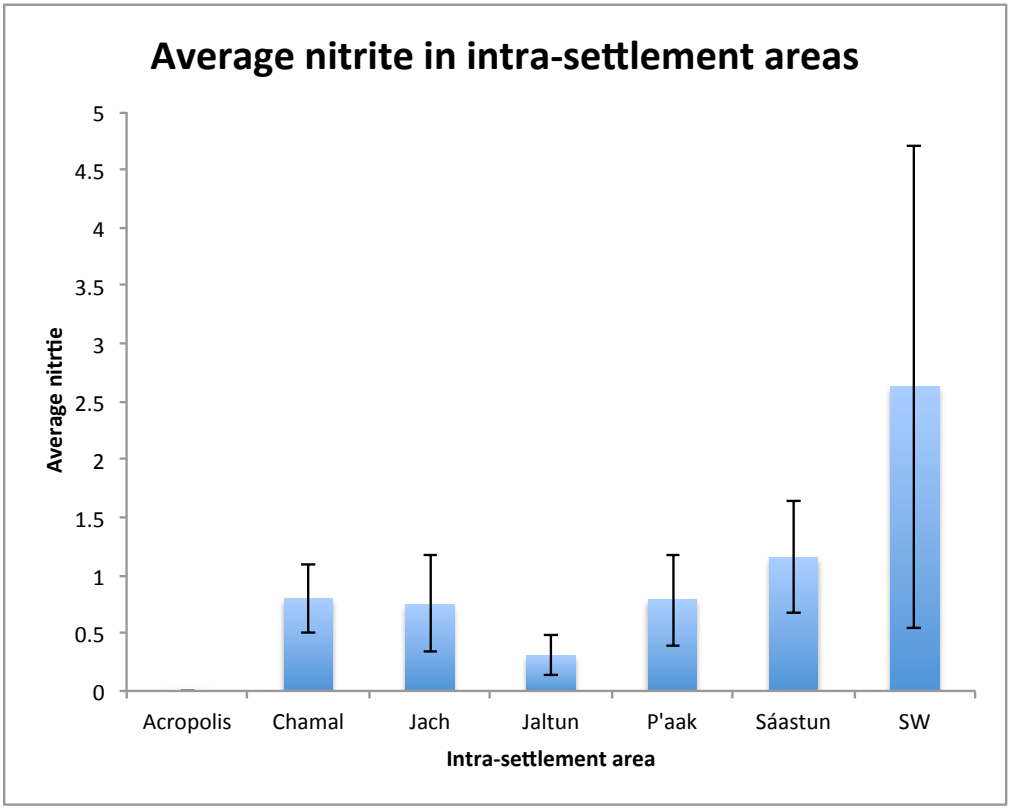

Figure 5.30 Average nitrite in intra-settlement areas (error bars indicate standard error)

2011). As with elevated pH and phosphate, elevated nitrite could be interpreted as evidence both for waste management strategies and for intentional enhancement of soil.

Soil chemistry analysis results are summarized in Chapters 6 and 7, and they are also presented as raw data in Appendix D. I am including in this chapter the graphic representations of the soil chemistry data that can be consulted when reading the summaries in the following chapters. These include a map of the trench locations (Figure 5.22), graphical representations of soil chemistry markers by their averages across trenches (Figures 5.23-5.26), graphical representations of their averages in intra-settlement areas surrounding house groups (Figures 5.27-5.30), and in schematic plans showing relative differences in soil chemistry across Tzacauil's intra-settlement area (Figures 5.31-5.33). It is important to bear in mind that soil chemistry in Yucatán comes with a burden of caveats – the thin soils and centuries of agriculture can make it difficult to assign chemical signatures to specific time periods or activities. This is why the soil chemistry results are treated cautiously and always used in conjunction with other lines of evidence to infer household activities.

5.5 Chapter summary

The creation of landscape is an ongoing narrative between people and their local environment. While this narrative is continuous, our ability to study it depends on using methodologies that best capture particular windows along this continuum. There are certain points along the narrative that leave more traces behind than others – this is the difference between the people living at Tzacauil in the Middle Formative, whom we can know only through the handful of ceramics they left behind, versus the people living at Tzacauil during the Late Formative, who built their houses on massive stone platforms and substantially altered their intra-settlement environment.

Archaeological methods of excavation and artifact analysis let us peer into narrow windows along the continuum when these physical traces of human-environment interactions aggregated to form strong material signatures. But because landscape is an ongoing phenomenon, we should not limit ourselves to the windows offered by strictly archaeological methods. Ethnoarchaeological and ethnographic methods offer the

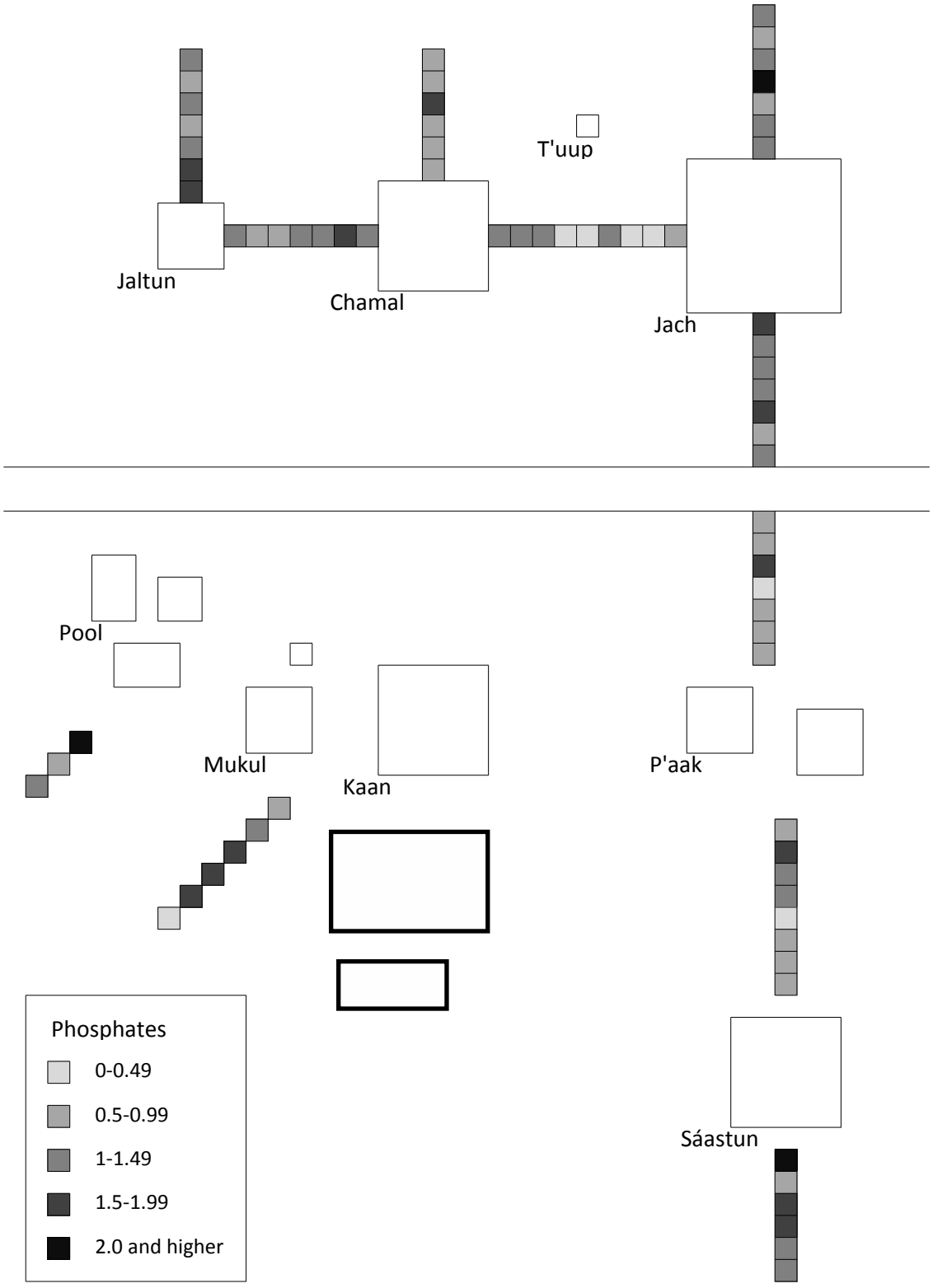

Figure 5.31 Schematic showing relative differences in soil phosphate levels at Tzacauil (values at 2 m intervals; not to scale)

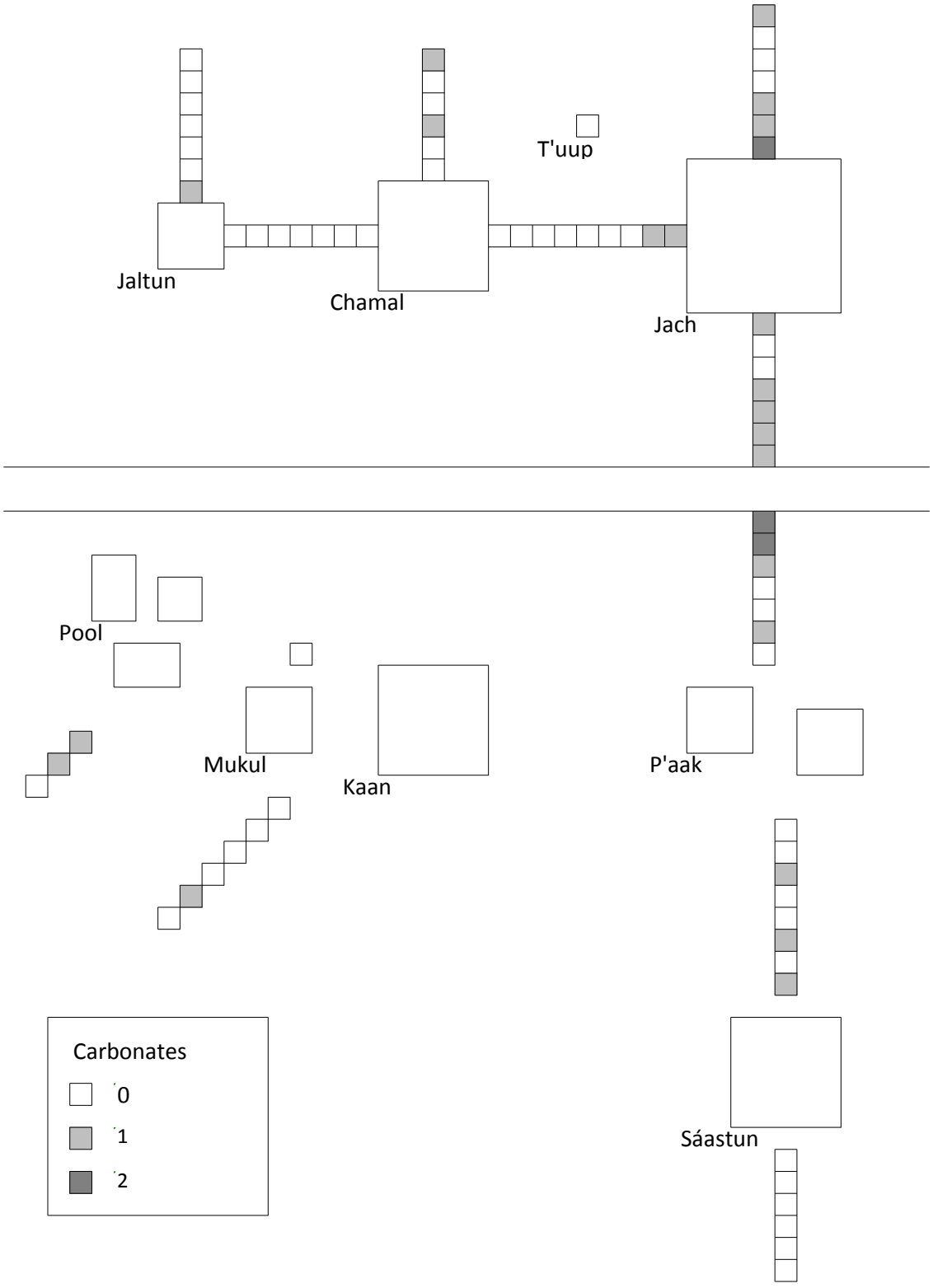

Figure 5.32 Schematic showing relative differences in soil carbonate levels at Tzacauil (values at 2 m intervals; not to scale)

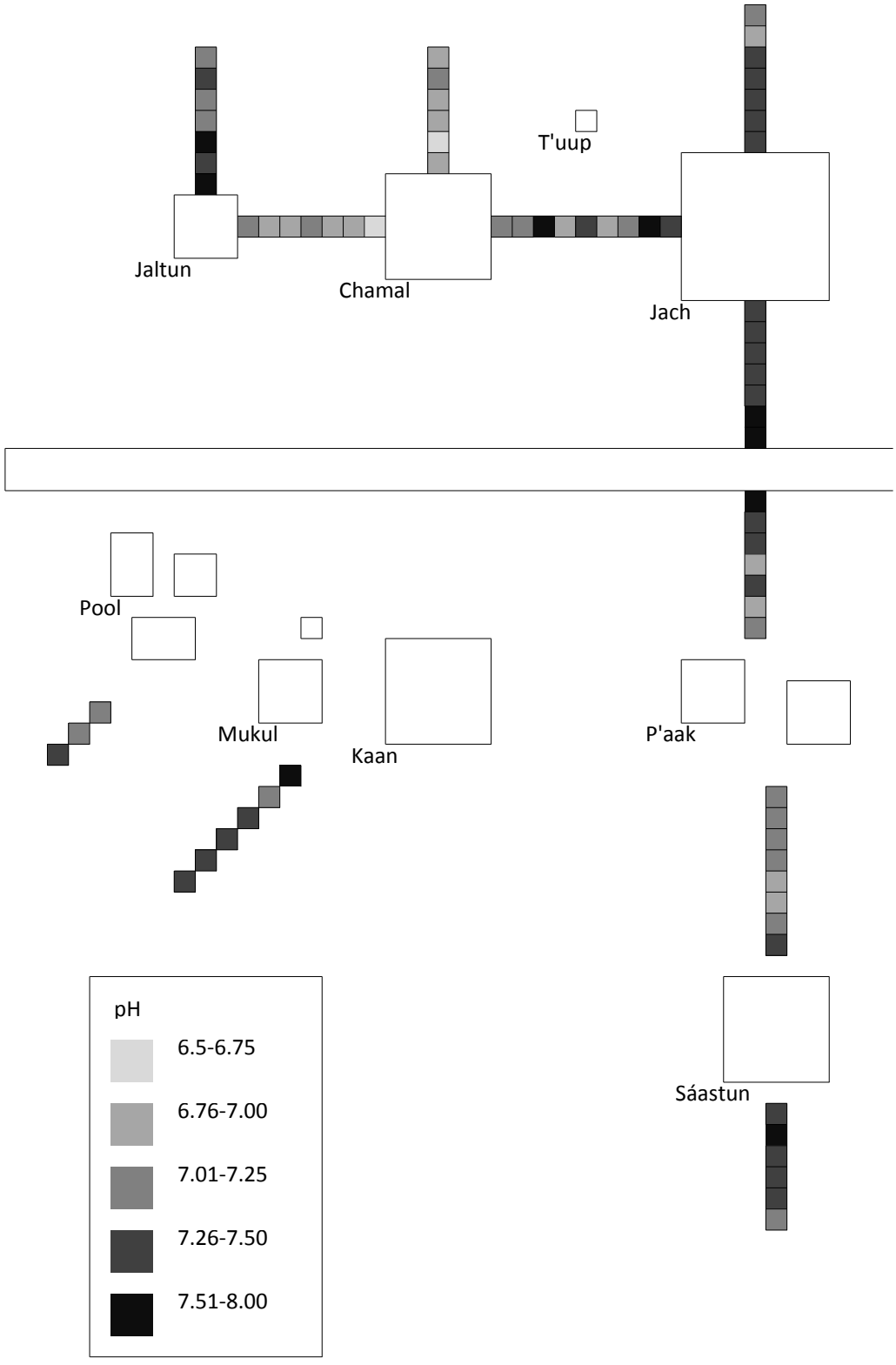

Figure 5.33 Schematic showing relative differences in soil pH levels at Tzacauil (values at 2 m intervals; not to scale)

opportunity to tie this narrative into the present by integrating the voices and experiences of a landscape's living inheritors, in this case, members of the modern Maya community of Yaxunah. With this in mind, my work at Tzacauil employed ethnoarchaeological approaches of walking and discussing the site's intra-settlement lands with *ejidatarios* from Yaxunah and visiting Yaxunah houselots. These methods allowed me to identify continuities in land-use practice and to explore how this particular place continues to be socially meaningful to the modern community.

These insights were complemented by data collected using archaeological methods. Excavations of house groups and the open spaces between and around houses recovered the material traces of how past people interacted with their environment, and how those interactions produced a socially meaningful landscape over the course of multiple generations and periods of occupation. Artifact analysis and soil chemistry analysis added additional nuance to these interpretations. It is only through integrating these diverse methods that we can read the Tzacauil landscape as a primary source of long-term interactions between farming communities and their local environment.

Chapter 6
Tzacauil in the Formative Period

6.1 Introduction

This chapter presents the results of my archaeological investigations of Formative period contexts at Tzacauil (Figure 6.1). After beginning with the evidence for a pre-agricultural Middle Formative presence at the site, I turn to a discussion of the Late and Terminal Formative monumental architecture, the Tzacauil Acropolis and Sacbe. Then I shift to a detailed discussion of each Formative house group I excavated, covering construction history, location, and intra-settlement features, and material culture for each. Some preliminary synthesis is provided at the end of the chapter, but most discussion will be presented in Chapter 9.

This is by far the longest chapter in this study. I directed full horizontal excavations of five Formative house groups, four of which had no Classic period overburden. This sample represents, as far as I can tell, close to 100% of the Late and Terminal Formative Tzacauil community. Realizing that my investigations of these Formative Tzacauil house groups and their intra-settlement lands will likely be this project's most significant contribution to the field, I wanted to present them in detail and preserve them together in a single cohesive chapter. With that said, I will begin with the ephemeral traces of pre-agricultural people at Tzacauil.

6.2 The Middle Formative presence at Tzacauil

The traces of Middle Formative people are limited at Tzacauil, but they are there. Excavations in many of the house groups as well as in the Tzacauil Acropolis recovered Middle Formative sherds (Table 6.1, Figures 6.2-6.4). These early sherds were almost never found in primary context. Rather, when Late Formative builders were looking for

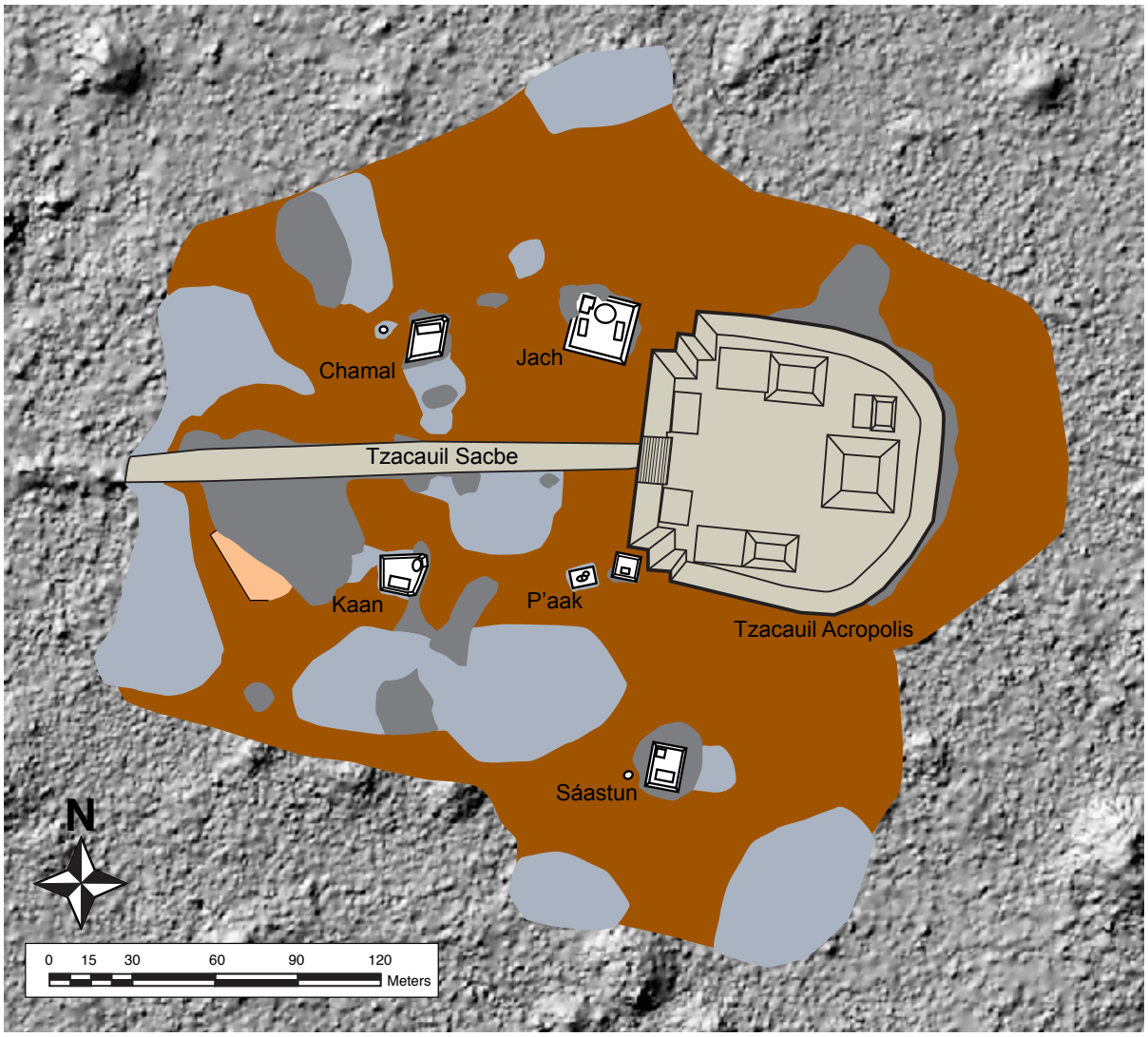

Figure 6.1: Map of Tzacauil in the Formative period

convenient sources of fill, they seem to have gone first to Middle Formative middens when available; these contexts are never "pure" Middle Formative and are invariably mixed with later ceramics. A twist on this: in at least two cases (the Jach Group and the P'aak Group), Late Formative people buried Middle Formative ceramic vessels in domestic architecture during construction episodes. When Maya deposited heirloom vessels in this way, it likely served as a way of animating houses and materializing multigenerational connections between land, ancestors, and the living (e.g., McAnany 1995). Similarly, Middle Formative vessels were interred into the construction of the dance platforms at Yaxuná (also built during the Middle Formative) (Stanton et al.

Context	Middle Formative sherd count	Middle Formative ceramic mass (g)
Jach	117	2134.4
P'aak	24	360.9
Chamal	23	339.1
Sáastun	24	92.1
Kaan	23	340.3
Pool	11	69.8
Jaltun	0	0
T'uup	0	0
Acropolis	35	331.2

Table 6.1: Middle Formative ceramics, by sherd count and by mass, found during excavations of the Tzacauil house groups and in the Tzacauil Acropolis

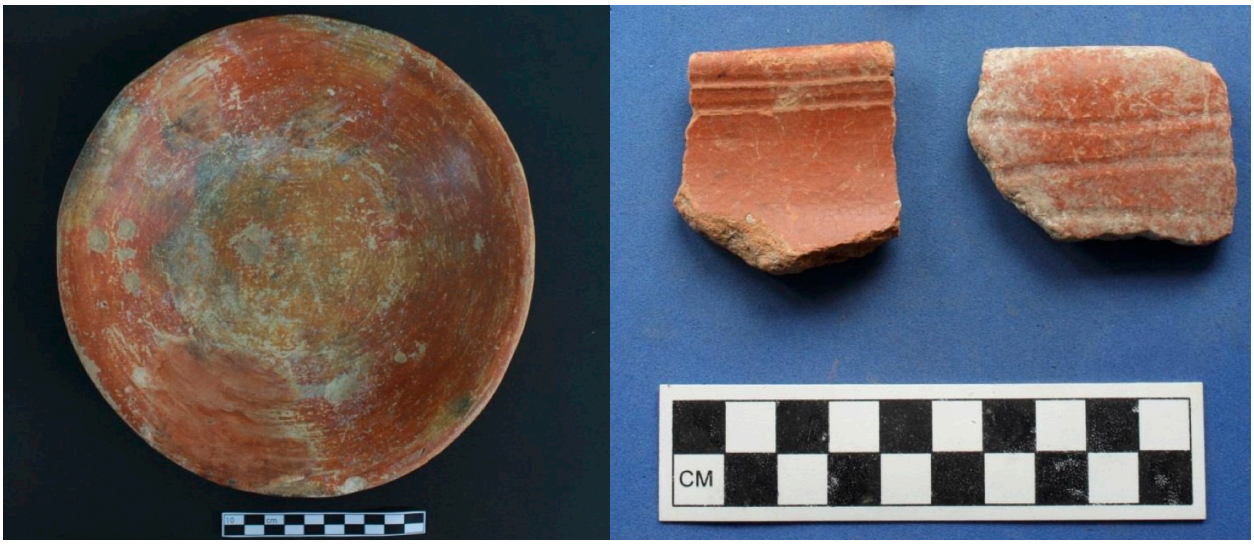

Figure 6.2 Examples of Middle Formative ceramics

2010). These caching practices seem to have activated or formalized relationships between people and particular places on the landscape at Yaxuná and Tzacauil.

When we compare the amounts of Middle Formative ceramic material found in each part of Tzacauil, we can start to identify “hot spots” of Middle Formative activity on the landscape. I think particular areas had accumulated Middle Formative middens (that were eventually included in later fills) through repeated temporary occupations during the era of semi-sedentism and mobility that accompanied the transition to farming in Yucatán. Whether seasonal, annual, or on some other cycle, these visits to Tzacauil likely involved the making of perishable wood and thatch structures and utilization of local resources. People carried their pottery around with them, and inevitably some of it

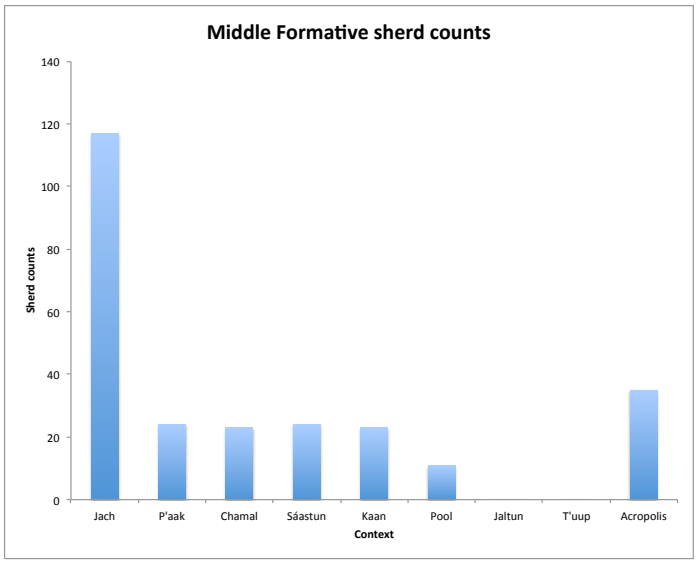

Figure 6.3: Middle Formative sherd counts from house group and acropolis excavations

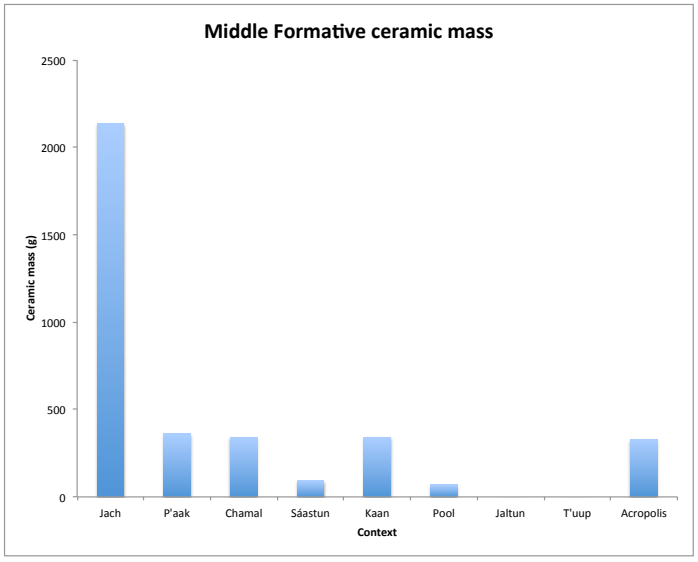

Figure 6.4: Middle Formative ceramic mass from house group and acropolis excavations

would break and get thrown away. In this way material accumulated over repeated visits.

But then a tipping point was reached: people dedicated themselves full-time to agriculture in the Late Formative. The people who first began building stone houses at Tzacauil may have been the descendants of kin-based groups who had been visiting this particular place for generations. Their ancestors may have been part of the gradual transition to agriculture in these lands, experimenting with planting and the permanence that accompanied it. Perhaps they were the first to use the massive bedrock outcrop

underlying the Tzacauil Acropolis for ritually-charged activities. Perhaps the route traced by the Tzacauil Sacbe was first a path that they and their ancestors had been treading for decades, or centuries. We do not know. What we do see, though, is that the Tzacauil Acropolis contains considerable amounts in its early fill levels (see Appendix with ceramics). We see that the earliest and most elaborate house group at Tzacauil, the Jach Group, has the most Middle Formative ceramics (Appendix). All of the boulder-lined platforms that date to the Late Formative contain some amount of Middle Formative sherds (Appendix). To me this suggests that the bedrock outcrops those stone houses are perched on had long been important – even before agriculture had fully taken off. Generational connections to those particular places may have spurred families to lay claims to them, using the materials and expressions of land tenure that emerged during the transition to the Late Formative.

6.3 Late Formative monumentality at Tzacauil

Tzacauil's Formative settlement is structured by its monumental architecture (Figure 6.1). Visually, the site is dominated by the Tzacauil Acropolis, a large Triadic Group near the eastern limit of the archaeological site (Figure 6.5). The Tzacauil Sacbe begins at the base of the acropolis and cuts across the site as it heads west. During early mapping efforts at the site, both the Tzacauil Acropolis and Tzacauil Sacbe were assigned tentative Late Formative dates based on their architectural style (Hutson et al. 2012a, 2012b). My project conducted test excavations in the Tzacauil Acropolis and was able to confirm a Late Formative construction date (Fisher 2016). We were unable to excavate the Tzacauil Sacbe but I feel fairly confident that its association with the acropolis lets us assign it a Late Formative date as well. As we saw in the previous chapter, the proliferation of Triadic Groups and sacbes is diagnostic of the Late Formative at Yaxuná and elsewhere in the Maya lowlands (e.g., Hansen 1998). In this section I will discuss the Tzacauil Acropolis and Tzacauil Sacbe. Many of the data presented here were collected during the initial seasons of PIPCY, during systematic survey and mapping of the structures east of Yaxuná. These data were published by Scott Hutson and colleagues (Hutson et al. 2012a, 2012b). Test excavations in the

Tzacauil Acropolis were supervised by Lic. César Torres Ochoa and myself during the 2016 field season (Fisher 2017).

6.3.1 The Tzacauil Acropolis

The Tzacauil Acropolis is a Triadic Group. Total station mapping of the acropolis provides a sense of its dimensions (Hutson et al. 2012a; Stanton and Magnoni 2011; Stanton et al. 2008). Its basal platform measures 80 x 70 m at its top and 110 x 105 m at its base, with a height of about 8 m. To access the platform, there was a 20 m wide stairway on its western side that meets the Tzacauil Sacbe at its base. There are eight superstructures on the platform, arranged in the typical Triadic Group form. The central principal structure reaches an additional 6.5 m above the platform surface, and its flanking structures are shorter at 4.0 and 3.5 m. While massive, there are hints that the acropolis incorporated a huge bedrock outcrop into its construction; bedrock is visible on one of the eastern corners of the pyramid, exposed about 4 meters below the acropolis' platform surface. This natural terrain expedited the building of this truly monumental platform. Its size truly makes it stand out in the landscape – in fact, the name by which Tzacauil is known locally is "Xnooj muul", literally, big mound.

For my project, we wanted to get a sense of when the acropolis was built, if and when it was renovated, and what kinds of techniques were used in its construction. To that end we followed the acropolis test pitting strategy that PIPCY archaeologists have used to collect chronological data from Yaxuná monumental architecture (e.g., Stanton and Magnoni 2014). A 4 x 2 m test pit was excavated into the basal platform's open plaza area, a few meters west of the acropolis' principal superstructure (Figures 6.6 and 6.7). We excavated down as far as we could. We reached sterile red soil, the kind typically found overlying bedrock in central Yucatán, but could not safely continue the excavation all the way to bedrock. Even with this limitation we were still able to collect data on the acropolis' entire construction history.

The Tzacauil Acropolis, as we suspected, was first built in the Late Formative. There were no clear signs of modification dating any earlier than that. What did this

Figure 6.5 Approaching the Tzacauil Acropolis

Figure 6.6 Profile of Tzacauil Acropolis excavation

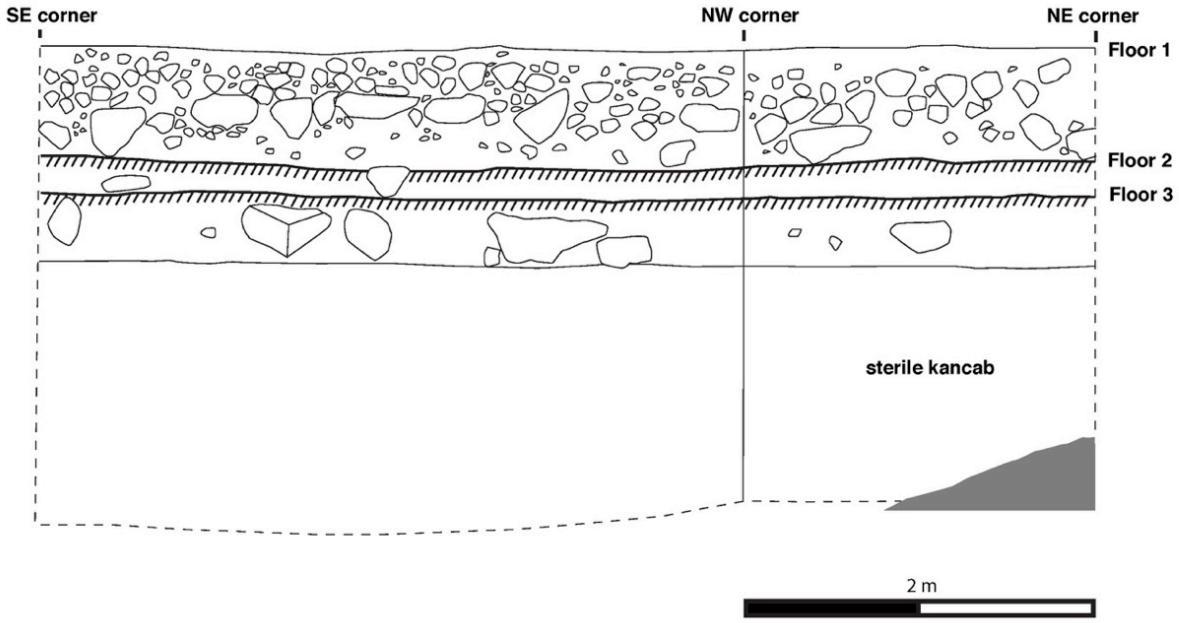

Figure 6.7 Profile of Tzacauil Acropolis excavation

place look like before construction began? In the deepest levels of our test pits, we found bright red soil. This soil was extremely compact and, in at least one part of the excavation, included protruding chunks of crumbling bedrock. This layer was completely sterile of cultural material. From this we can say that before construction, there was a massive bedrock florescence here, the top of which was characterized (at least here) by deep pockets of kancab soil.

Late Formative builders selected this site for the construction of a Triadic Group, the first version of the Tzacauil Acropolis. On top of the compact red soil covering the

surface of the bedrock outcrop, these builders piled on a layer of large stones. This evened out the surface of the outcrop, and raised it by about 60 cm (in this particular place – the fill layer seems to have contoured to the bedrock outcrop). On top of this layer of large fill stones the builders constructed a floor, which we designated Floor 3. Floor 3 was extremely hard and compact. It was made by first packing a layer of small stones mixed with orange colored sascab – likely, this material was sascab combined with red kancab. They capped this layer with a surface of fine white sascab. When we look at the ceramics that were found in the fill associated with the construction of this earliest floor, we see significant numbers of Middle Formative sherds as well as a few Late Formative sherds.

To me, this indicates two things. First, the amount of Middle Formative sherds suggests that this bedrock outcrop was a Middle Formative destination: a place pre-agricultural, semi-sedentary people repeatedly visited on their seasonal or annual rounds. Selecting this place for a ritually-charged, physically imposing monument shows that the Late Formative builders of the Tzacauil Acropolis were invoking and formalizing a connection to their ancestors (or precursors). Second, the paucity of Late Formative ceramics tells me that permanent settlement had only recently begun at Tzacauil when the acropolis was built. Some refuse from this newly agricultural settlement had accumulated and managed to make its way into construction fills, but not enough to dominate the ceramic assemblages recovered from those fills.

The stratigraphy of the Tzacauil Acropolis' basal platform shows that it was renovated twice during the Late to Terminal Formative transition. During the first renovation, or the second construction episode at the acropolis, builders deposited a layer of small stones directly on top of Floor 3. They capped this with another floor, Floor 2. Floor 2 consists of light brown soil, slightly orange in color, with sascab inclusions. We noted a few instances of burned stones and larger chunks of sascab as Floor 2 was excavated. This suggests that the preparation of construction material, the lighting of fires to burn limestone, was happening right here on top of the basal platform. This renovation episode raised the surface of the basal platform 20 cm. Sherds found between Floor 2 and Floor 3 are a mix of Middle, Late, and Terminal Formative sherds,

which leads me to place this construction event to the transition between the Late to Terminal Formative.

Apparently only a short time later, there was a final renovation to the basal platform. This time builders deposited a layer of large fill stones on top of Floor 2, raising the surface by 40 cm. These stones were placed so that their flat sides, if they had any, were facing up. This produced a rough flagstone effect. The builders deposited a fill of medium-sized stones and chich mixed with a tremendous amount of dark brown soil. The surface was highly disturbed by tree roots and exposure, but we could see that this chich layer would have formed the subfloor ballast for a final floor, Floor 1, likely made of packed earth and sascab. This last construction event raised the surface of the basal platform by another 65 cm. Again, sherds in this fill suggest a construction date during the Late to Terminal Formative transition.

Of course we cannot know everything about the Tzacauil Acropolis' construction history, much less its function, from a single test pit in the basal platform. We lack, for starters, a sense of when and how the acropolis' eight superstructures were built and used. We do not know if the Tzacauil Sacbe was always a part of the acropolis, or if it was added during one of the later renovations. Keeping in mind these limitations, we are left to glean what we can from this glimpse into the Tzacauil Acropolis. At the end of this chapter, I will fit the acropolis' construction sequence into the larger context of Formative developments at Tzacauil and make some ventures about its significance to the community that formed around it.

6.3.2 The Tzacauil Sacbe

The Tzacauil Sacbe is a raised limestone causeway or road that originates at the base of the Tzacauil Acropolis and runs west, before fizzling out about halfway between Tzacauil and Yaxuná's site core (Figure 6.8). Though it has not yet been excavated, the sacbe's articulation with the Tzacauil Acropolis strongly suggests a Late Formative construction date.

Total station mapping of the sacbe by PIPCY provide us with important information about its dimensions and orientation (Hutson et al. 2012a, 2012b; Stanton

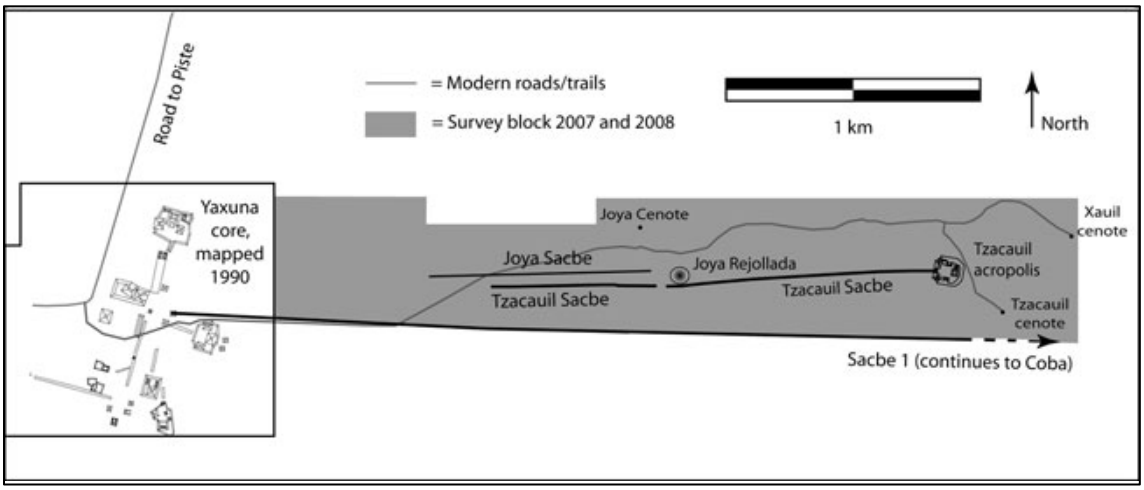

Figure 6.8 Map of Tzacauil Sacbe,showing relationship between Yaxuná, Joya, and Tzacauil (from Hutson et al. 2012a)

and Magnoni 2011; Stanton et al. 2008). At the base of the acropolis, the sacbe measures 9 m wide, though elsewhere along its length it fluctuates between 6-10 m. Some segments of the sacbe include crudely cut facing stones on the sides. Near its beginning at the Tzacauil Acropolis, the sacbe has a low step running along either side of it.

The sacbe's initial orientation of 270 degrees puts it on a collision course with the Joya Rejollada (discussed below), but after the first 100 m the sacbe shifts course to 264 degrees. It maintains this orientation to a distance of 900 m from the acropolis, allowing it to avoid the rejollada but still pass directly along its southern side. The final few hundred meters of the sacbe follow an orientation of 268 degrees. The sacbe ends 1700 meters west of the Tzacauil Acropolis.

The lack of a formal endpoint for the Tzacauil Sacbe raises questions about who built it, and why, and why they stopped (Hutson et al. 2012a, 2012b). There is an initial break at 1570 m from the acropolis, but a nearby structure suggests that this break was due to later stone robbing. At 15 m further to the west (1600 m west of the acropolis) the sacbe picks up again, but only as a crude alignment of rubble measuring 25 m long. It halts, and then begins again as another rubble alignment that stops at 1670 m west of the acropolis. After another break, the sacbe's last gasp, a 10 m long scatter of medium-sized stones, terminates at 1700 m west of the Tzacauil Acropolis and 1460 m east of

Yaxuná's central datum in the E-Group plaza. These fragments raise the possibility that the sacbe was built by different work groups (Hutson et al. 2012a; Shaw 2008:67), and what we are seeing in these rubble fragments are preparations for construction that was never finished.

Hutson and colleagues (2012a) have suggested that the Tzacauil Sacbe materializes a somewhat unsuccessful attempt by Tzacauil to co-opt political authority from elite factions at Yaxuná. Their interpretation is based on a scenario where Tzacauil and Yaxuná were competitors for political clout in the Late Formative central Yucatán region. While this is certainly possible, I think when viewed in the context of larger Late Formative dynamics in the northern lowlands, a different picture emerges.

One of the points made by Hutson and colleagues (2012a:297) contends that the Tzacauil Sacbe solves no logistical necessities – the ground it crosses, they say, would be just as easy to cross without it, even in the rainy season. Based on excavations of Late Formative houses at Tzacauil and conversations with Yaxunah *ejidatarios*, I have to disagree with this point. Walking in kancab is difficult – or at least uncomfortably messy – during the months of the rainy season. As I will discuss in greater detail below, Late Formative households went to great lengths to make it possible to live surrounded by kancab, even when bedrock provides natural advantages, especially in the rainy season. Late Formative householders built reinforced walkways in soil-rich areas. In one case, they incorporated a raised tract of bedrock – what I informally called a bedrock finger – into house group construction. This bedrock finger provided a raised, fairly flat natural walkway that facilitated access across kancab-rich areas. And while central Yucatán is often characterized as flat – and it is, relatively – the ubiquity of bedrock outcrops means that the shortest distance between two points might involve a lot of climbing up and down rough terrain. If we consider that the Tzacauil Sacbe, like many Yucatán sacbes, was likely used for formal processions, the argument for a logistical and dignified solution to rainy season mud is even more compelling. So I think that there is a case to be made that the Tzacauil Sacbe did make it easier to walk through the landscape.

As PIPCY archaeologists found, the Tzacauil Sacbe initially heads straight for the Joya Rejollada. It course corrects before it gets there, adjusting so that it passes right alongside the southern edge of the rejollada before continuing west. I think that formalizing a path between Tzacauil and the Joya Rejollada may have been just as much of a reason to build the Tzacauil Sacbe as was formalizing a path between Tzacauil and Yaxuná's E-Group. There are a couple of reasons to believe this.

First, ritual circuits connecting meaningful places on the landscape is known to have been important over the last several centuries of Maya history. There are ethnographic accounts of this among 20th century Maya living in the highlands of Chiapas (Vogt 1961, 1983). Community leaders and ritual participants would walk a circuit at certain points of the year, visiting in an ordered sequence the wells, caves, and other locales that their community claimed. Doing so reaffirmed the community's boundaries and its multigenerational connections to sacred places – places which often held symbolic as well as practical importance. Asserting community landholdings through circuits connecting special places is suggested in Colonial Yucatec Maya documents, which refer to places through the listing of landmarks that give boundaries to a claimed landscape (Marcus 1993; Roys 1957; see also Diego de Landa's account, published in Tozzer 1941). Periodically walking to places as a way of expressing claims to those places seems to have considerable time depth in the Maya area.

Second, rejolladas seem to have been enormously important features to the northern lowland Maya. They naturally conserve moisture and accumulate soil, creating microclimates that foster the growth of diverse plant and animal communities. Trees can grow taller and faster in these environments, making them ideal places for intentional arboriculture and/or the tending of wild stands of fruit trees. *Rejolladas* provide a source of soil that can be collected and transported to houselot gardens. In some parts of the Maya lowlands, households expressed claims to rejolladas by situating their houses at their edges (Kepecs and Boucher 1996; Lowry 2013)

Given all this, it is likely that people had been coming to the Joya Rejollada for generations – for centuries – before agriculture was adopted in the northern Maya lowlands. The rejollada is truly enormous, at 73 m in diameter and 15 m in depth (Figure

Figure 6.9 Yaxunah ejiditarios in the Joya Rejollada

Figure 6.10 *Albarrada* in Joya Rejollada

6.9). It contains three rockshelters, a pyramid, several stone masonry walls, rock carvings, and evidence of limestone modification (Hutson et al. 2012b) (Figure 6.10). Now, this activity has been attributed to the site of Joya, which is located on the western side of the Joya Rejollada. Joya is reported to have had Late Formative and Late to Terminal Classic occupations based on ceramics recovered in 2011 (Stanton and Magnoni 2011:83). But it is important to note that this occupation sequence (not to mention the interpretation that Joya absorbed Tzacauil, which we will talk about at the end of this chapter) is based on only ten 1x2 meter test pits, all of which were excavated off-mound. So I would argue that we cannot really yet say with, any certainty, what is going on between the Joya site, the rejollada, and other sites in the area, including Tzacauil.

What we *can* say is that the Joya Rejollada has been an important locus of activity for a very long time. Even today, Yaxunah *ejidatarios* prize this place. When I visited the rejollada in 2017 during the xíimbal k'áax survey with the six Yaxunah *ejidatarios*, they repeatedly remarked about all that could grow in a place like this. They

also pointed out stone masonry walls built beneath the overhang of one of the rockshelters in the rejollada – these, they told me, had been built for protection when Maya people were driven in to hiding during the turmoil of the Caste War.

With all that said, it would be surprising if Late Formative people at Tzacauil were *not* aiming for the Joya Rejollada when they charted the course of their new sacbe. In the same way that Tzacauil houses and the Tzacauil Acropolis physically materialized claims to places that had been significant to earlier, mobile peoples, the Tzacauil Sacbe materialized a previously ephemeral circuit on the landscape.

This in no way invalidates the idea that the ultimate destination of the Tzacauil Sacbe was the Yaxuná E-Group. I agree that one of its functions would have been to facilitate movement from Tzacauil to the E-Group to attend special events.. Across the Maya lowlands at this time, we see that settlements were becoming more extensive, and that new mechanisms of community integration were developing to tie together dispersed farmers. In the scenario I am proposing, people at Tzacauil were not vying for political authority by building their sacbe. Rather, they were likely very much involved with what was happening at Yaxuná, and probably were often moving between the two centers on ephemeral trails, with stops at significant places along the way.

With the transition to the Late Formative, people were highly motivated to reorder the materials of their natural surroundings into powerful statements of land tenure and multigenerational continuity on the landscape. It makes sense, under these conditions, that people at Tzacauil would formally materialize their circuit to the west with a monumental sacbe. While walking on the Tzacauil Sacbe likely held ritual significance at certain times, this sacbe would have also solved logistical needs. The elevated, smooth path would have facilitated access through the craggy bedrock terrain and muddy kancabales over the course of the agricultural year, permitting regular access to the E-Group plaza, the Joya Rejollada, and likely other places unknown to us.

Again, no excavations of the sacbe have been conducted. We cannot know at this time the pace at which it was built, if there was a pause between the segment that brought it to the Joya Rejollada and the segment that was going to take it to Yaxuná. We cannot know when construction began and when it ended. But based on

chronological data collected by my excavations in the Tzacauil Acropolis and houses at Tzacauil, construction reached its peak at the Late to Terminal Formative transition, immediately after which we start to see signs the community began to dissolve.

So why does the Tzacauil Sacbe stop where it does? I propose that the momentum of Late Formative building projects had come to an end. I do not believe there was a sudden halt, and probably people on both sides intended to finish it. But in this region, as we will discuss at the end of this chapter, changed profoundly in the Terminal Formative. The sacbe was never finished.

6.4 The Tzacauil settlement in the Formative period

Scattered around the west side of the Tzacauil Acropolis and on either side of the Tzacauil Sacbe are the house groups of the site's Formative settlement (Figure 6.1). The house groups that give us the clearest picture of life in the Formative are the Jach Group, the P'aak Group, the Sáastun Group, and the Chamal Group. These four groups were not reoccupied in the Classic period, preserving their Formative contexts. In the southwest part of the site, though, where Classic period reoccupation was focused, there was also earlier occupation in the Formative. The Kaan Group and the Pool Group both have evidence for Formative occupation, but these are difficult to discern with the Classic period overburden.

The rest of this chapter is dedicated to in-depth descriptions of what my project found conducting horizontal excavations of the four "pure" Formative house groups at Tzacauil: Jach, P'aak, Sáastun, and Chamal. I will discuss the evidence for Formative occupations at the Kaan and Pool Groups as well, but reserve more thorough treatment of those groups for the next chapter. For each Formative house group, I will begin with a brief overview before discussing the group's construction history, location and intra-settlement features, and material culture before ending with a brief summary. More detailed descriptions of these excavations, unit by unit, can be found in Appendix E and in reports submitted to the Mexican government (Fisher 2016, 2017). After each house group is described, I will conclude this chapter with inter-house group comparisons and

a discussion of what these data – from house groups, intra-settlement, and monumental architecture – tell us about life at Tzacauil in the Formative period.

6.5 The Jach Group

6.5.1 Overview of the Jach Group

The Jach Group is the largest, most elaborate, and most complicated of the domestic architecture known at Tzacauil. Ceramic data suggest it was probably the first of the house groups built at the site, in an area that shows strong signs of earlier Middle Formative activity.

As my team and I found it during the 2015-2017 seasons, the Jach Group consists of a large basal platform with sloping sides, constructed around a massive bedrock outcrop (Figures 6.11-6.14). The basal platform is designated Structure 1. The platform mostly concealed the underlying bedrock outcrop except in a few places, but its builders also clearly designed it to incorporate an elevated, flat bedrock "shelf" on its northwest side. This shelf offered a ready-made living surface and was likely attractive to the initial settlers. Bedrock is also visible off the platform's northern side, where it is crumbling into large boulders. Little effort was made to clean up this side of the platform with architecture; this seems to suggest, along with other evidence, that the platform's formal access was on its south side. Not coincidentally, the south side faces the Tzacauil Sacbe, and orients to the point where the sacbe meets the Tzacauil Acropolis.

On top of the Jach Group's basal platform, we documented four clear superstructures (there was one other possible structure that could not be securely identified). Structure 1A is the tallest and I will often refer to it as the principal structure of the group. It consists of a circular or conical construction, evidently built over the pinnacle of the underlying bedrock outcrop. While the structure supports an elevated flat area, which appears to have been divided into two rooms, its form suggests that it was not used for regular daily domestic activities. It may have served as a shrine, but this cannot be known based on available data. At the base of Structure 1, a wide strip of dense surface chich runs from it down towards the southeast corner of basal platform. Initial excavations of this chich concentration in 2016 suggest that it was a ramp,

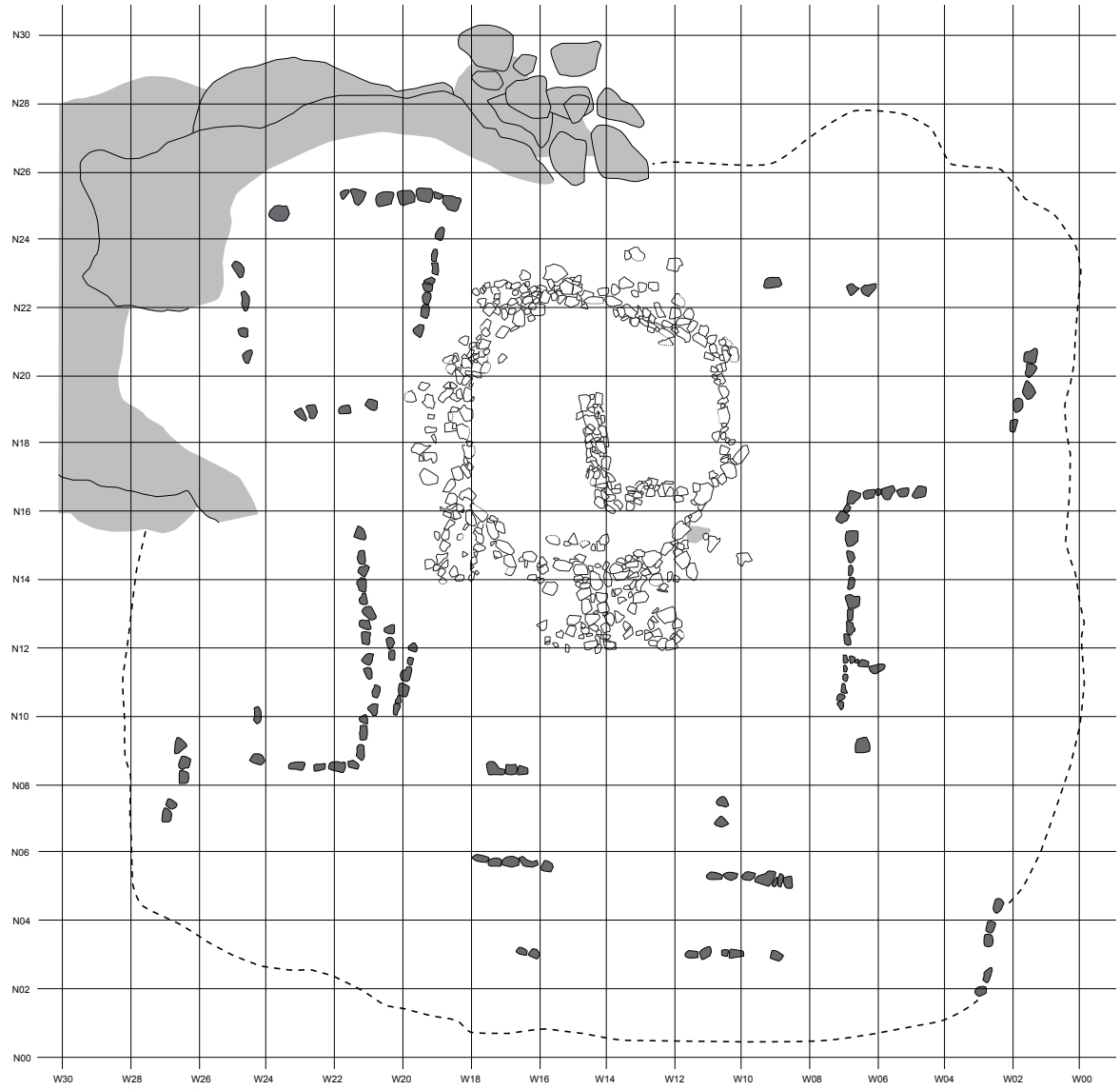

Figure 6.11 Plan of Jach Group

providing access between the principal structure and the base of the platform. It should also be emphasized that by connecting to the southeast corner of the platform, this ramp gives architectural emphasis to the point where the Tzacauil Sacbe meets the Tzacauil Acropolis.

Two rectangular superstructures flank the principal structure in front of it (south) on either side of the basal platform; the western structure is designated Structure 1B, the eastern is Structure 1D. These structures are variably preserved, but the western structure (Structure 1B) retains cut-stone masonry foundation braces that were visible

on the surface. Both would have supported perishable structures and both have chich floors in their interiors. Both would have been spacious enough for sleeping and other household activities. It is important to note that the basic layout of the principal structure (Structure 1A) and these two rectangular structures mimics the Triadic Group arrangement seen on top of the Tzacauil Acropolis as well as in Late Formative monumental construction at Yaxuná (East Acropolis, North Acropolis, 5E-19 Group, 5E-30 Group).

At least one other superstructure occupies the Jach Group's basal platform. This structure, Structure 1D, is located in the northwest part of the unit, near where the constructed platform connects with the exposed bedrock shelf. This structure appears to have been "L" shaped but was badly preserved, and mostly recognizable for its dense concentration of chich.

My excavations suggest that the Jach Group had at least two major construction phases, both of which occurred in the Late Formative and possibly into the early Terminal Formative (Figure 6.15). However, there are also strong indications that this spot was a locus for Middle Formative activity before stone masonry construction began. In the rest of this section, I will discuss the Jach Group's construction history, its location and intra-settlement features, and its material culture.

6.5.2. Jach Group construction history and techniques

The Jach Group is among the most complex of the residential architecture at Tzacauil (Figures 6.11, 6.16. While it was not reoccupied (at least in a detectable way) during the Late to Terminal Classic occupation of Tzacauil, it was renovated at least once in the Formative and was simply too large to excavate entirely. These complexities made it difficult to document the group's construction history as fully as was possible in other groups, especially because I wanted excavations to minimize disturbance of later architecture as much as possible. With that in mind, what are we able to say about the Jach Group's construction history and techniques, based on the data available?

To begin, the Jach Group offers some clues to a Middle Formative occupation at Tzacauil. Middle Formative sherds can be found in the fill of many of the Tzacauil house

Figure 6.12 Southeast corner of the Jach Group, with Tzacauil Acropolis to the left

Figure 6.13: Bedrock “shelf” on the northwest side of the Jach Group

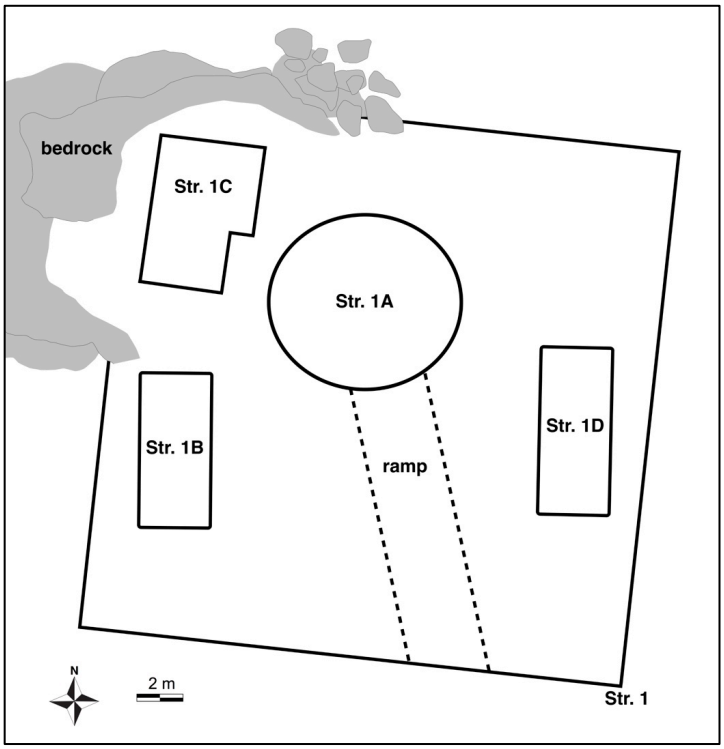

Figure 6.14 Stylized plan of the Jach Group

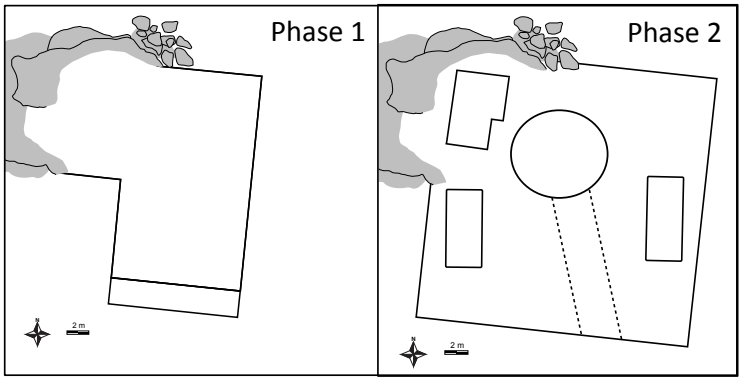

Figure 6.15 Stylized plan of construction phases of the Jach Group

groups, but no domestic architecture can be definitively associated with that period. This is consistent with the general pattern in Yaxuná (though there are exceptions, e.g. 6E-30 Group; see Chapter 4). At least at Tzacauil this Middle Formative occupation seems not to have involved stone construction, only transient settlements of perishable structures. Perhaps only a few middens had been left behind.

However, the Jach Group has significantly more Middle Formative sherds than were found in the fills of any other house group. These sherds were most likely carried along for the ride as Late Formative builders scooped up soils to use as fill during construction episodes. Though they are not in primary contexts, they can alert us to "hot spots" of Middle Formative activity at Tzacauil. So the fact that more Middle Formative sherds are found here than anywhere else suggests that this part of the site – perhaps the bedrock outcrop on which the Jach Group was built – was a locus for repeated Middle Formative activity. The bedrock outcrop here is flat and elevated, and it makes sense that semi-mobile people would have been attracted to it, perhaps even visiting it season after season or year after year.

All of this is to say that when Late Formative builders selected this bedrock outcrop to begin building with stone, they or their ancestors may have already had a strong connection to this place, or at least known that others had considered it a desirable place to be. We found that the earliest fills in the basal platform (Structure 1) include high proportions of Middle Formative ceramics.

The Late Formative builders of the Jach Group were likely attracted to the natural bedrock outcrop here, which would have saved them a lot of time and energy in raising a fairly massive platform. They built up a basal platform that is now mostly concealed by the later renovation. However, excavations in targeted areas suggest that, like elsewhere at Tzacauil, basal platform construction began by "boxing in" the bedrock outcrop with boulders. The surface of the bedrock was then raised with fill to form a flat platform surface.

We can get a sense of how the Late Formative builders built up the original basal platform from excavations in Unit N08W18 (see Appendix E) (Figures 6.16-6.18). First, the builders readied the outcrop by depositing soil mixed with sascab to fill in

depressions and irregularities in the bedrock surface. They next placed large stones, either directly on the bedrock or on the prepared surface. The placement of these stones reflects a remarkable amount of construction sophistication. The stones are dry-core fill (*junta seca* in Spanish): by carefully placing the stones on a prepared surface, and stabilizing them with *cuñas* (small wedge-shaped stones), the fill layer was so secure that it did not require the addition of smaller rubble and soil to hold the large stones in place. The drawback of dry-core fill for archaeologists is that it usually is not associated with a lot of ceramic material, because it does not contain a significant amount of soil or rubble. From the few sherds found in the deepest levels of Unit N08W18, it seems that the initial builders of the Jach Group may have used earlier Middle Formative midden for their fill deposits.

Excavations on the southern side of the Jach Group basal platform illustrate how this group's architecture is more sophisticated than most, if not all, other domestic architecture at the site. The tops of the stones of the original basal platform's southern wall are visible on the surface, even though most of the original basal platform is concealed by later renovations. After we saw the top of the wall here, we used excavations in Unit N04W18 to target a section of this wall. Along with excavations in Unit N02W18, these excavations give us a sense of how the first basal platform was built and accessed. The original basal platform wall was a multi-course wall built much like modern albarradas in Yucatán (Figures 6.19-6.21). The builders took great care to prepare the area before building the wall. They deposited a thin layer of soil, possibly mixed with sascab, onto the bedrock to level it. They added a thicker layer of soil packed with small stones on top of this, further stabilizing the area. Then the first course of wall stones were placed, with care to select large, well-shaped stones. Wall stones decreased in size as it was built up, with the stones effectively locked together using strategically placed cuñas (wedge-shaped stabilizing stones).

The base of the original basal platform wall was covered by the construction of a low, wide step that apparently ran along the length of the Jach Group's south side (Figure 6.17). To make this, the builders placed large rocks over bedrock in an area in front of the basal platform wall. They capped these rocks with smaller stones and soil.

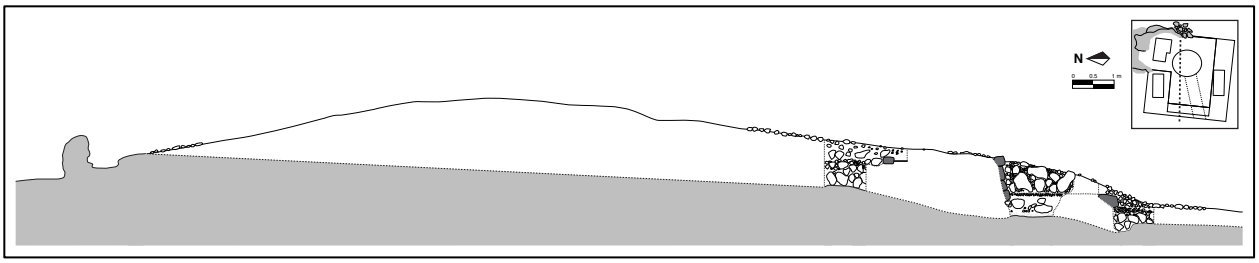

Figure 6.16 Jach Group north-south *corte* along W16 line

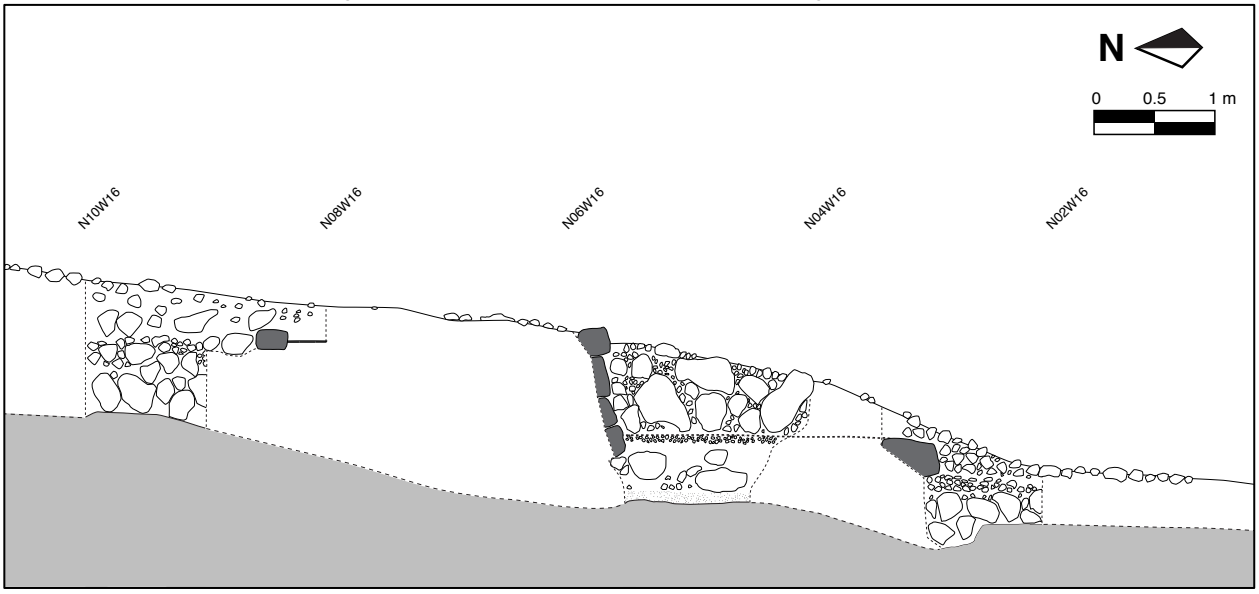

Figure 6.17 Detail of Jach Group north-south *corte* along W16 line

Then the stones of a wall were placed on this fill, creating a raised step. This step was on the same level as the base of the albarrada style wall of the basal platform, about 1.5 meters to the north. This left a depressed gap between the step and the basal platform wall.

This gap was filled in, but fascinatingly, excavations found the sherds of at least two Middle Formative vessels that had been placed at the base of the basal platform wall (Figures 6.22 and 6.23). Though these vessels had been crushed by the overlying fill, most of their pieces were recovered during excavations; this suggests that when they were interred, they were intact. In other words, the vessels were set in place, and then the step was filled in. I think based on their placement and their age, these vessels were heirlooms and left as offerings during this construction episode. This adds more credence to the idea that whoever built this platform may have been staking a long-

Figure 6.18 Jach Group Unit N08W18 Level 3.1, showing dry core fill over bedrock

Figure 6.19 Excavating earlier basal platform wall on the south side of the Jach Group

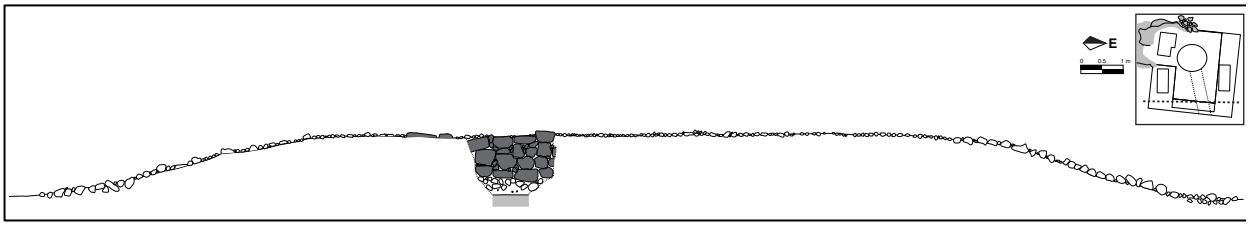

Figure 6.20 Jach Group east-west *corte* along N06 line

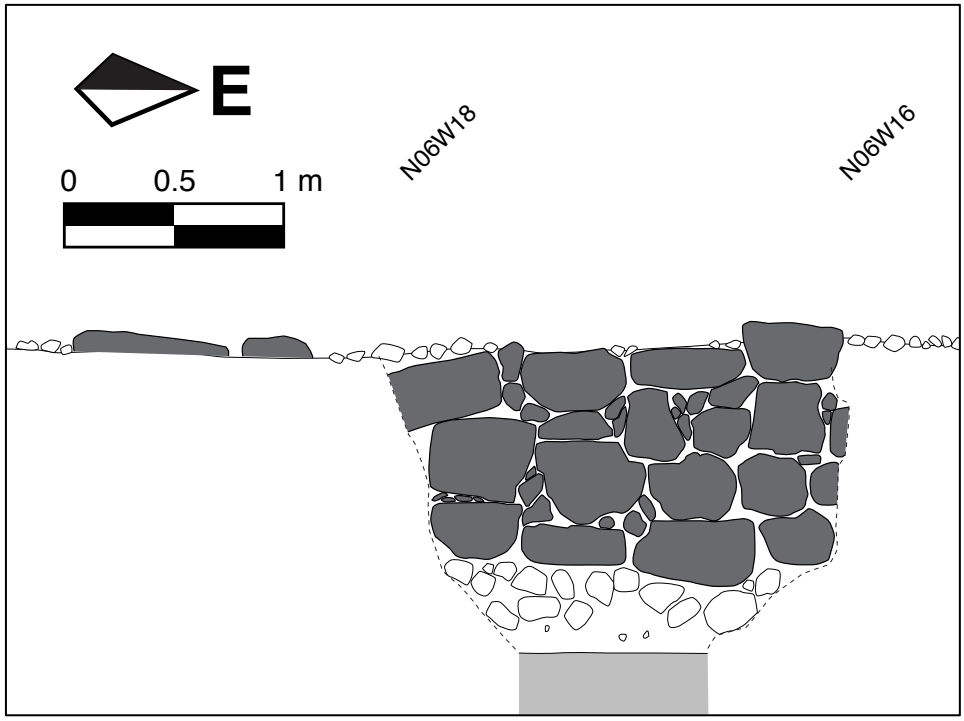

Figure 6.21 Detail of the Jach Group east-west *corte* along N06 line showing earlier platform wall and construction over bedrock

Figure 6.22 Close-up of Middle Formative ceramic vessel buried at the base of the Jach Group basal platform wall

Figure 6.23 Middle Formative ceramic vessel buried at the base of the Jach Group basal platform wall

Figure 6.24 View of the Jach Group basal platform's southern expansion and earlier platform wall

term, multigenerational claim to this particular place, reaching potentially back to the Middle Formative.

After the vessels had been placed, the area between the step and the basal platform wall was filled in with rocks and soil to level it. It was then capped with a compact layer of chich packed with soil, or bahpek. This bahpek created the surface of a low step that would have run the length of the southern side of the original basal

platform. There are some indications that one or more additional steps may have been built into the original platform's southeast corner, but because of later constructions this could not be verified.

Similarly, it could not be determined with certainty how many superstructures would have been associated with this original platform. Excavations in Unit N10W22 identified another segment of the same multi-course basal platform wall identified on the south side of the platform. It is also probable that the original platform incorporated the bedrock shelf on the northwest side, since it essentially provides ready-to-use platform space with very little modification required. But determining the original platform's dimensions is difficult because of the massive renovations that occurred. A segment of a possible wall was identified in Unit N08W18, as well as patches of floor made of packed soil and sascab that had been covered by later renovation but appear to be associated with the earlier basal platform. While these finds cannot be linked to particular structures, they do suggest that the area on top of the original basal platform supported architecture and was finished with a packed sascab floor. Based on patterns at Yaxuná and Tzacauil, it seems likely that Structure 1, the principal superstructure of the Jach Group, may have existed in some form during this first construction episode. But in the interest of minimizing disturbance to later architecture, the principal structure was not test pitted to determine whether it had existed during the platform's first occupational phase. Though it cannot be known at this time how many superstructures the original basal platform supported, it likely would have provided ample room for multiple superstructures.

Later in the Late Formative period, the Jach Group was renovated. It appears that the renovation had a couple of goals in mind: first, to create a more focused way of accessing the basal platform on the south side; and second, to raise and expand the basal platform to support additional superstructures.

Excavations on the south side of the Jach Group suggest that this renovation funneled formal access to the basal platform's southeast corner (Figures 6.17, 6.24). Again, excavations in Unit N02W18 and N04W18 were helpful in determining construction history. From our investigations of the first phase of construction, we found

that a low step ran along the length of the platform's southern side, abutting the basal platform's south wall. Now, during the renovation, this original basal platform wall and step were both covered with sloping fill. A mixture of large stones, chich, and a significant amount of soil were deposited along the south side of the platform. It appears that the ramp (recognizable as a strip of dense surface chich) was added at the same time, directing access to the platform to the southeast corner (Figures 6.25-6.27). But this is not fully understood because our investigations of the ramp were limited. A couple steps may have led to this ramp on the southeast side of the basal platform. In any case, this fill on the south side of the platform effectively covered the previous basal platform wall and its associated step.

Excavations on the western side of the basal platform indicate a different strategy for renovation (Figures 6.28, 6.29). Here, it appears that the goal was to expand the basal platform's elevated area, likely to support the construction of additional superstructures. The way that the builders accomplished this is highly sophisticated, an evaluation based on our identification of construction techniques in Unit N10W22.

The earlier multicourse basal platform wall had been built on (possibly modified) exposed bedrock on the western side. To expand the platform during renovation, builders utilized a kind of dry core fill technique involving construction cells (Figures 6.30, 6.31); this technique is identical to those identified during PIPCY's 2013 excavations of the Yaxuná East Acropolis. The builders situated vertical slabs of limestone (each about a 0.75-1 m high, and likely broken bedrock) at intervals alongside the earlier basal platform wall. These slabs created a stone scaffolding running alongside the earlier wall. The project could not excavate much further from the earlier wall without disturbing one of the superstructures, but it seems a whole area (perhaps over 3 m wide) of dry-core fill was carefully arranged along the western side of the earlier basal platform. The construction cells formed by the vertical slabs along the earlier basal platform wall minimized the need for moving massive amounts of rubble and soil. To bridge the gap between the tops of these vertical slabs, the builders situated horizontal slabs (again, likely broken bedrock) to roughly "seal" off the construction cells. They then added more dry-core fill on top of these slabs to reach the

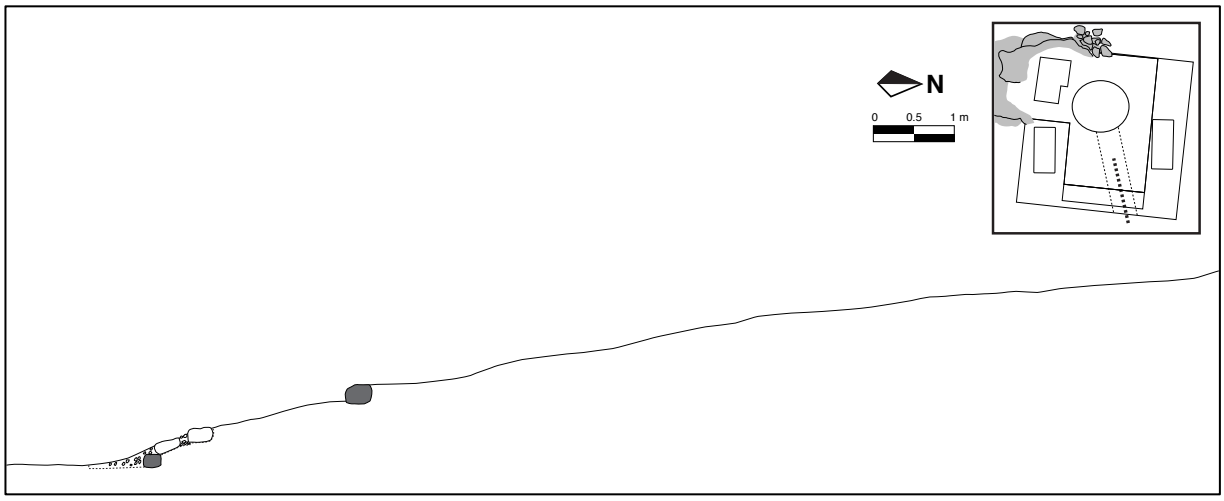

Figure 6.25 Jach Group *corte* along the basal platform's ramp

Figure 6.26 Jach Group ramp

Figure 6.27 Step at the base of the Jach Group ramp

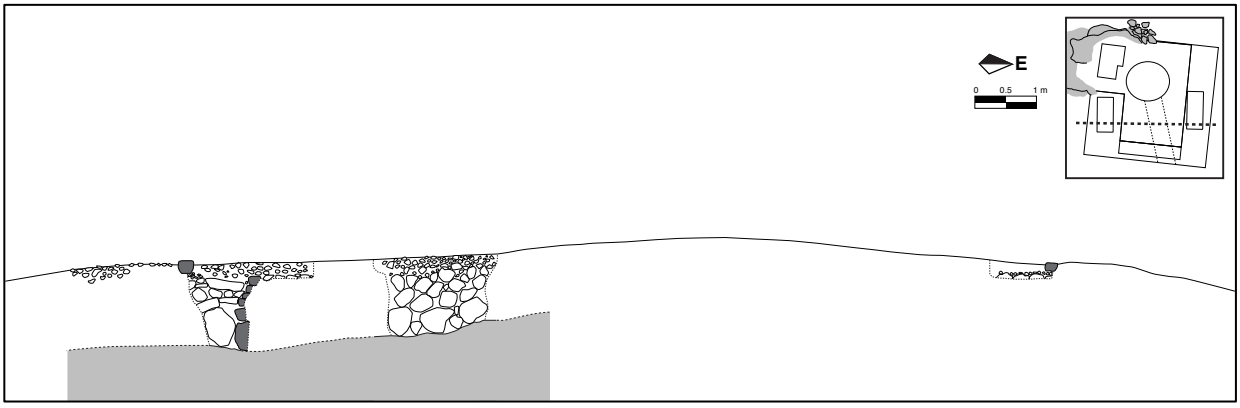

Figure 6.28 Jach Group east-west *corte* along the N11.5 line

level of the earlier basal platform. Before placing the final layer of chich and soil that would form the floor of the basal platform, the builders finished off the dry-core fill by

arranging more horizontal slabs to cover gaps (see also excavations in House Group 8 and Structure 8A for similar use of this technique) (Figures 6.32, 6.33). In at least one case, they also appear to have attempted to plug the dry-core fill gaps by wedging a chunk of construction material (burnt lime cal and sascab) between stones. With this done, a final layer of soil, chich, and smaller stones (chichitos) could be deposited without having to worry too much about it filtering down into the underlying dry-core fill.

On this newly expanded platform surface, the builders were then able to construct the Jach Group's extant superstructures (Figures 6.34, 6.35). Foundation braces were situated while the final chich and soil fill layers were being added. Denser concentrations of chich and soil were added in the interior of the structures to create floors. Again, the available data do not permit us to know if Structure 1A, the principal structure, had an earlier building phase, but at this point in the group's construction history it was built up into the small pyramidal shape it has today, and potentially divided into two rooms. The ramp, identifiable by its dense concentration of chich, connects the base of the principal structure to the southeast corner of the newly expanded basal platform.

Elsewhere around the Jach Group, areas of the basal platform could not readily be associated with either construction phase, and may in fact have been utilized by both. This seems most likely given how they show evidence of utilizing natural contours of the bedrock, which appears to have been attractive to Formative builders at Tzacauil (a similar pattern is noted at the P'aak, Sáastun, Chamal, and Kaan Groups). In excavations in the northeast part of the platform (Unit N18W02), it could be seen that basal platform walls had been placed directly on top of bedrock and followed its natural contours. Where the level of bedrock was higher, the builders placed wall stones directly on top of it, stabilizing them with cuñas. Where bedrock was lower, they first added a layer of chich and soil before placing the wall stones. Similarly, on the northwest side of the basal platform, it seems probable that builders and residents in both phases of construction made use of the natural bedrock shelf (Figure 6.36). In an area where this otherwise flat bedrock dipped down, a rough, informal wall was added to retain a small amount of fill that smoothed it all out.

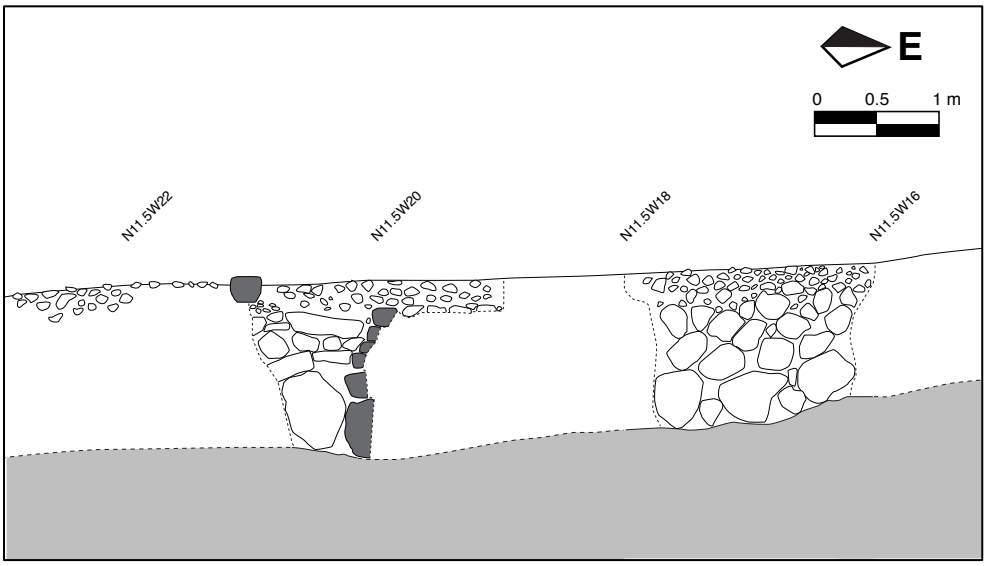

Figure 6.29 Detail of the Jach Group east-west *corte* along the N11.5 line, showing earlier basal platform wall and construction cell building technique

Figure 6.30 Construction cells on the west side of the Jach Group, Unit N10W22

Figure 6.31 Construction cells on the west side of the Jach Group in N10W22

Figure 6.32 Slabs covering dry-core fill in Unit N08W22 of the Jach Group

Figure 6.33 Slab used to “seal” dry-core fill in Unit N08W22 of the Jach Group

Figure 6.34 Excavations of Structure 1B of the Jach Group

Figure 6.35 Structure 1C of the Jach Group

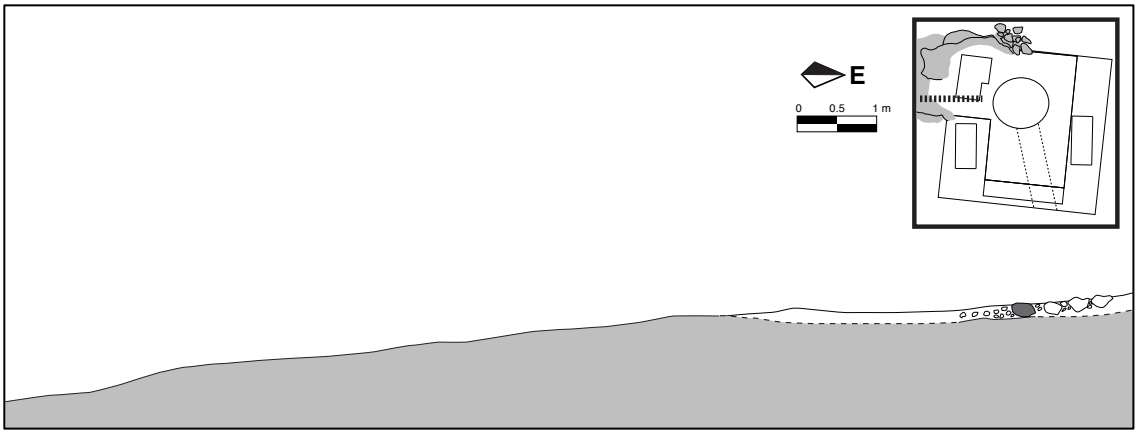

Figure 6.36 Jach Group east-west *corte* along N20 line

Figure 6.37 Stepping stones in kancab west of the Jach Group basal platform, Unit N04W28

Whereas much effort clearly went into creating formal points of access and aesthetically pleasing architecture in the Jach Group, investigations also suggest that throughout its occupation this group maintained less formal activity areas as well. For example, the bedrock shelf is fairly withdrawn from the more public side of the basal platform and would have provided an area for domestic activities. Similarly, little was done to “dress up” the exposed bedrock on the north side of the platform, suggesting that this too would have been a more private area.

Finally, excavations off the west side of the Jach Group basal platform show that rough medium and large stones had been placed in kancab (Figure 6.37). Yaxuneros excavating the group described how their grandparents would do this in their solares to create informal pathways, which in kancab were particularly important during the rainy season. These informal walkways allowed people to avoid getting muddy. Now, people in Yaxuná find it much more practical to just use cement, but it is the same idea. This may seem minor, but it is important for understanding Formative period settlement decisions. The first people to arrive in Tzcauil selected bedrock outcrops that were largely surrounded by kancab for their houses. In contrast, most of the Classic settlement is clustered in an area dominated by surface bedrock. Bedrock may be easier for walking on, but there were evidently reasons that Formative settlers were willing to settle in soil-rich areas. To accommodate this preference, they had to go to extra lengths to facilitate access during all months of the year.

6.5.3 Jach Group location and intra-settlement features

The Jach Group's location, like its architecture, marks it as different from the other Formative house groups at Tzacauil (Figure 6.1). Located just off the northwest side of the Tzacauil Acropolis and just meters north of where the Tzacauil Sacbe meets the acropolis, the Jach Group is positioned close to Tzacauil's public architecture. As I mentioned, when the group was renovated in the Late Formative, its access was rebuilt to further emphasize where the sacbe meets the acropolis. This suggests that people living here were more than aware of their proximity to these ritually charged monuments – they were actively engaging with them.

What stand out even more to me are the Jach Group's intra-settlement surroundings, which are more homogeneously soil than the terrain surrounding any other house group. The Jach Group occupies a massive bedrock outcrop that is otherwise "floating" in the largest continuous expanse of soil, or kancabal, found in the Tzacauil settlement. The survey I did with the Yaxunah *ejidatarios* found a zone of flat bedrock, riddled with the cavities known locally as *sartenejas*, approximately 60 m to the north of the group, but other than that and a few places where bedrock poked through the soil, the intra-settlement area was dominated by soil.

We excavated three intra-settlement trenches in this *kancabal*. Trench 2 (Figures 6.38-6.40), located off the north side of the Jach Group basal platform and running north for 26 meters, found soil depth to range between 4 and 45 cm. Trench 3 (Figures 6.41, 6.42) spanned the kancabal west of the Jach Group's bedrock outcrop, connecting it to the Chamal Group. This trench measured 34 meters. In units closest to the Jach Group, we excavated almost to a meter without hitting bedrock. Moving west towards the Chamal Group, the soil became shallower, ranging from 1 to 34 cm. Trench 5 (Figures 6.43, 6.44) radiated from the south side of the Jach Group and ran up to the north side of the Tzacauil Sacbe. This trench measured 26 meters and found soil depths to range from 0 to 60 cm.

Artifact densities in the trenches around the Jach Group were light. A few ceramics and lithics were found, but I am hesitant to assign these to Formative contexts. For instance, one of the very few pieces of obsidian found at Tzacauil was found in

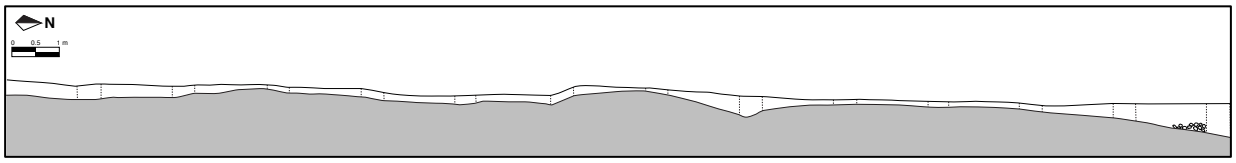

Figure 6.38 Profile of Trench 2

Figure 6.39 Trench 2

Figure 6.40 Trench 2

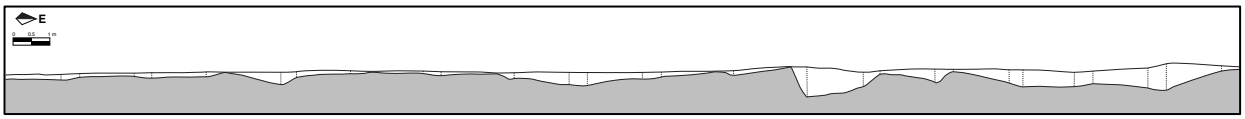

Figure 6.41 Profile of Trench 3

Figure 6.42 Trench 3

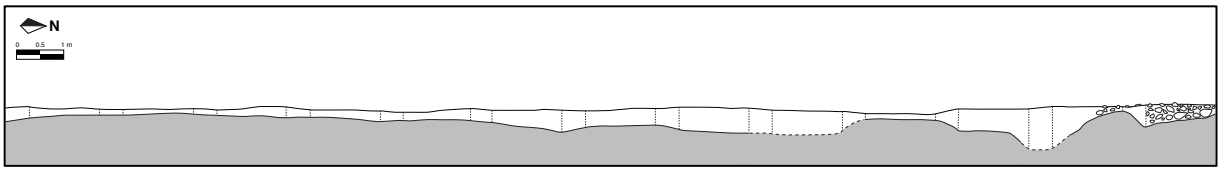

Figure 6.43 Profile of Trench 5

Figure 6.44 Trench 5

Trench 2, but there is simply no way of knowing when it was left there. Diagnostic sherds from the Terminal Classic and Middle Formative could be found in the same thin layer of soil, and so I am reluctant to attach any of these objects to the Formative occupation of the Jach Group. The other lithics that were found include basic limestone handheld tools, either grinding stones or tools for chopping (a broad category which includes tools that may have been used for breaking up soil; see Chapter 5). These could be discarded agricultural or food preparation tools but they are not found in clear enough patterns to assign specific functions to intra-settlement areas.

The soil chemistry data provide us with some clues about how the Jach Group household related to its intra-settlement lands (Figures 5.22-5.33; Appendix D). Soil chemistry analysis conducted on samples from these three trenches gave us some of the highest values for soil pH and phosphates found at Tzacauil. As seen in the schematic (Figure), phosphate levels were highest in samples to the north (Trench 2)

and south (Trench 5) of the house group. Soil acidity was lowest (i.e. pH levels were highest or most basic) to the west (Trench 3), but all areas had some of the most basic soils known at Tzacauil. This can be seen more clearly in the chart displaying the averages of intra-settlement areas per house group, where the values from Trenches 2, 3, and 5 have been averaged together. The Jach Group has the highest pH value of all the house groups occupied exclusively in the Formative (and second highest when the re-occupied southwestern area of the site is included). With the Chamal Group to the west, which shares Trench 5 as part of its intra-settlement area, it also has the highest average phosphates of Tzacauil intra-settlement areas.

These elevated values have to be taken with a grain of salt (see Chapter 5 for discussion of the caveats) but they are consistent with what we would expect from a household adopting place-based agricultural strategies over the course of multiple generations. Elevated pH levels in Yucatán are typically an indicator of regular deposition of ash. While this could indicate burning was taking place in these areas, I tend to think of it more as a sign that ash from fires elsewhere was being scattered. Discarding ash in this way could be both a household waste management strategy as well as an intentional practice of fertilizing cultivated areas. In the same way, elevated phosphates can be the result of repeated food preparation, or repeated discard of household waste, including food refuse and human and animal waste. Over time, these wastes enhance the soil. Both the elevated pH and phosphates are signaling interrelated processes of waste management and soil amendment.

I interpret the elevated phosphates and pH around the Jach Group as part of a cycle of waste management and fertilization, probably of a garden or infield agricultural plot. It is not useful to assign one or the other strategy – waste management or intentional garden fertilization – when interpreting these levels; at the multigenerational scale that the Jach Group's household was situating itself in the Tzacauil landscape, these processes are one and the same. The longer a household lived and grew in a place, the more waste it would accumulate, the more fertile its soil would be, the more productive its infield agriculture would be, the longer the household would remain there,

and the cycle repeats. This is even observable ethnographically in Yucatán (see Chapter 3).

Carbonates (which are measured using interval values; see Chapter 5) were also particularly high around the Jach Group compared to readings from samples elsewhere. Looking at the distribution of samples with elevated carbonates, I suspect that the elevated carbonates south of the Jach Group (in Trench 5) may be the result of lime processing related to construction of the Tzacauil Sacbe and/or Acropolis. Elevated carbonates to the north (Trench 2) and immediately off the basal platform to the west (Trench 5), however, may be related to nixtamalization. Repeated washing of maize with lime, and then dumping the water, could produce these signatures.

The measurement of nitrite was done, more as an exploratory test, as well on half of the samples from these three trenches. Values were generally low north of the house group (Trench 2) but a few samples in the west (Trench 3) and south (Trench 5) registered as elevated in nitrites. Nitrites are a potential indicator of human urine (see Chapter 5) but have not been as studied as phosphates, carbonates, and pH in archaeological soil chemistry in Yucatán. Like phosphates and pH, elevated nitrites could be interpreted as evidence for interrelated processes of waste management and soil enhancement, since ethnographically we know that urine can be used as fertilizer (see Chapter 5). For now this remains unresolved and something I will continue exploring in future studies.

All together, the intra-settlement data from around the Jach Group show that its household selected an area characterized by the deepest and most expansive stretches of soil in the site. These soils bear the chemical markers of long-term, multigenerational-scale household processes potentially related to nixtamalization and the management of household wastes (ash, food waste, human and animal waste) in ways that would enhance soil fertility. This suggests a place-based focus on agricultural strategies, one supported by the group's construction history and material culture.

6.5.4 Jach Group material culture

The inventory of all artifacts recovered from excavations in the Jach Group can be found in Appendices A, B, and C. A brief summary of what was found will be provided here, to facilitate the inter-house group comparisons that will be made at the end of this chapter, and expanded on in Chapter 9.

Ceramics at the Jach Group were almost exclusively Middle Formative and Late Formative types. The Jach Group had exponentially more Middle Formative sherds (n= 117, total mass 2134.4 g) than any other house group excavated (Table 6.1; Figures 6.3, 6.4). This includes the two vessels that had been placed as an offering during a Late Formative construction episode.

Clearly diagnostic Terminal Formative sherds were not well-represented in the assemblage, leading me to believe that the Jach Group was likely abandoned by in the early Terminal Formative. Only a light scattering of Classic period sherds were found and are not enough to assign a Classic re-occupation of the house group. The Jach Group had the highest ceramic density of the "pure" Formative house groups at Tzacauil (Figure 6.45; Table 6.2). A total of 498 sherds or 5657.4 grams of ceramics were found in the 230 square meters excavated, providing an average sherd density of 2.166 sherds per square meter. By mass, the average ceramic density was 24.60 grams per square meter.

In terms of identifiable vessel shapes, the Jach Group had 206 jar fragments and 198 bowl fragments (Table 6.3; Figures 6.46-6.49). This can be broken down by period. Middle Formative sherds include 46 jar fragments and 70 bowl fragments. All Formative period sherds include 94 jar fragments and 200 bowl fragments. The Classic sherds found in the Jach excavations include 8 jar fragments and 26 bowl fragments. The takeaway from this vessel data is that there is a ratio of about two bowls for every jar in the Formative period assemblage.

Lithic artifacts (n=63) were found during excavations of the Jach Group. Stone tools found at the Jach Group were predominantly made of local limestone, though two artifacts of chert were also identified. Grinding stones were the easiest to identify in this assemblage, and included 6 metate fragments, 5 one-hand grinding stones, and 1 indeterminate grinding stone. The grinding stone assemblage suggests that Jach

House group	Square meters excavated	Total sherd count	Mean sherds per m^2 excavated	Total mass of ceramics (g)	Mean ceramic mass (g) per m^2 excavated
Jach	230	498	2.165	5657.4	24.597
P'aak	161	118	0.733	1302.8	8.092
Chamal	262	610	2.328	5177.9	19.763
Sáastun	178	150	0.843	953.7	5.358

Table 6.2 Ceramic density across Formative house groups

Context	Jars (Middle Formative)	Bowls (Middle Formative)	Jars (Formative)	Bowls (Formative)	Jars (Classic)	Bowls (Classic)	Jars (all periods)	Bowls (all periods)
Jach	46	70	94	200	8	26	206	198
Pa'ak	9	13	23	56	0	1	38	56
Chamal	3	16	75	253	5	13	266	254
Sáastun	5	17	21	60	0	4	48	60
Kaan	9	14	159	131	52	12	397	144
Pool	4	7	94	250	111	45	488	296
Jaltun	0	0	1	0	8	13	9	13
T'uup	0	0	0	0	4	0	7	0
Tzacauil Acropolis	0	28	77	102	0	0	77	102
TOTALS	**76**	**165**	**544**	**1052**	**188**	**114**	**1536**	**1123**

Table 6.3 Ceramic vessel form counts in Tzacauil house groups and Tzacauil Acropolis excavations

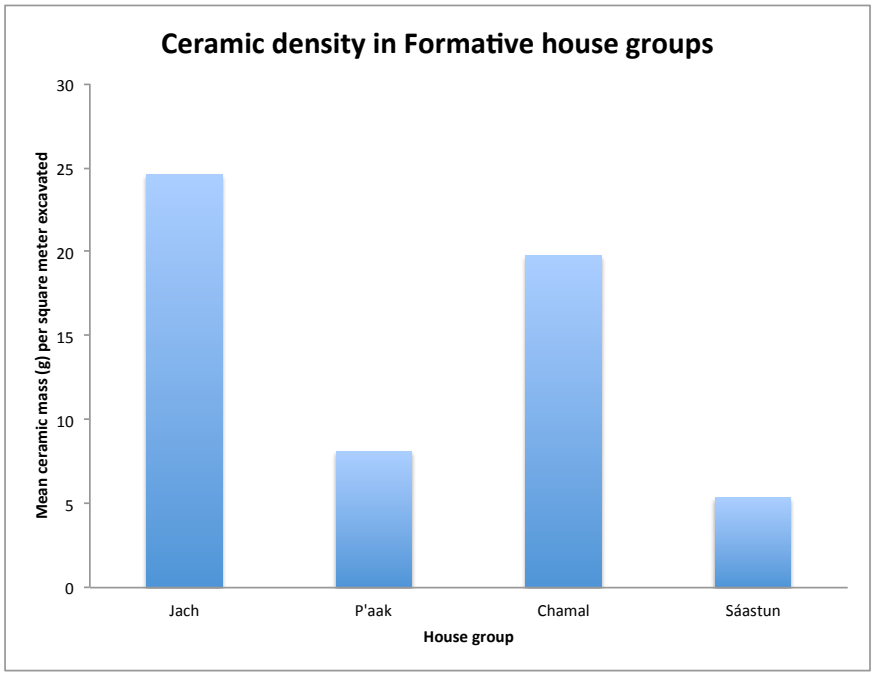

Figure 6.45 Ceramic density in Formative house groups at Tzacauil

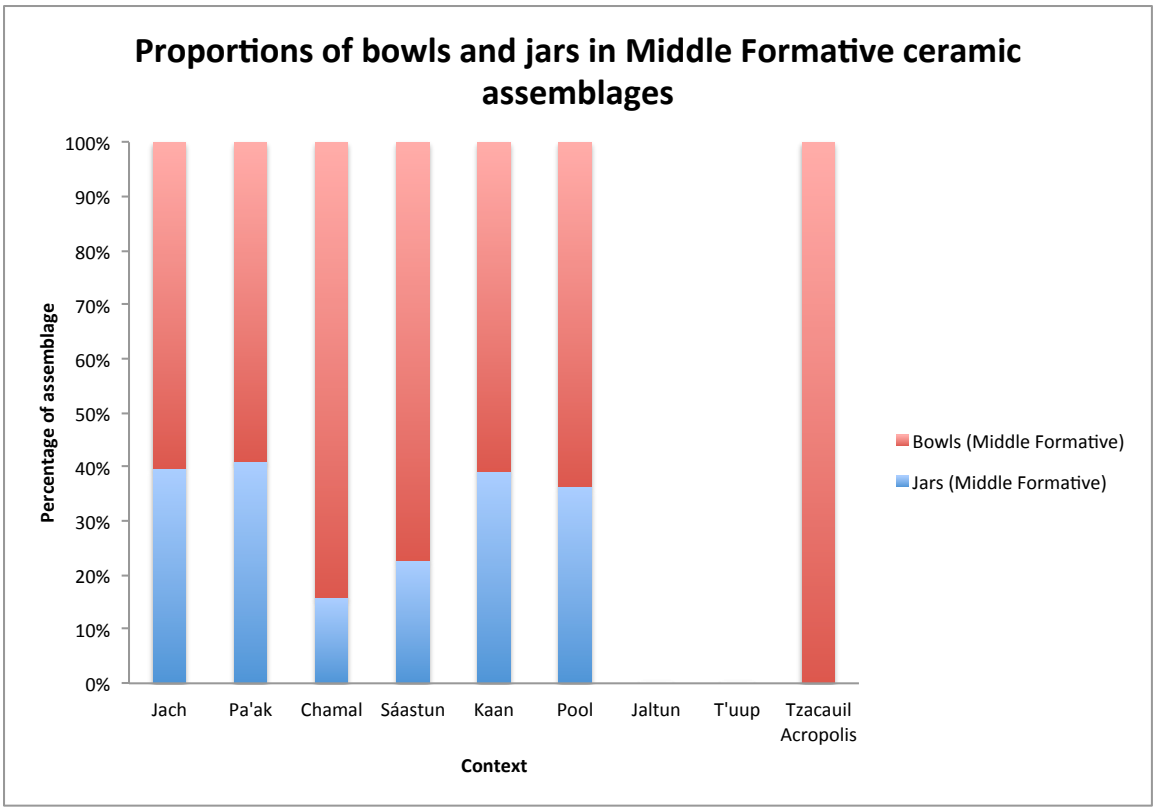

Figure 6.46 Proportions of bowls and jars in Middle Formative ceramic assemblages

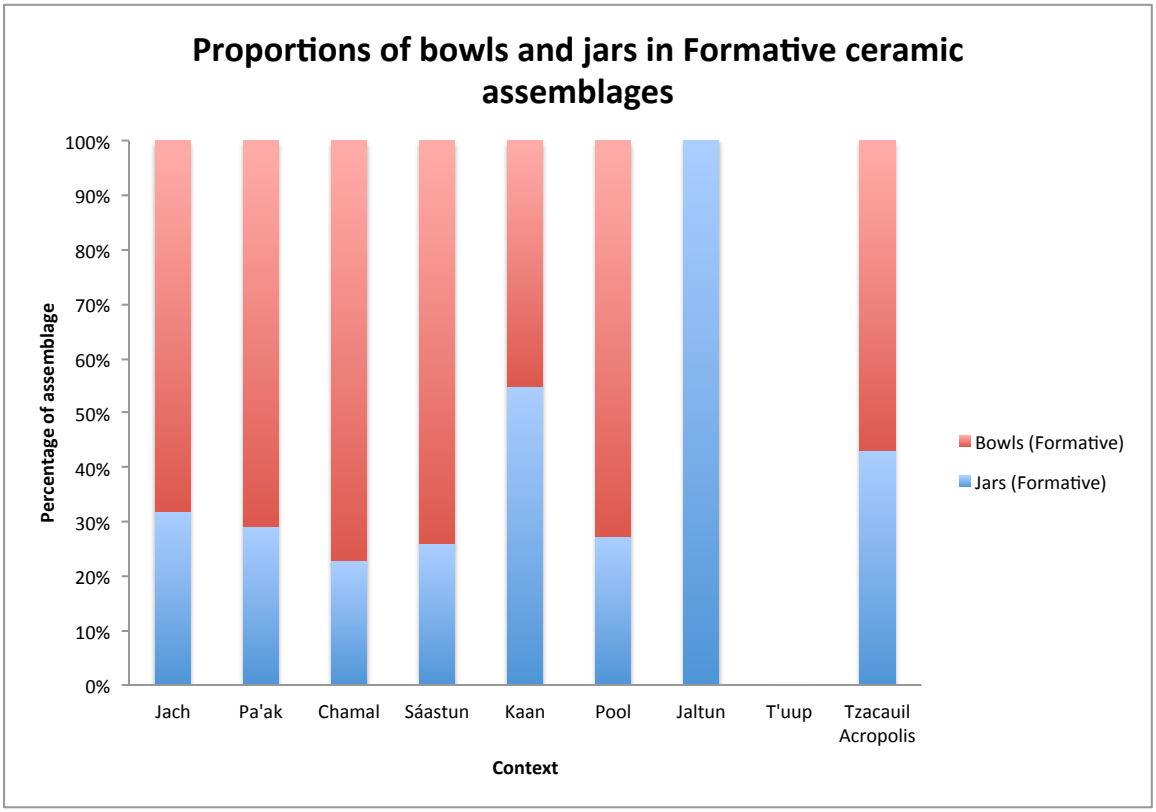

Figure 6.47 Proportions of bowls and jars in Formative ceramic assemblages

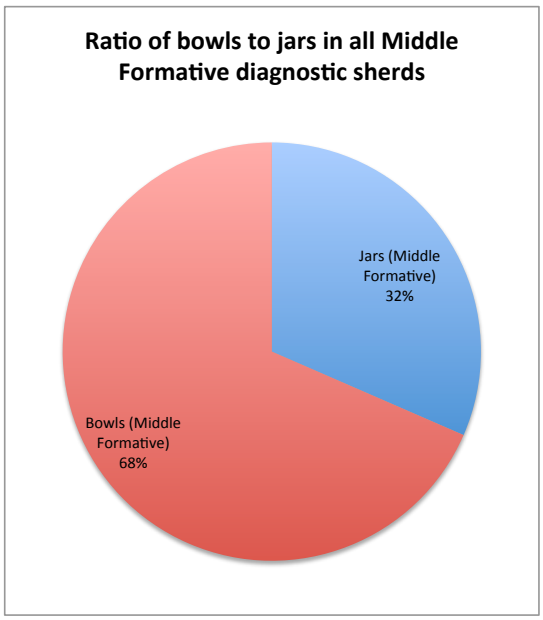

Figure 6.48 Ratio of bowls to jars in all Middle Formative diagnostic sherds

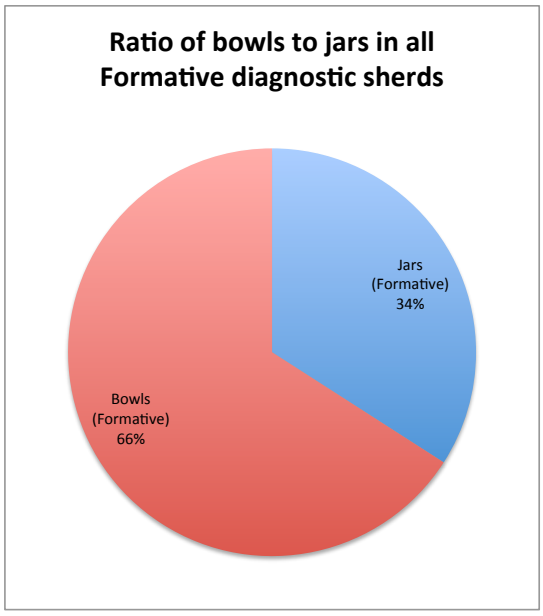

Figure 6.49 Ratio of bowls to jars in all Formative diagnostic sherds

Figure 6.50 Metate fragment found in the fill of the Jach Group, Unit N24W14 1.1

residents were pursuing grinding strategies that were both portable (i.e. moveable metates) and bedrock-based (i.e. one handed grinding-stones). During excavations we also recovered two large pieces of a broken metate trough discarded in the fill of the Jach Group basal platform (Figure 6.50).

Aside from grinding stones, the other limestone tools were fairly crude and so it was difficult to assign a clear function to many of them. But with that said, I tentatively identified tools that may have been used for polishing (n=3), scraping (n=4), chopping (n=6) and stone-working (including chipped stone debris) (n=38).

6.6 The P'aak Group

6.6.1 Overview of the P'aak Group

The P'aak Group consists of a pair of structures located just south of where the Tzacauil Sacbe meets the base of the Tzacauil Acropolis (Figures 6.1, 6.51-6.53). The eastern construction, designated Structure 4A, is a rectangular basal platform constructed over a bedrock outcrop that supported at least one superstructure. The second structure of the pair, Structure 4B, is about 10 m west of Structure 4A and consists a low platform supporting one superstructure, divided into three rooms. The platform construction of both Structures 4A and 4B includes substantial open, elevated areas. These are likely areas where outdoor activities would have taken place. Based on the excavations my team and I did here in 2017, I have concluded that these two structures were likely used together by a single or shared social unit (e.g., household or family). The ceramics we found in the P'aak Group suggest that the two structures were constructed around the same time, in the Late Formative, and abandoned around the time of the Late to Terminal Formative transition.

6.6.2 P'aak Group construction history and techniques

We will start with Structure 4A, the eastern of the two structures in the P'aak Group (Figures 6.54, 6.55). The Structure 4A basal platform is rectangular and integrates a natural bedrock outcrop on its south side. Builders were likely attracted to the elevated bedrock outcrop that now underlies this structure. In many places, particularly on its southwest side, the outcrop is extremely flat and would have provided a stable, elevated living surface (Figure 6.56).

To prepare the outcrop for construction, the builders constructed a retention wall that arcs, roughly from west to east, along the north side of the bedrock outcrop's highest point (Figure 6.57). In some areas, the stones of this wall were placed directly on the surface of bedrock. In other places where bedrock dipped lower down, soil (possibly mixed with sascab or burnt lime construction material) was first deposited to help level the building surface. Wall stones were stabilized with *cuñas* where necessary. This arcing wall reinforced the addition of rough stones and soil that leveled out the

Figure 6.51 P'aak Group

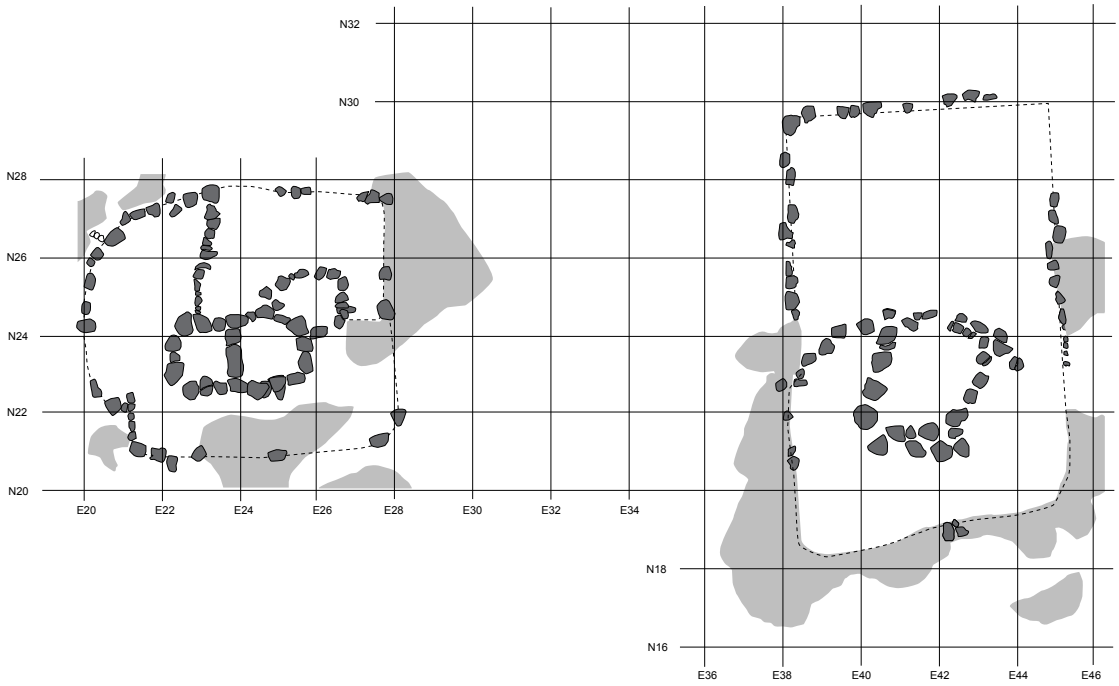

Figure 6.52 Plan of the P'aak Group excavation

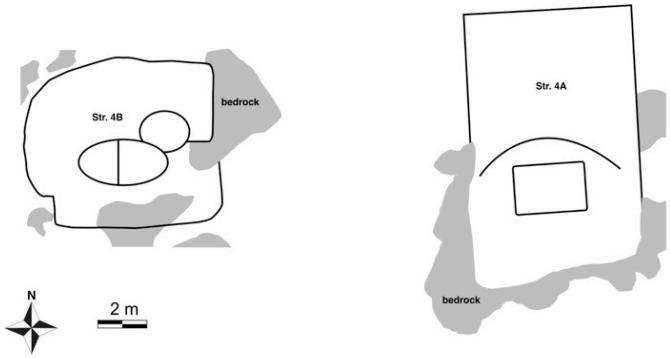

Figure 6.53 Stylized plan of the P'aak Group

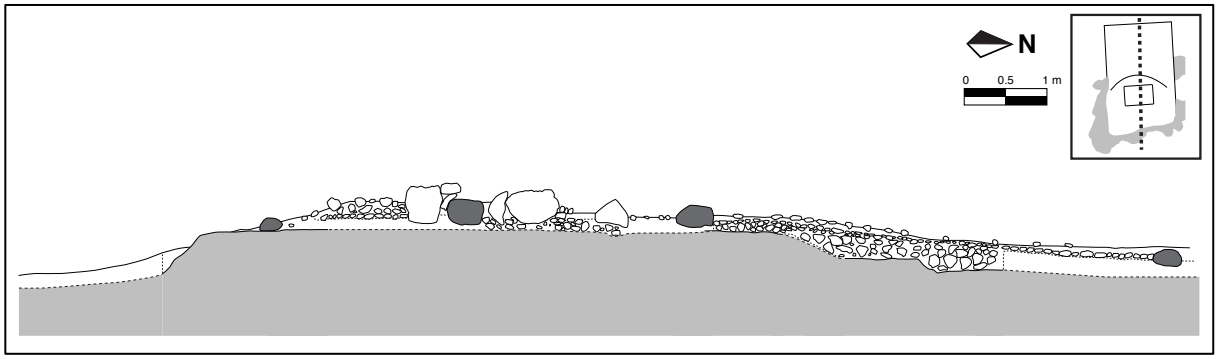

Figure 6.54 North-south *corte* of Structure 4A of the P'aak Group

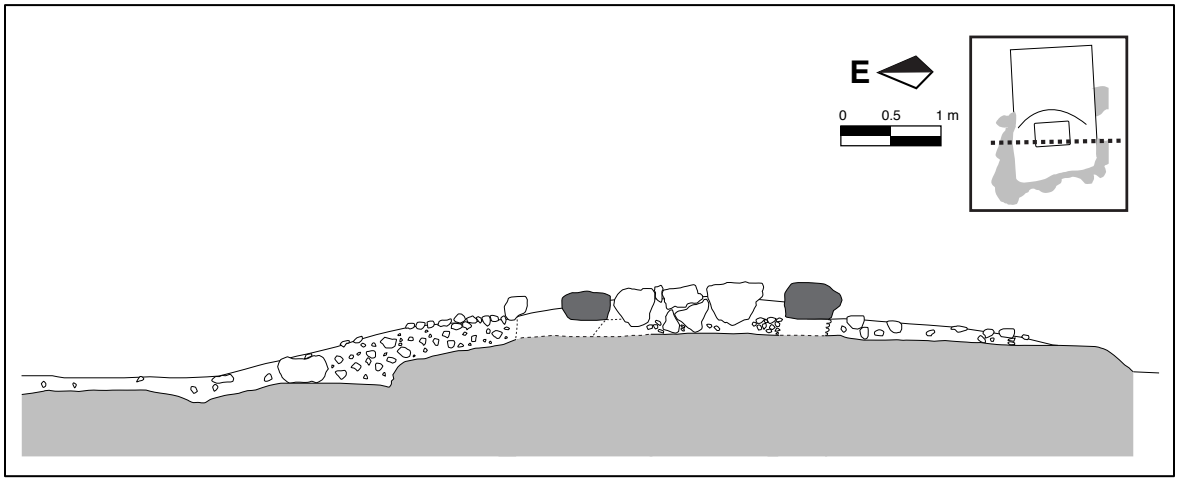

Figure 6.55 East-west *corte* of Structure 4A of the P'aak Group

Figure 6.56 Excavating Structure 4A of the P'aak Group

surface of the bedrock. Elsewhere, only thin layers of fill were necessary: a thin layer of chich and soil covers the relatively flat surface of bedrock along much of the southern side of the outcrop. Formal retention walls were mostly unneeded on the southern side of the outcrop, since so little fill was required to smooth its surface. However, at the

back (south side) of the platform, the builders “bridged” a gap in the bedrock outcrop with a rough retention wall and fill. This shows how they worked with the natural contours of the bedrock whenever possible.

Having leveled and stabilized the bedrock outcrop, the surface was ready for the addition of a superstructure (Figure 6.58). At the time of excavation, this superstructure had collapsed and some of its wall stones had been robbed. As a result it was difficult to determine the structure’s original form and dimension, but it appears to have been roughly rectangular. Careful excavations in this superstructure revealed its basic construction history. To prepare the highest point of the bedrock outcrop, the P’aak builders first prepared a surface by depositing about 15 cm of soil mixed with small and medium stones, directly on top of bedrock. Once the bedrock had been covered with this fill layer, large stones were placed on top of it to form the walls of the superstructure. As opposed to the single-course foundation brace structures often found in central Yucatán, this structure appears to have used albarrada style construction: large stones were first placed, and then successively smaller stones were added as additional courses and stabilized with cuñas. After the first course of wall stones had been placed, more chich and soil was added both inside and outside the structure, partially covering the bases of the wall stones. Soil would have likely been packed to form a floor, but since abandonment this soil has since filtered down to the lower levels of the construction. This surface level of chich and soil is the so-called *nivel original* (original level) and would have been the living surface for the residents of the P’aak Group.

The north side of Structure 4A shows a different construction. The underlying bedrock is lower here. The builders seem to have wanted to extend the platform out to the north by creating a gently sloping surface that would have simultaneously facilitated access while also providing additional space for domestic activities. To accomplish this, they leveled and reinforced the bedrock by adding a layer of bahpek – tightly placed small stones and soil – that was itself stabilized by walls of medium-sized stones that form a rectangular apron in front of the underlying bedrock outcrop (Figure 6.59). Where bedrock was extremely shallow, bahpek was not as necessary. It must also be noted

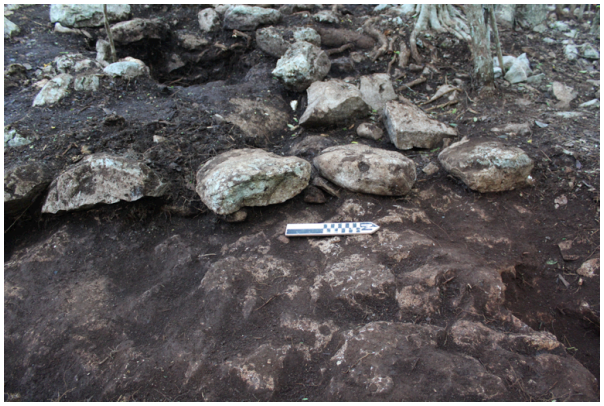

Figure 6.57 Arcing wall of Structure 4A of the P'aak Group, Unit N24E44

Figure 6.58 Structure 4A of the P'aak Group after excavation

Figure 6.59 Exposed bahpek north of Structure 4A, P'aak Group

Figure 6.60 Structure 4B of the P'aak Group

that this gentle ramp construction is very close to the base of the Tzacauil Acropolis, and may have fulfilled a desire for a more formal access facing the site's monumental architecture. Interestingly, east of the ramp, excavators revealed that medium and large sized stones had been placed in kancab, right up alongside the Acropolis. These stones may have also facilitated access around and between these structures during the rainy season months, similar to what was noted around other structures at Tzacauil. It is also important to note that the northern extreme of this ramp was so low that it had been concealed by a thin layer of soil accumulation and collapsed rubble associated with the southern part of the structure. Like other excavations at Tzacauil, excavations here confirmed that the post-abandonment soil accumulation at the site is generally only about 5-10 cm.

Now we will shift our focus on to the western structure of the P'aak Group, Structure 4B. Whereas Structure 4A incorporates a substantial bedrock outcrop, Structure 4B is much lower and built at ground level. It consists of an irregularly shaped (but roughly square) low platform supporting a three-roomed superstructure (Figure 6.60).

The construction techniques of Structure 4B's low basal platform vary in different areas, suggesting different construction needs and, potentially, different uses (Figures 6.61, 6.62). West of the superstructure, bedrock is lower than elsewhere in the vicinity. To deal with this, builders deposited medium-sized stones mixed with kancab to raise the area to the level of the shallow bedrock to the east (Figure 6.63). Before they deposited this fill, they interred a Middle Formative vessel in a cavity in the bedrock (see description for Unit N26E20); the interment of this heirloom may have marked a multigenerational claim to this particular place. The fill on this side of the platform had to be larger to deal with the lower bedrock here, and, interestingly, it was not capped with a layer of chich, only soil. The placement of medium stones in kancab as exhibited by this side of the platform is consistent with other residential areas of Tzacauil, where stones were placed in soil to facilitate walking during the rainy season.

The lack of dense surface chich on the west side of Structure 4B is very different from what is found on the structure's northeast side. Here, bedrock is much shallower. It seems that builders took advantage of this shallow, flat bedrock, to add a layer of bahpek – dense chich and soil – creating a stable, slightly elevated surface that could support and withstand regular domestic activities. To reinforce and demarcate this stable surface, effectively separating it from the larger stone fill to the west, the builders added a rough retention wall running north-south on this side of the platform. This bahpek surface appears to have provided an activity area associated with the superstructure; it also likely facilitated access to the superstructure. Here and to the southern side of the platform, bedrock is fairly shallow and level and so could be easily transformed into a living surface with a little modification. Bedrock was so shallow that very little chich and soil was needed to smooth it – for this reason, even retention walls

were not always necessary, and so Structure 4B's platform walls include large gaps where no reinforcement was necessary.

The superstructure on this low platform was added after the underlying bedrock surface had been prepared with a thin (6 cm) layer of soil and sascab (or possibly burnt lime) before the first course of wall stones were placed. Like Structure 4A's superstructure, the superstructure here at Structure 4B seems to have been built in albarrada style: an initial course of large stones followed by successively smaller stones, all of which was stabilized with cuñas only (i.e. no mortar) (Figures 6.64, 6.65). The interior of the structure was then smoothed and raised slightly with a layer of chich and soil, and finished with a packed soil surface, which has since disintegrated and filtered down to the bedrock. Somewhat unexpectedly, the interior floor surface is slightly lower than the bahpek surface found outside (north) of the superstructure; this may simply be a product of the fact that bedrock is slightly higher north of the superstructure.

In any case, it appears that the original superstructure here was apsidal. Either from the beginning or at a later date, the structure was divided into two rooms. The third room of the superstructure appears to have been added last, perhaps as part of the construction of the bahpek surface north of the superstructure. Like the bahpek surface, the interior floor level of this third room is somewhat higher than the interior floor level of the other two rooms. However, based on the data I do not believe that the addition of this third room represents a separate construction phase, because the eastern wall of the apsidal structure had been placed to accommodate this higher floor level. It seems that the entire structure was constructed in a single phase.

However, it should be noted that all three rooms in Structure 4B are extremely small; the Yaxuneros working on site insisted that they were too small for people and instead were for animals. Whether or not that specific suggestion is true, it does seem that in their final use, these rooms were not used for sleeping or other activities (i.e. cooking) and may have served some special function related to storage or animals. However, the structure's use could easily have changed over time.

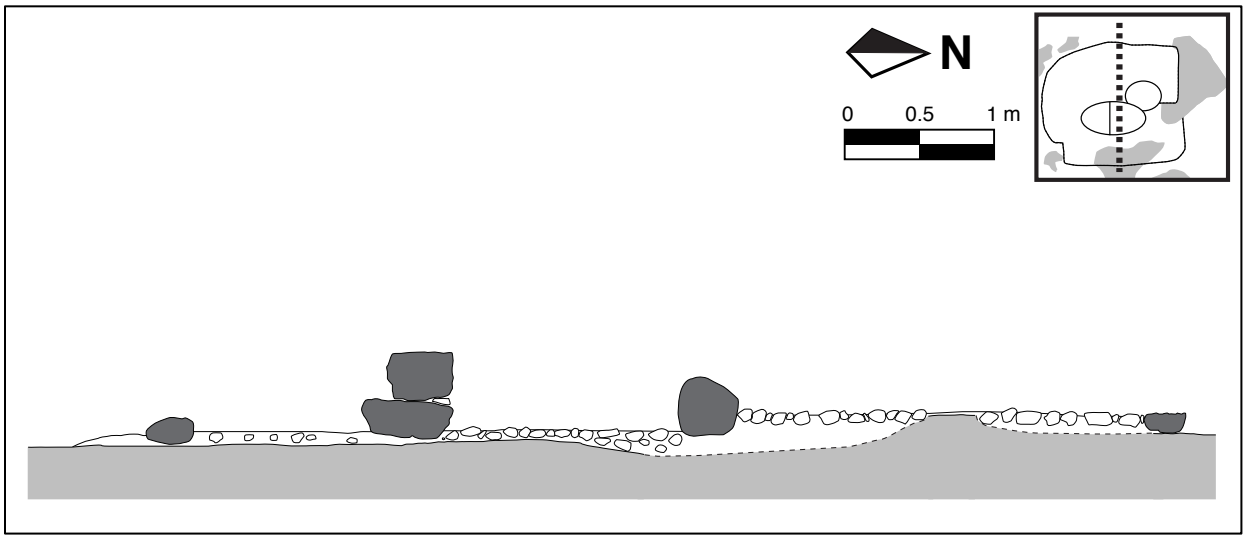

Figure 6.61 North-south *corte* of Structure 4B of the P'aak Group

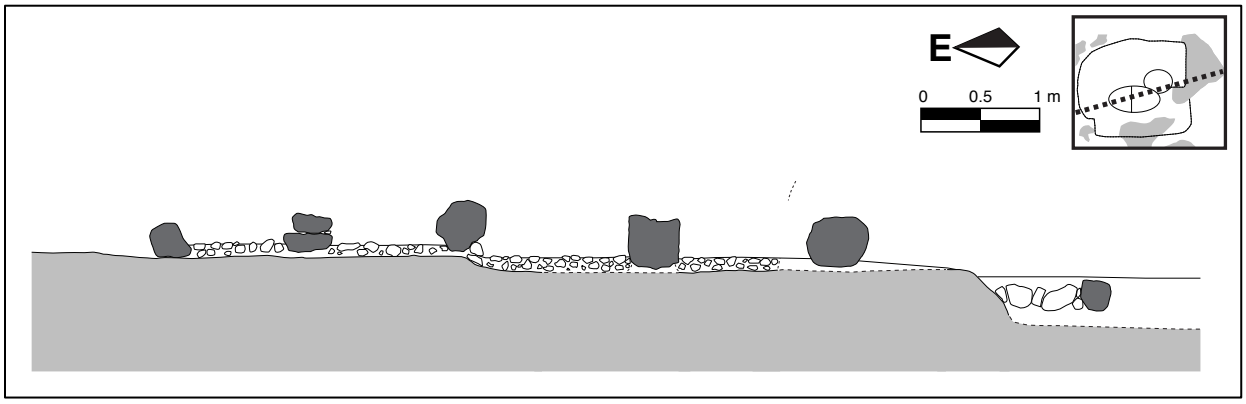

Figure 6.62 East-west *corte* of Structure 4B of the P'aak Group

Figure 6.63 Stepping stones in kancab around perimeter of Structure 4B, P'aak Group

Figure 6.64 Figuring out wall fall in Structure 4B, P'aak Group

Figure 6.65 Structure 4B of the P'aak Group after excavation

The ceramics from both structures suggest a single phase of construction in the Late Formative period. With that said, based on my excavations of Formative house groups in Yaxuná and Tzacauil, I would suggest that Structure 4A was likely built first because large, elevated bedrock outcrops seem to have been the most favored Formative construction sites. If this is true, then Structure 4B may represent the growth in size and/or changing needs of the household or social unit associated with Structure 4A. This cannot be known for sure, and in any case I do not see enough evidence to suggest that the two structures are from chronologically distinct phases.

6.6.3 P'aak Group location and intra-settlement features

In terms of location, the P'aak Group is somewhat like a mirror of the Jach Group: both are located on opposite sides of the Tzacauil Sacbe, both are nestled up against the Tzacauil Acropolis, and both are built on bedrock outcrops that are otherwise "floating" in expanses of soil (Figure 6.1). These commonalities are important

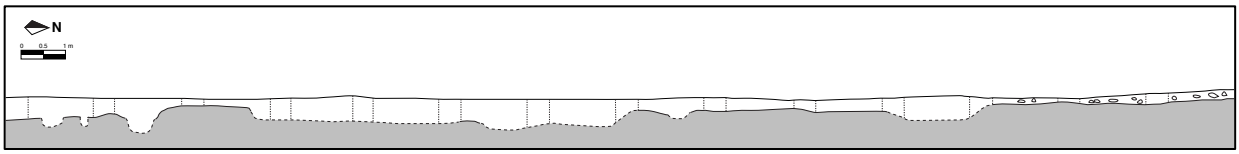

Figure 6.66 Profile of Trench 6

for thinking about what Late Formative farmers were attracted to when they settled at Tzacauil.

When I surveyed the P'aak Group's intra-settlement areas with the *ejidatarios* from Yaxunah, we determined that it is predominantly surrounded by kancab soil. To the immediate east of the P'aak Group is the Tzacauil Acropolis, but moving clockwise from there, the house group is surrounded by homogeneous kancab flats. If you go about 40 meters southwest away from the P'aak Group, you reach an area of exposed bedrock – the kind that is flat and full of *sartenejas,* the small bedrock cavities that serve as reservoirs in the rainy season. You reach a similar kind of terrain moving about the same distance to the northwest. For comparison, at the Jach Group, you have to go about 60 meters away from the group before you reach an area of exposed bedrock. Exposed bedrock is closer here, but there is still ample room for cultivation in the area immediately surrounding the house group. And it is important to remember that exposed bedrock has other uses in Yucatán, namely in that its cavities can be used for container-style cultivation and seasonal water storage (see Chapter 3).

There are two intra-settlement trenches that explored the kancabal around the P'aak Group, Trench 6 and Trench 7. Trench 6 ran across the kancabal from the south side of the Tzacauil Sacbe up until the north side of the P'aak Group, spanning 28 meters (Figures 6.66, 6.67). Our excavations found more sherds and discarded lithic artifacts in this trench than in many of the other intra-settlement trenches excavated (see Appendix B), which I interpret as evidence of this being a highly trafficked area. It is important to remember that even abandoned sacbes can facilitate forest travel, and so the elevated artifact density around the sacbe is not necessarily a product of Formative period activity (see, for comparison, the account of how Sacbe 1 facilitated the founding of modern Yaxunah in the 20th century in Chapter 8). Close to the sacbe,

Figure 6.67 Trench 6

soil depths ranged from 6-40 cm, though these depths were variable from unit to unit. In units closest to the P'aak Group, soil depth increased to 50 cm without finding bedrock.

Trench 7 ran south from the P'aak Group towards the neighboring Sáastun Group, crossing a distance of 30 meters through kancabal (Figures 6.68, 6.69). The open area between these two groups is fairly expansive, and I wanted to maximize excavations in the zone between the groups. For this reason, Trench 7 began slightly south of the P'aak Group and ended slightly north of the exposed bedrock around the Sáastun Group. Neither end of Trench 7 goes directly up to the house groups; intead this trench gives us a sense of the broad open area between the two groups. Soil depth throughout this trench was again highly variable but typically measured 20 to 40 cm, though some units had less and others were excavated to 50 cm without finding bedrock. Discarded stone tools (mostly grinding stones) were found in this trench, but not with enough frequency or patterning to assign a clear land-use strategy here. No ceramics were found.

Soil chemistry analyses were run on samples from Trench 6 and Trench 7 and offer potential insights into land-use strategies (Figures 5.22-5.33; Appendix D). Soils south of the P'aak Group (Trench 7) had slightly more acidic (i.e. lower pH values) than soils north of the group (Trench 6). Both north and south areas had similar phosphate and carbonate values when compared as averages across the trenches, but the schematic (Figure) provides more interesting details. Phosphates are fairly elevated off

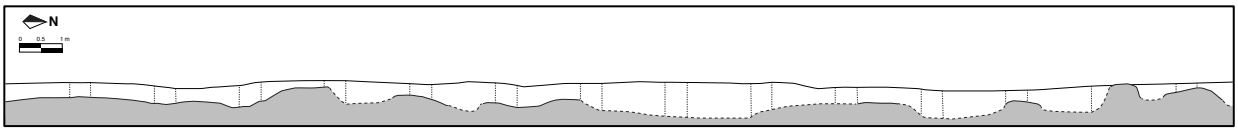

Figure 6.68 Profile of Trench 7

the Tzacauil Sacbe, but then drop down as you approach the P'aak Group from the north. South of the group, phosphate levels are higher before again tapering off as you approach the neighboring Sáastun Group. In terms of pH, values are somewhat elevated south of the Tzacauil Sacbe in Trench 6, but do not stand out as particularly elevated in the area between the P'aak Group and Sáastun Group (Trench 7). Carbonates are elevated just south of the sacbe in Trench 6 but do not register as particularly elevated elsewhere in the area surrounding the P'aak Group aside from a few slight readings (i.e. a 1 on the interval scale; see Chapter 5) in the area between the P'aak and Sáastun Groups.

Testing for nitrites, which can be linked to human urine, was also conducted on half of the samples from these trenches, but as I have said these tests were experimental and require more evaluation. With that said, soil samples from the southern half of Trench 7, that is, the side closer to the Sáastun Group, had consistently elevated levels of nitrites. No nitrites were found in Trench 6. Until more is known about the nitrite tests, these results cannot be assigned to specific land-use practices.

When soil chemistry data are averaged across the two trenches and compared to other intra-settlement areas, the P'aak Group's pH, phosphate, and carbonate levels do not stand out as particularly elevated; phosphates are slightly lower than those around the Jach and Chamal Groups, and pH is higher than at the Chamal Group but lower than at the Jach Group.

My interpretation of the soil chemistry data from around the P'aak Group suggests that its household was focusing much of its domestic activity on the south side of the house group, away from the Tzacauil Sacbe. Carbonates, an indicator of nixtamalization and/or lime processing, are fairly low all around the group but likewise are highest (though only slightly) south of the P'aak Group, between it and the neighboring Sáastun Group. I interpret the elevated carbonates just south of the

Figure 6.69 Trench 7

Tzacauil Sacbe to be more likely related to processing activities related to the construction of the sacbe and acropolis.

Phosphates and pH are slightly elevated to the south of the P'aak Group, which is consistent with the habitual discard of ash and other kinds of household refuse. That these activities were restricted to the south indicates that the front of the group, that is, the side just off the Tzacauil Sacbe, was kept relatively clean. As I discussed with regards to the Jach Group, these elevated levels may be the product of interrelated processes of waste management and soil enhancement. Combined with the fact that, like the Jach Group, the P'aak Group suggests a strong household preference for living surrounded by soil in the Formative, these soil chemistry data suggest to me that people were likely gardening or practicing intensive agriculture in these soil flats, perhaps focused on the south side of the P'aak Group. These soil chemistry data have to be taken as suggestive, as always, but to me these lines of evidence are consistent with Late Formative place-based agricultural strategies.

6.6.4. P'aak Group material culture

An inventory of all the artifacts found in the P'aak Group excavations can be found in Appendices A, B, and C. Here I will just briefly summarize what was found to aid in the inter-house group comparisons at the end of this chapter and again in Chapter 9.

P'aak Group ceramics are predominantly Middle and Late Formative types, as well as transitional Late to Terminal Formative types. There is only one Classic period sherd, and this is not enough to infer Classic period re-occupation. Based on the relative paucity of Terminal Formative sherds, I conclude that the P'aak Group fell out of occupation probably by the early Terminal Formative. In terms of early material, the P'aak Group had 24 Middle Formative sherds, with a total mass of 360.9 grams. This includes a vessel that had been placed in a bedrock cavity during a Late Formative construction episode. Across 161 square meters excavated at the P'aak Group, a total of 118 sherds was found with a mass of 1302.8 grams. This makes for a ceramic density of 0.73 sherds or 8.09 grams per square meter.

In terms of identifiable vessel shapes, there were 38 jar fragments and 56 bowl fragments from all time periods. Breaking this down, we see that there were 9 Middle Formative jars and 13 Middle Formative bowls. For all Formative sherds there were 23 jars and 56 bowls. A single Classic bowl fragment was found. The takeaway from these data is that there is a ratio of about two bowls for every jar fragment in the P'aak Group's Formative assemblage.

Lithic artifacts (n=62) were recovered from the P'aak Group excavation. Most of the artifacts were made of locally available limestone, though there were also a few examples that could have been non-local chert. An obsidian blade fragment was also found, though it came from an off-mound unit and so cannot be definitely associated with the P'aak Group's Formative occupation. Grinding stones in the assemblage included 3 metate fragments, 1 molcajete fragment, 7 two-hand grinding stones, 3 one-hand grinding stones, and 2 indeterminate grinding stones. The grinding stone assemblage suggests that P'aak residents were pursuing grinding strategies that were

both portable (i.e. moveable metates with two-hand grinding-stones) and bedrock-based (i.e. one handed grinding-stones).

In addition to grinding stones, the other lithic tools were rough and it was often difficult to assign them a clear function. With that in mind I tentatively identified stone tools linked to polishing (n=7), scraping (n=19), chopping (n=5), cutting (n=1), perforating (n=5), and stone-working (including chipped stone debris) (n=9). These suggest the processing of various kinds of raw materials here at the P'aak Group during its Formative occupation.

6.7 The Sáastun Group

6.7.1 Overview of the Sáastun Group

The Sáastun Group is located at the southeastern limit of the Tzacauil settlement, and is the most far-flung of the Formative house groups (Figure 6.1). The group consists of a boulder-lined platform (Structure 3) constructed over a large natural outcrop of bedrock (Figures 6.70-6.73). On top of the platform, the bedrock's highest rise was incorporated into a superstructure, which I will refer to either as Structure 3A or the principal structure. In front (north) of the principal structure, the platform consists mostly of a flat, open activity area. In the northwest corner of the platform, there are traces of a small rectangular superstructure, designated Structure 3B. The Sáastun Group also includes an ancillary structure, Structure 3C, located a few meters off the southwest side of the basal platform. Off the platform's south side, we also identified a pile of rocks that may have been an ancillary structure associated with the Sáastun Group; whether or not it was a structure could not be determined and so it will not factor into further discussion of the group. Based on our excavations, I conclude that the Sáastun Group was built in a single construction episode at the Late to Terminal Formative transition. It appears to have been abandoned (potentially in the middle of a renovation of the group's principal structure) during the Terminal Formative to Early Classic transition.

6.7.2 Sáastun Group construction history and techniques

Our knowledge of the Sáastun Group's construction history is based on horizontal excavations on the basal platform (Structure 3) and its superstructures (Structures 3A and 3B), as well as of the group's ancillary structure (Structure 3C). I will begin with excavations on the basal platform and its associated superstructures (Figures 6.74-6.77).

Horizontal excavations on the Sáastun Group's basal platform were conducted with two main goals. First, large areas of the platform's elevated patio space were excavated to the level of platform fill, to find artifacts associated with activities that took place on the platform. Second, platform and structure fill were strategically excavated at specific places on the platform to collect data on its construction history: what techniques and materials were used, whether the platform underwent multiple stages of construction, and the timing of building episodes based on diagnostic ceramics found in fill.

As stated earlier, the basal platform was built over a large, natural outcrop of bedrock. This particular outcrop seems to have been attractive to Late Formative settlers because its surface is elevated and quite flat. The builders extended and enclosed the north side of this bedrock outcrop with boulder alignments (Figure 6.78). In some places where the team excavated, like on the north side of the platform, these boulder alignments were placed directly on bedrock. Elsewhere, a thin layer of soil (possibly mixed with sascab or burnt lime cal), was placed first to level the bedrock surface in preparation for the boulder wall. In other places, the bedrock was prepared with a layer of bahpek – tightly packed chich, small stones, and soil – to help stabilize the boulder wall.

Once the bedrock outcrop had been enclosed with boulders, the builders deposited a layer of large, rough stones to raise the level of the platform (Figure 6.79). It seems they were seeking to meet the level of the naturally elevated, flat portion of the bedrock outcrop to the south. In some areas, the builders prepared the bedrock before adding large stone fill by using stone slabs to roughly seal off natural cavities in the bedrock. This expedited construction and stabilized the platform by preventing fill from slumping into bedrock cavities.

Figure 6.70 Sáastun Group

Figure 6.71 View off the north side of the Sáastun Group basal platform

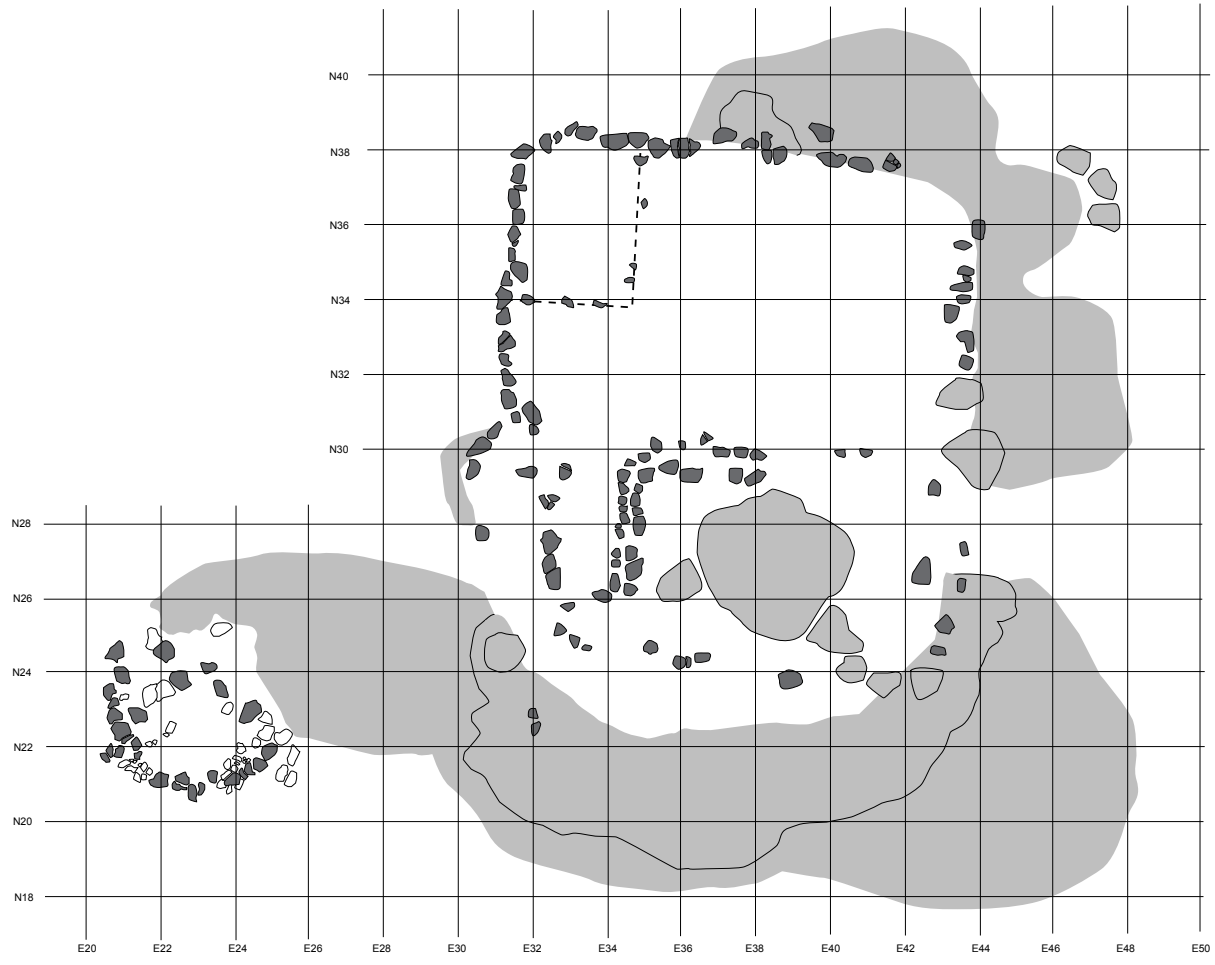

Figure 6.72 Plan of the Sáastun Group excavation

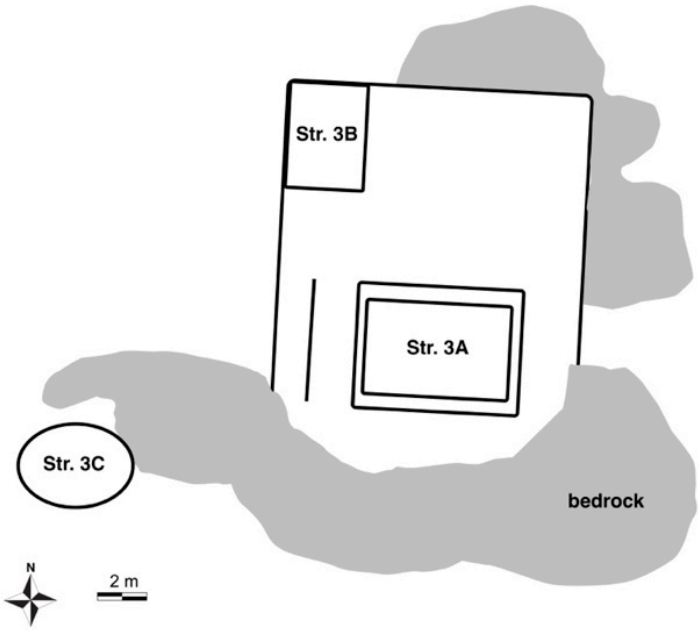

Figure 6.73 Stylized plan of the Sáastun Group

After depositing the rough fill of large stones on the northern side of the platform, the builders added a layer of fist sized cobbles, or chich, before finishing with a final layer of soil, which may have been mixed with sascab or other construction material. On the southern side of the platform, however, the natural contours of the bedrock made stone fill unnecessary; they were already fairly flat and so were only finished with a thin layer of soil.

As I have said, there were at least two superstructures on the Sáastun Group's basal platform. The group's principal structure, Structure 3A, is constructed around the highest part of the underlying bedrock outcrop (Figures 6.80, 6.81). This pinnacle is substantially higher than the rest of the platform, and required substantial preparation to support a superstructure. The builders surrounded the outcrop with fill, which required additional reinforcement on the western side; an extra retaining wall was added here. This wall may have also facilitated movement between the house group's basal platform and its ancillary structure to the southwest. The principal structure itself was built on two low platforms, formed by rectangular foundation braces which frame the bedrock outcrop. On top of the bedrock outcrop, a layer of cobbles (chich) was found, indicating that the surface had been prepared for a floor. However, how this principal structure

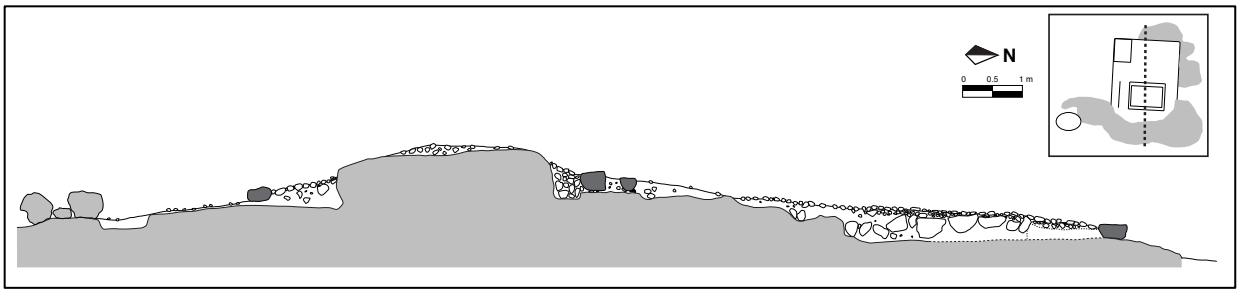

Figure 6.74 North-south *corte* of the Sáastun Group basal platform

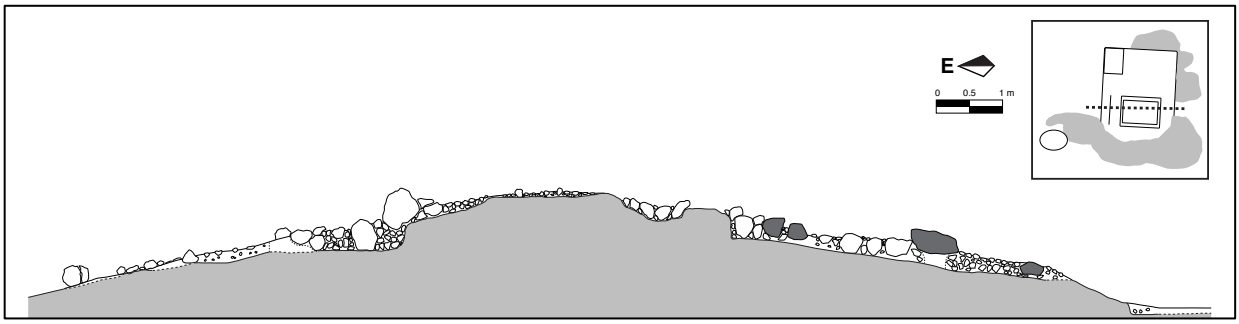

Figure 6.75 East-west *corte* of the Sáastun Group basal platform along N28 line

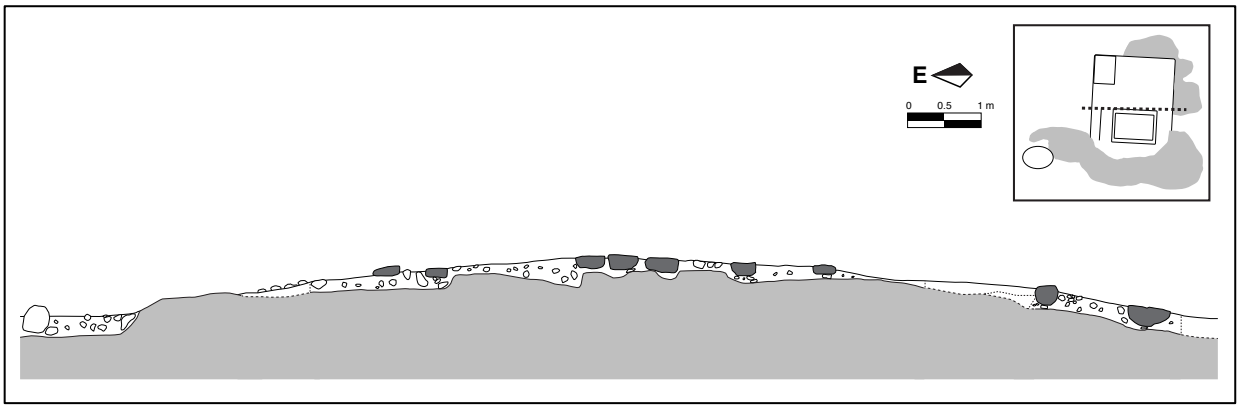

Figure 6.76 East-west *corte* of the Sáastun Group basal platform along N30 line

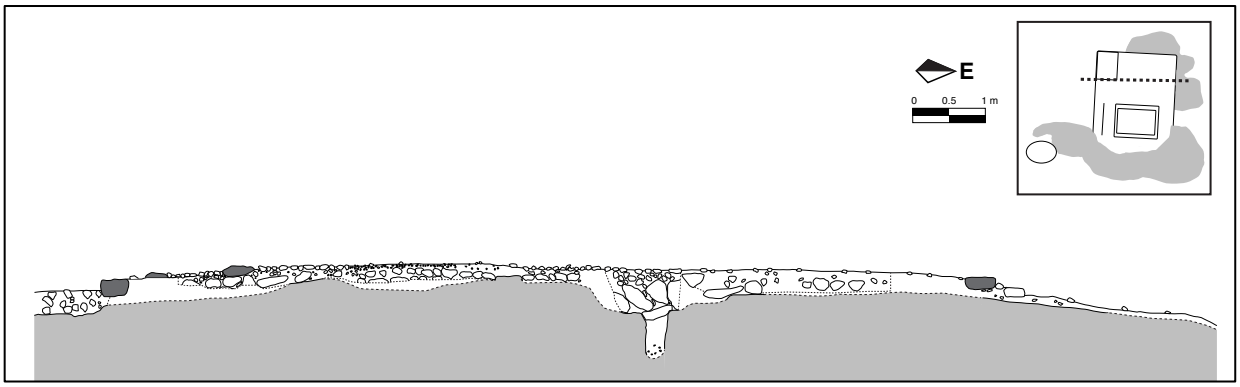

Figure 6.77 East-west *corte* of the Sáastun Group basal platform along N34 line

was used remains unclear based on the project's excavations. Some of the *ejidatarios* on the excavation team even thought that it appeared unfinished: there simply were not enough stones to have created a level surface for superstructure construction. Regardless of whether it was finished, Structure 3A may not have been used for daily domestic functions (i.e. sleeping, eating) but perhaps rather for some sort of less frequent or ritual purposes.

The other superstructure, Structure 3B, occupies the northwest corner of the basal platform and is only recognizable as a dense concentration of cobbles (chich) (Figure 6.82). Excavations showed that this chich had been placed after construction of the rest of the basal platform. A concentration this dense would have provided stability as a floor for a perishable superstructure. A few stones were found retaining the chich, but in general this structure lacked formal foundation braces. The north and west boulder alignments of the basal platform would have helped support a perishable superstructure here.

Now we will shift our attention away from the basal platform, to the small ancillary structure, Structure 3C, off its southwest side (Figures 6.83-6.86). Based on the identifiable foundation braces, this would have been an apsidal structure with a packed soil floor, measuring about 5-15 cm over bedrock. There was no chich subfloor ballast associated with this structure, though in some areas, rough stones were included in the fill to help support the foundation braces. Outside the structure in some areas, the excavators found some areas where chich had been mixed with soil; this may have served to stabilize the structure and facilitate access. Similarly, exposed bedrock on the northeast side of the structure may have been used as a stable accessway to the structure. Cavities in the bedrock here had been filled in, perhaps to make it easier to walk on. Burned rocks were found in excavations associated with this structure. Structure 3C may have served as the kitchen for the Sáastun Group, though the building's function could have changed over time.

Based on our excavations and review of the ceramic data, I conclude that the Sáastun Group's basal platform, superstructures, and ancillary structure were all built in a single construction phase at the Late to Terminal Formative transition. Excavations

Figure 6.78 Excavations on the western side of the Sáastun Group basal platform

Figure 6.79 Fill of the Sáastun Group basal platform

Figure 6.80 Structure 3A of the Sáastun Group

Figure 6.81 Excavating Structure 3A of the Sáastun Group

Figure 6.82 Structure 3B of the Sáastun Group

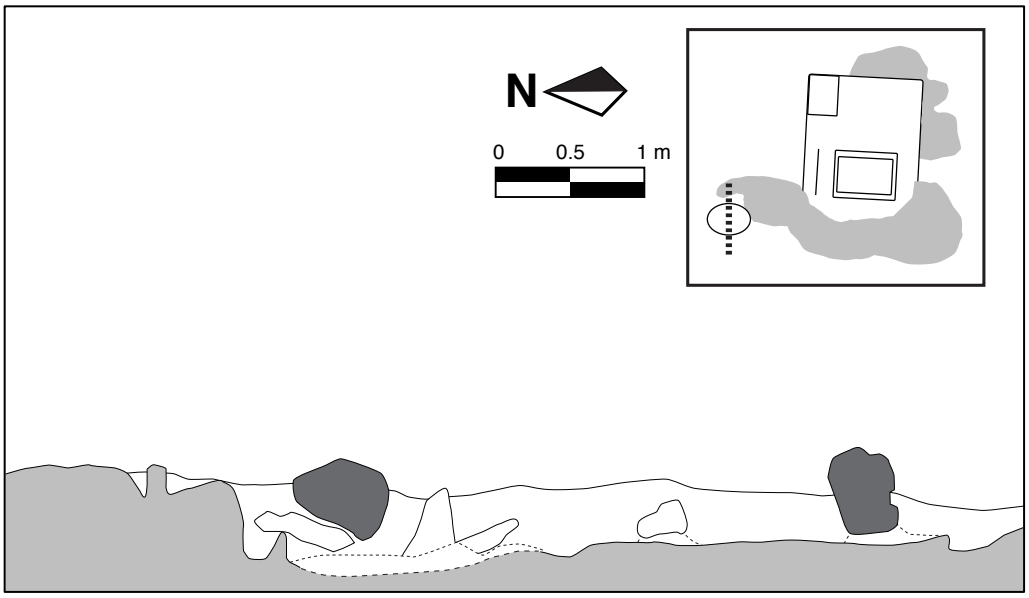

Figure 6.83 North-south *corte* of Structure 3C of the Sáastun Group

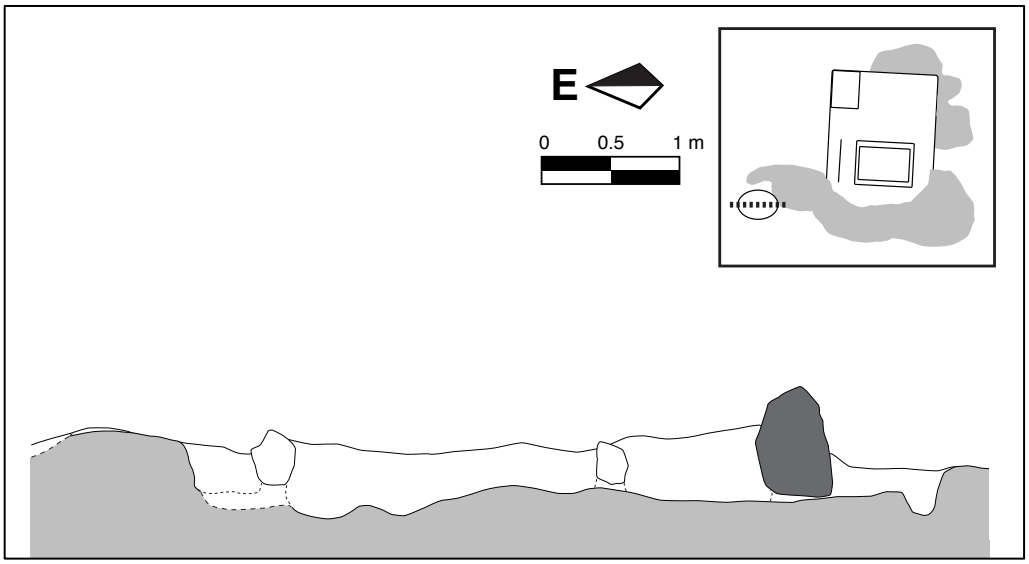

Figure 6.84 East-west *corte* of Structure 3C of the Sáastun Group


Figure 6.85 Structure 3C of the Sáastun Group


Figure 6.86 Excavating Structure 3C of the Sáastun Group

recovered a few sherds dating to the Terminal Formative to Early Classic transition, but Classic period materials were not represented.

6.7.3. Sáastun Group location and intra-settlement features

The Sáastun Group's location and associated intra-settlement areas indicate an interesting shift at Late Formative to Terminal Formative Tzacauil. This same shift is observable in the location and intra-settlement areas of the Chamal Group and Kaan Group, which were both settled during this same transition. Now, Formative farming households looking to settle at Tzacauil had to make compromises – they were not the first-comers, and prime kancabales had already been claimed by the people living at the Jach and P'aak Groups. All the same, these new-comers seem to have been willing to go to great lengths to build their homes in areas surrounded, as much as possible, by soil-rich kancabales.

The builders and residents of the Sáastun Group were able to secure an area still predominantly kancab, but to do so they had to go pretty far away from the Tzacauil Sacbe and Acropolis. Given the fact that all Formative architecture is oriented towards this monumental complex (even the Sáastun Group), and given that all other Formative house groups are built right off the sacbe, this distance from the central ceremonial artery reads as a compromise to me.

But out here, there were still unclaimed kancabales. These kancabales were not as deep or as expansive as those around the Jach and P'aak Groups, but they still would have afforded Sáastun farmers and gardeners plenty of opportunities for localized cultivation around their homesite. The Sáastun Group is built on a bedrock outcrop that extends, as exposed boulders of crumbling limestone, several meters out to its north side. Further north of that is the kancabal situated between the Sáastun Group and the P'aak Group. On the east side, there is a fairly large expanse of flat exposed bedrock, the kind riddled with cavities called sartenejas. West of the group is technically a kancabal, but the soil is so thin that bedrock peeks through in several places before fully emerging as a flat expanse further to the west. South of the group there are ample kancabales, framed by areas of exposed flat bedrock further to the southeast and

southwest. Again, it is important to remember that these areas of exposed bedrock have cavities that can be used for container-style planting and seasonal water storage (see Chapter 3). Even still it seems that expanses of kancab were preferred by Formative settlers.

The project excavated one trench around the Sáastun Group, and that was Trench 7 – this is the one that spans the kancabal between the Sáastun Group and the P'aak Group and was discussed earlier. To briefly recapitulate, Trench 7 ran for 30 meters, beginning a few meters south of the Páak Group and ending a few meters north of the bedrock expanse north of the Sáastun Group. Soil depth was highly variable but ranged between 20-40 cm, though some units went to 50 cm without finding bedrock. A few discarded stone tools, mostly grinding stones, were collected. No ceramics were found.

Because of logistical limitations, we did not excavate a trench south of the Sáastun Group but we did collect soil samples from a transect measuring 22 meters. For the sake of consistency I call this transect Trench 10, even though a trench was not excavated here. Trench 10 provides soil chemistry data for the southern kancabal behind the Sáastun Group.

Soil chemistry tests on samples from Trench 7 and Trench 10 were conducted to collect data on pH, phosphates, carbonates, and nitrites (Figures 5.22-5.33; Appendix D). When sample values are averaged across each trench, neither trench stands out with particularly high or low averages for any chemical signature except phosphate; Trench 10 has slightly higher phosphate on average than most other areas examined at Tzacauil.

However, when we move away from averages across trenches and look at the gradient of sample values displayed in the schematic plot, it is easier to get a better idea of the soil chemistry patterns. Along the entire length of Trench 10, samples from the south side of the Sáastun Group had consistently elevated phosphate levels. In contrast, samples from the north side (Trench 7) were much lower in phosphates. Similarly soils south of the group were more basic (i.e. higher pH levels) than soils north

of the group. Carbonates were present in low amounts north of the group, but completely absent from all samples taken south of the group.

As I indicated in the previous section, we also tested for nitrites in half the soil samples. Values were low or non-existent in Trench 10, but Trench 7 had high values of nitrites in the samples taken from the southern units, that is, the side closest to the Sáastun Group. More testing will be required to evaluate the significance of nitrite in archaeological soil chemistry, but in the meantime it is worth noting simply that those elevated levels are there.

Taken as a whole, the picture of the intra-settlement area around the Sáastun Group suggests to me that place-based agricultural strategies, localized around the home, were important to the household living here. As I have said, Formative householders seem to have been highly motivated to stake out multigenerational relationships to particular landholdings. The interrelated processes of waste management and soil enhancement are intrinsically wrapped up in multigenerational occupation of particular places – there is a feedback loop between the two, and on a multigenerational scale they are essentially the same process. What is really interesting to me is that these dual activities of waste management and soil enhancement were so clearly concentrated behind the Sáastun Group. Even though it was far away from the Tzacauil Sacbe and Acropolis – which, as I have said, is the price these Sáastun householders had to pay to be surrounded by kancab – the Sáastun Group still orients its best face to the sacbe, keeping its front side relatively clean. Behind the group's basal platform, householders took care of their daily tasks and likely practiced intensive agriculture or gardening.

It is also important to note, and this is a point to which I will return, that simply by virtue of being settled later in the Formative occupation of Tzacauil, the Sáastun Group had less time to leave its mark, so to speak, on the soils of its surrounding area. That such a strong signature of human activity nonetheless was detected around it suggests, even more, that deliberate strategies of soil enhancement related to intensification were going on here.

6.7.4 Sáastun Group material culture

Descriptions and measurements of all the artifacts we found during excavations at the Sáastun Group can be found in Appendices A, B, and C. Here I will provide a brief summary of what was found so that inter-house group comparisons can be made.

Ceramics at the Sáastun Group were predominantly Formative types. A light scatter of Classic sherds was found in the assemblage, but not enough to suggest to me that the platform was reoccupied after the Formative. There were 24 Middle Formative sherds, weighing 92.1 g. Over 178 square meters excavated at the Sáastun Group, we found only 150 ceramic sherds or 953.7 g. This works out to be an average density of 0.84 sherds or 5.36 grams of ceramic per square meter excavated.

Vessel shapes that could be identified in the ceramic assemblage conform to the overall pattern for Formative Tzacauil of higher quantities of bowls than jars. Of the Middle Formative sherds, 5 were from jars and 17 were from bowls. Across all Formative sherds there were 21 jar fragments and 60 bowl fragments. There were 4 Classic bowl fragments. Across all ceramics for which vessel shape could be assigned there were 48 jar and 60 bowl fragments.

Like those of other Formative house groups at Tzacauil, the Sáastun Group's lithic assemblage was predominantly made up of tools made from locally available limestone. There were a few instances of potentially non-local chert in the assemblage, as well as a few small spherical pebbles of a dark, hard stone that could not be identified (it is from these strange stones that the group derives its name, *sáastun*, the Yucatec term for a seer stone used for magic). Additionally, we found two pieces of obsidian on top of the Sáastun Group's basal platform, in surface levels. We cannot know for sure when these date to, but the very few instances where obsidian have been found at Tzacauil almost always come from off-mound contexts. I tend to favor the idea that they wound up scattered around the site during the Classic period reoccupation, when obsidian was plentiful at nearby Yaxuná (e.g., Fisher 2016, 2017; Stanton et al. 2010). But this remains an open question.

As in most cases at Tzacauil, the lithic assemblage of the Sáastun Group is rather ragtag and does not include very many clearly identifiable tools. Grinding stones

are the most recognizable. The Sáastun Group had 8 metate fragments (7 in the basal platform, 1 in the ancillary structure), 12 two-hand grinding stones (all in the basal platform), 16 one-hand grinding stones (14 in the basal platform, 2 in the ancillary structure), and 2 indeterminate grinding stones (both in the basal platform). Among the remaining lithics there were tools I tentatively identified uses for, including polishing (n=12), scraping (n=22), cutting (n=4), perforating (n=3), stone working (including chipped stone debris) (n=13), and filing (n=1). All together there were 93 lithic artifacts collected from the Sáastun excavations.

6.8 The Chamal Group

6.8.1 Overview of the Chamal Group

The Chamal Group is one of the most elaborate and complex house groups documented in the Tzacauil settlement. Located north of the Tzacauil Sacbe and west of the Jach Group, this group consists of a rectangular basal platform, designated Structure 8, built over a large, natural bedrock outcrop (Figures, 6.1, 6.87-6.91).

When we first began work at the Chamal Group, we could see that the basal platform supported at least one superstructure, a rectangular structure on the platform's northern side. I will refer to this structure as Structure 8A or the principal structure. Our excavations would reveal the presence of at least one additional superstructure to the south, designated Structure 8B. All together, the basal platform exhibits evidence for at least three major construction episodes. At the end of the 2015 field season, we identified an unmapped ancillary structure off the northwest side of the Chamal Group's

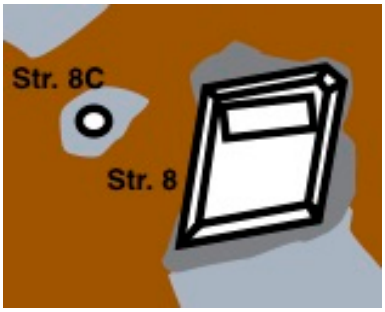

Figure 6.87 Stylized plan of the Chamal Group


Figure 6.88 Chamal Group basal platform


Figure 6.89 View of the top of the Chamal Group basal platform

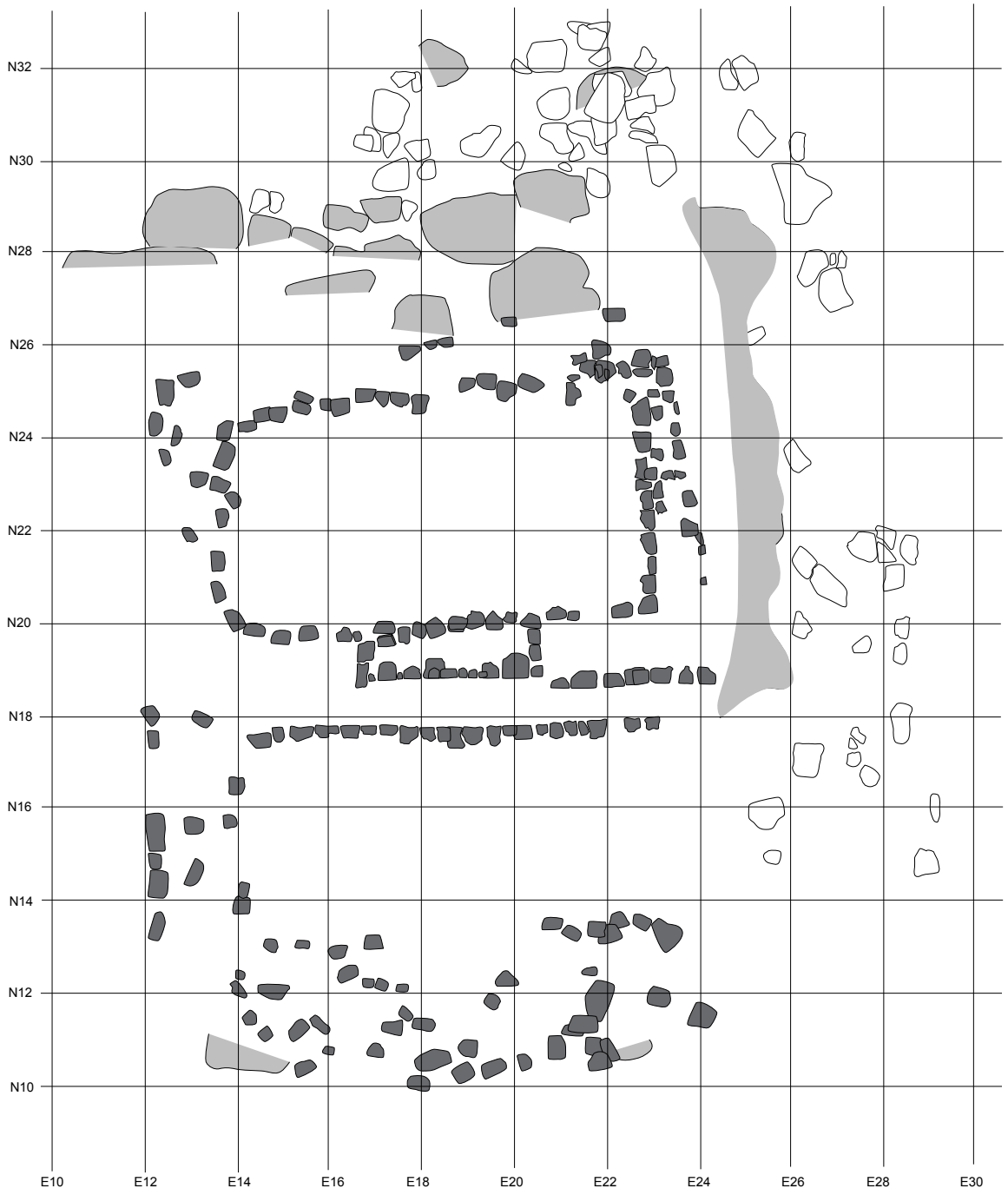

Figure 6.90 Plan of the Chamal Group basal platform excavations

basal platform. This structure, Structure 8C, was excavated in the 2017 field season and it was likely a kitchen for the group.

Investigations in the Chamal Group's intra-settlement area as well as in its house group architecture indicate that this area was used for limestone extraction and

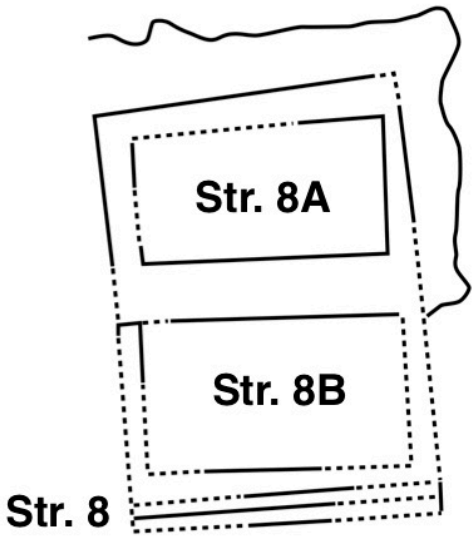

Figure 6.91 Stylized plan of the Chamal Group basal platform and superstructures

processing. As will be discussed in greater detail below, excavations in Structure 8C suggest that before the structure was built, this area was used as a pit-kiln for producing burnt lime. Intra-settlement excavations north of the Chamal Group found discarded stone cutting tools that would have been used for cutting bedrock. Driving this point home, we found several semi-worked blocks and flat sheets of broken bedrock utilized in with the fill in the Chamal Group's platform constructions. I see two main explanations for this, which may or may not involve the household living at the Chamal Group's direct participation in limestone processing. These hypotheses will be discussed below.

Before getting into the details about the Chamal Group, I will preface the following descriptions with the group's timeline, which is somewhat more complex than the other Tzacauil house groups. Ceramic data suggest that before any permanent stone architecture was built here, people were processing burnt lime using the pit-kiln in the Late Formative. The Chamal Group basal platform and principal structure were first built at the Late to Terminal Formative transition. At that same time, the pit-kiln was filled in and Structure 8C was built of the leveled surface. The two renovations of the Chamal Group, including when Structure 8B was added, seem to have occurred in the Terminal Formative. The group was abandoned at the transition from the Terminal Formative to the Early Classic.

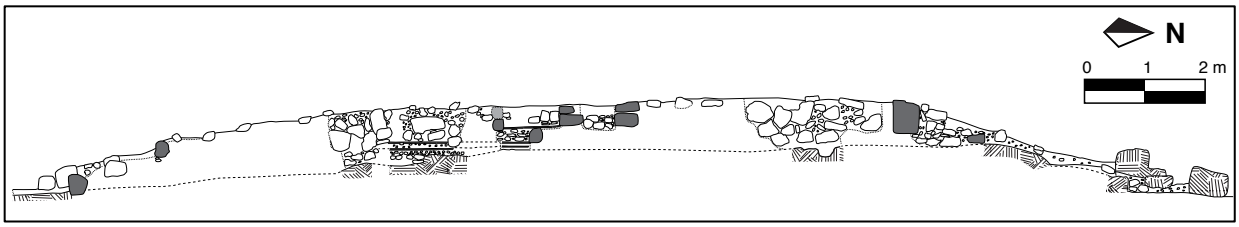

Figure 6.92 North-south *corte* of the Chamal Group basal platform along its central axis

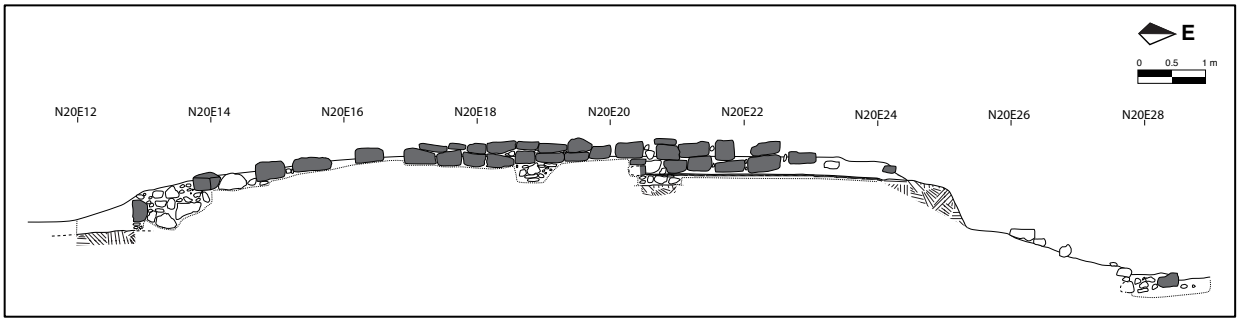

Figure 6.93 East-west *corte* of the Chamal Group basal platform

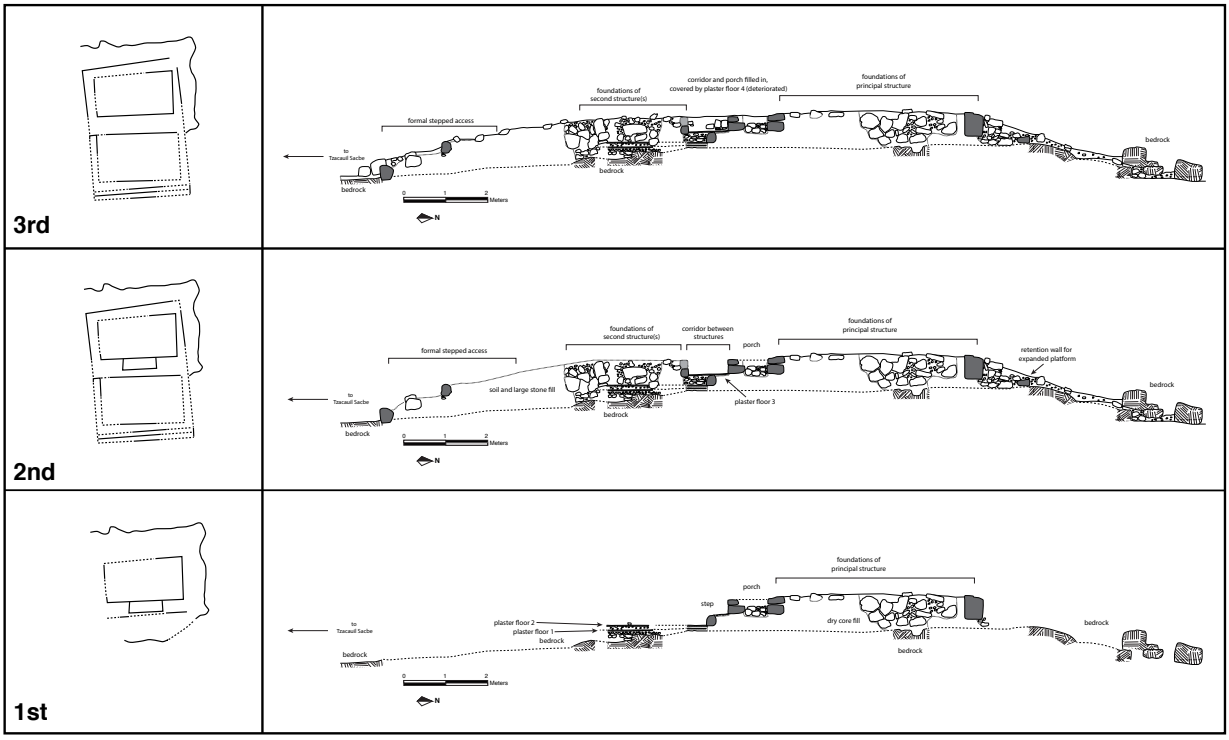

Figure 6.94 Construction phases of the Chamal Group basal platform

6.8.2 Chamal Group construction history and techniques

The Chamal Group had three major episodes of construction, which we were able to discern through horizontal excavations of the group's basal platform (Figures 6.92-6.94). Like other Formative house groups at Tzacauil, the Chamal Group basal platform began with a natural, elevated outcrop of bedrock. The first major construction episode here centered on Structure 8A, the group's principal structure. The builders started construction by preparing the surface of the bedrock outcrop. They applied a layer of soil mixed with cal (burnt lime), which allowed them to create a compact, hard, and level surface (Figure 6.95). We confirmed the high quantity of cal inclusions in the underlying soil layer by squeezing a lime on top of it; the soil was so basic because of its lime inclusions that when the acidic lime juice hit the soil, it effervesced.

Once this surface had been prepared, the builders raised the level of the bedrock by depositing a layer of large stone fill. When our team excavated this fill, we could see that some of the stones still had residues of construction material (burnt lime cal) attached to their bases. These stones were laid as dry-core fill. Their accommodation reflects a sophisticated knowledge of construction techniques, and efficiently raised the building surface without requiring substantial amounts of soil and smaller stones.

Notably, this dry-core fill also includes stones that appear to have been semi-worked into blocks (Figure 6.96). This became a frequent occurrence at the Chamal Group: its fill often included stones prepared for more visible, formal use – but that had been ultimately rejected and used instead for construction fills. Other stones in the dry-core fill of this earliest building episode are flat slabs of broken bedrock, consistent with fills of other Formative constructions at Tzacauil. These were likely discard from stonecutting.

This dry-core fill was placed in a roughly rectangular shape towards the north end of the bedrock outcrop. A formal, well-made wall – designated Wall 4 – was constructed along its southern end, creating a low platform. This wall, a single course of stones, had been arranged on a carefully placed layer of bahpek (compact stones and soil) that had been placed on the soil-material layer overlying bedrock. This created a stable, low platform on top of the bedrock outcrop.

Figure 6.95 Prepared bedrock surface below construction of Structure 8A of the Chamal Group

Figure 6.96 Dry-core fill “sealed” with slabs in Structure 8A of the Chamal Group

Figure 6.97 View of the Chamal Group superstructures, showing the elements of the second phase of construction

On top of this low platform, the builders installed a rectangular wall (the southern segment of this wall was designated Wall 1). This wall formed the foundation brace for the Structure 8A superstructure. At the same time they were constructing this, the

builders also added a low step measuring about 4 m east-west by 1 meter north-south abutting the superstructure on its central axis (the wall of this porch construction was designated Wall 2) (Figure 6.97). This small step or porch both formalized and facilitated access to the superstructure.

The principal structure, Structure 8A, was further prepared by constructing a floor inside the rectangular foundation brace (Figures 6.98, 6.99). To do this, the builders had to add smaller stones, chich, and soil on top of the dry-core fill they had placed on top of bedrock. However, dry-core fill by its nature has a lot of gaps in between stones; these can make overlying floors unstable because smaller fills fall through. To combat this, the builders placed flat bedrock slabs over the widest gaps in the dry-core fill. (This strategy was also observed in the dry-core fill of the Jach Group's basal platform.) These flat slabs, likely discard from stone-cutting, essentially functioned as flagstones. Then they added smaller stones, chich, and soil. The final floor was likely packed earth, perhaps mixed with cal or sascab to make it more stable. While still sophisticated, this kind of floor construction would likely have required periodic repairs and the addition of more soil, as material filtered down or washed away over time. In fact, by the time our team excavated this structure, most of the material originally overlaying the dry-core fill had filtered down to the lowest levels. The surface of the small porch or step in front of the structure had a similar floor construction of chich and soil.

A floor made of packed sascab and soil was added in front of Structure 8A. It had been preserved beneath later construction, and gives us an idea of what the now long-ago deteriorated floors of Structure 8A (and Formative floors elsewhere in Tzacauil) may have looked. This floor, designated Floor 2, began at the base of the structure's low platform (Wall 4), and extended south for a few meters (its southern limits could not be determined because of later renovations). Our excavations suggest that this floor might have been repaired and/or resurfaced at least once during this construction phase. Floor 2 was very well made. It had been built over a layer of compact soil and chich that had been packed over bedrock. The floor itself was sascab and soil, and included a high-density of small gravel (micro-chich). This gravel stabilized the floor and made it more resistant to weathering.

Figure 6.98 Excavating Structure 8A of the Chamal Group

Figure 6.99 Excavating Structure 8A of the Chamal Group

During this earliest phase of building at the Chamal Group, it seems that much of the area south of Structure 8A was left open. Here, whether on the surface of Floor 2 or on the bedrock itself, residents could have conducted the daily activities of their lives.

Dating this initial construction episode is difficult for a few reasons. First, the earliest occupation contexts in Tzacauil generally lack very many ceramics. Second, the nature of the construction of Structure 8A, and the fact that it was continuously in use for the duration of the group's occupation, means that it lacks secure contexts. As I mentioned, the floor of the superstructure would have had to have been periodically reinforced and repaired with the addition of soil and chich. Sherds included in this fill, and the fill itself, eventually percolated to the lowest levels of the underlying dry-core fill. This means that sherds in the lowest contexts of this construction are not reliable for dating its initial construction. Of the very few sherds that were found in these earliest contexts, a couple are Terminal Formative and the rest are inconclusive. However, given what is known about the group as a whole, and looking at the body of ceramics included in fill in later renovations, it seems that a substantial Late Formative occupation had to have occurred here. For that reason, I am reasonably confident that we can assign a late Late Formative or very early Terminal Formative date to the Chamal Group's initial building episode.

Turning our attention momentarily to the group's ancillary structure, Structure 8C, gives us more information about the Chamal Group's early history (Figures 6.100-6.103). Again, it is difficult to assign secure dates, but excavations in Structure 8C's

lowest levels indicate that it was built over a fairly large bedrock cavity (Figure 6.104). This came as a surprise to us. All around Structure 8C, bedrock is exposed at the surface. We expected that we would have very little to dig to expose bedrock throughout the structure, but instead found bedrock plunging sharply down in the middle in a cavity that had apparently been cut out. (As we will discuss in a later section, this is identical to the situation documented beneath Structure 6C of the Pool Group.) Why would Formative builders select a place that required so much additional labor to fill in and level out, when flat bedrock building surfaces are naturally ubiquitous?

The most plausible explanation for this pattern is that these cavities are byproducts of limestone extraction and processing. And in fact, comparative data on the burnt limestone industry in Yucatán conducted by Seligson and colleagues (2017, 2018) strongly suggests that these cavities were, in fact, pit-kilns for the production of burnt lime cal. If this is true for the pit underlying Structure 8C, then it seems probable that this area may have been dedicated to resource extraction and processing for a period of time in the Late Formative. This suggestion of limestone processing around the Chamal Group is further supported by several lines of evidence: the semi-worked stones discarded in fill, the thin bedrock slabs used to “seal” dry-core fill, and the quarry and bedrock quarrying tools tentatively identified north of the group (see Section 6.8.3). A feature for limestone extraction near all this would be consistent with these other lines of evidence.

When the area around Structure 8C was no longer used for limestone processing, the bedrock cavity was filled to smooth it out to the level of the surrounding bedrock. Structure 8C exhibits different types of fills that respond to differences in the underlying bedrock (Figure 6.105). In areas where bedrock is deep, builders placed dry-core fill, using vertical slabs of bedrock to create a kind of stone “scaffold” that quickly added volume. The dry-core fill would occasionally be semi-sealed off with horizontal slabs to prevent floor ballast from filtering into the gaps. The floor ballast placed over dry core fill shows remarkable sophistication, as builders utilized cuñas to create compact, stable surfaces over the dry core fill (Figure 6.106). However, in areas where bedrock was shallow and flat, it was only necessary to cover it with a thin layer of soil. Either

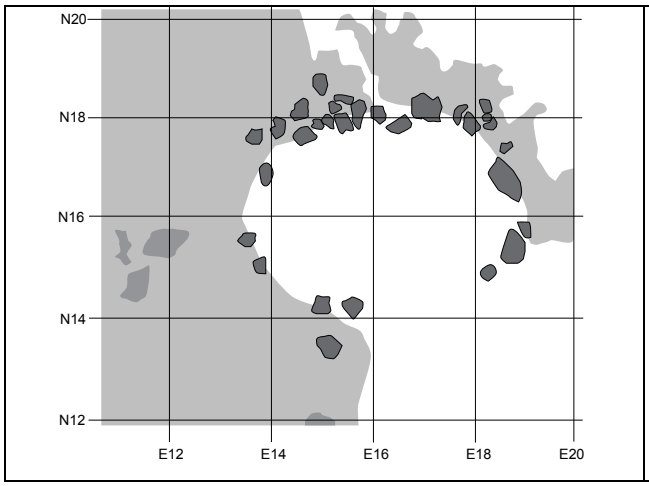

Figure 6.100 Plan of Structure 8C of the Chamal Group

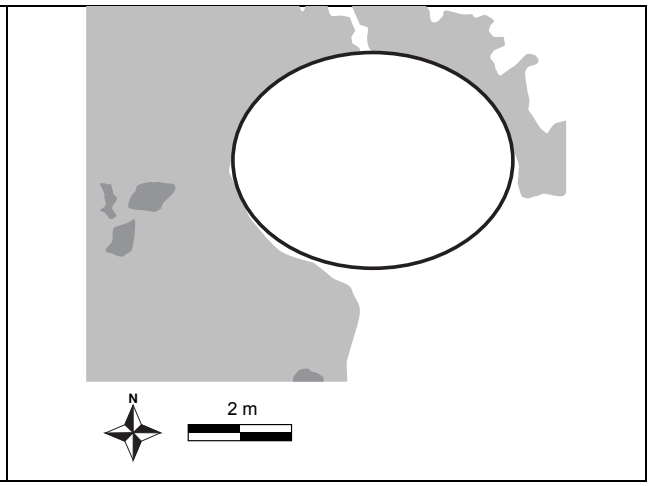

Figure 6.101 Stylized plan of Structure 8C

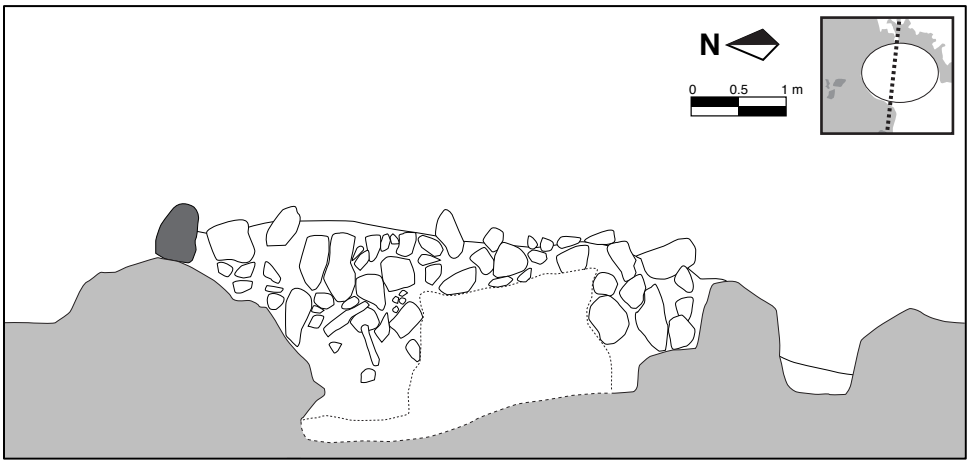

Figure 6.102 North-south *corte* of Structure 8C of the Chamal Group

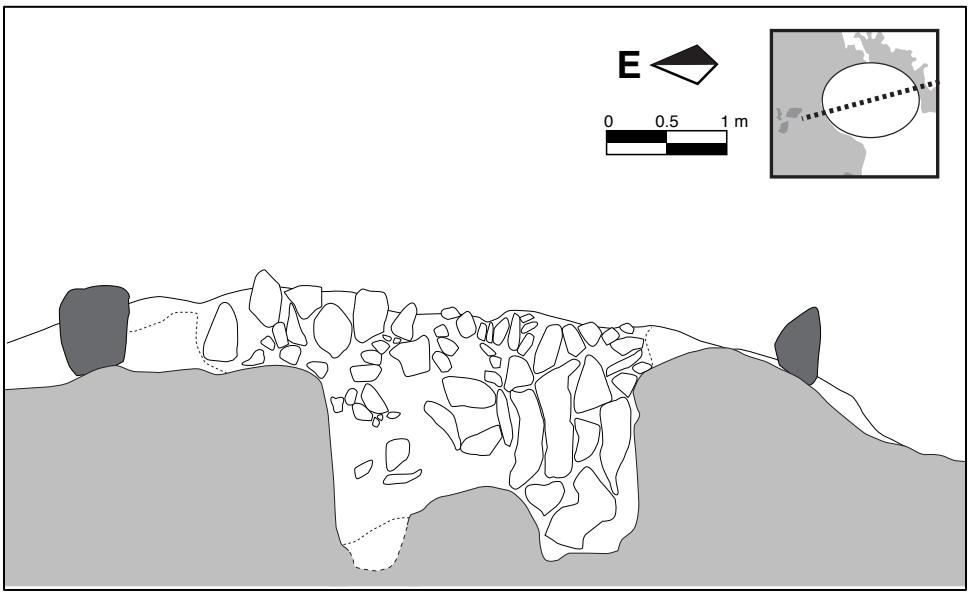

Figure 6.103 East-west *corte* of Structure 8C of the Chamal Group

right when the cavity was filled or some time later, the area was raised again by depositing more fill, adding walls, and building a perishable superstructure here. This structure likely served as a kitchen for people living on the Chamal Group basal platform, and seems to date to the Terminal Formative. While we cannot link up Structure 8C's construction to a particular moment in the Chamal Group's construction history, I suspect it was built around the same time as the group's first major renovation episode in the Terminal Formative.

Now we will return to the construction history of the Chamal Group basal platform and its superstructures. The second construction episode, and first major renovation, of the Chamal Group basal platform occurred in the Terminal Formative. The scale of the renovation is massive and represents a substantial investment of energy, resources, and engineering (Figures 6.94, 6.97, 6.107, 6.108). It also reflects changes in building techniques from the earlier construction.

During this renovation, the exposed bedrock south of the principal superstructure was covered with a massive volume of soil and large stone fill. Many of the stones associated with this construction fill were semi-worked blocks. Floor 2 and Wall 4 were both covered as the builders elevated the height of the platform with a layer of rocks mixed with a substantial amount of soil. A perimeter wall of boulders was added around the bedrock outcrop to box it in on its southern side. These additions expanded and elevated the area of the entire basal platform. With the expansion of this space, another superstructure, Structure 8B (identified during excavation by its northern wall, Wall 3) was constructed on the southern half of the platform. Adding Structure 8B left a narrow passage, with a plaster floor (Floor 1), between the two superstructures.

At the same time, the builders reaffirmed the group's orientation to the south, facing the Tzacauil Sacbe, with the construction of a formal access on the south side. This access consisted of three steps running along the length of the platform's southern side. The construction of a formal access on the southern side of the platform suggests that Structure 8B was not completely covered by a single perishable superstructure. This is possible, but a single structure would obstruct access between the principal structure and the platform's access. Therefore it seemed more likely to us that the

Structure 8B foundation braces had supported two perishable superstructures flanking the platform's central axis. This would leave a path open between the platform's access and its principal structure.

Some time later in the Terminal Formative, the narrow passageway between the Structure 8A and 8B was filled in (Figure 6.94). The small porch or step in front of the principal structure was covered with fill. A floor, which had disintegrated but could be inferred from a dense concentration of chich, probably covered the new occupation level. Canceling out this narrow passageway does not appear to have affected either of the two superstructures. The northern superstructure continued as the principal building, but the southern superstructure may either have been reverted back to an open activity area, or it may have continued to support perishable buildings. This construction episode was the last clear modification made to the platform before it was abandoned at the transition from the Terminal Formative to the Early Classic.

6.8.3 Chamal Group location and intra-settlement features

The Chamal Group, like the Sáastun and Kaan Groups, was settled during the Late to Terminative Formative transition. By this point, prime areas of the site – the kancabales abutting the Tzacauil Acropolis – had already been claimed by the inhabitants of the Jach and P'aak Groups. The founders of the three groups established at this transition seem to have sought, like the first settlers, to build their homes in kancabales. They were willing to make compromises in order to ensure access to soil. In the case of the Chamal Group, its builders picked an area that provided access to kancab while still allowing them to be close to the Tzacauil Sacbe (Figure 6.1). Yet there were also substantial areas of exposed bedrock in their intra-settlement area. While bedrock does afford seasonal advantages (e.g., water storage, stable and elevated surfaces in the rainy season) and can be used for container-style gardening, Formative settlers at Tzacauil were most interested in embedding their homes directly in the middle of soil expanses.

South of the Chamal Group's basal platform, there is an area of boulder-like outcrops of bedrock. These boulder outcrops smooth out into a flatter exposed stretch of

Figure 6.104 Chamal Group Structure 8C, Unit N16E16, excavating bedrock cavity

Figure 6.105 Excavating Chamal Group Structure 8C

Figure 6.106 Well-laid fill and floor in the construction of Structure 8C of the Chamal Group

Figure 6.107 Chamal Group excavations

Figure 6.108 Chamal Group excavations

Figure 6.109 Small reservoir (*charco*) south of the Chamal Group

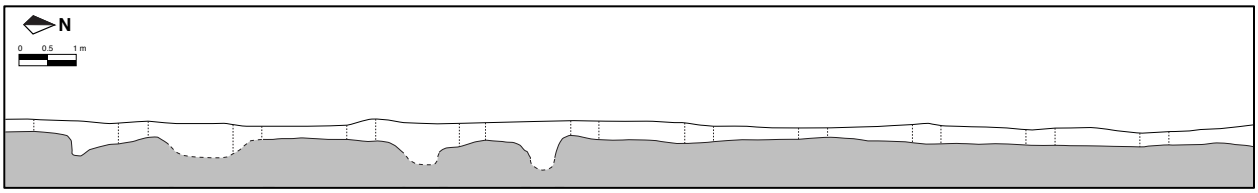

Figure 6.110 Profile of Trench 4

Figure 6.111 Trench 4

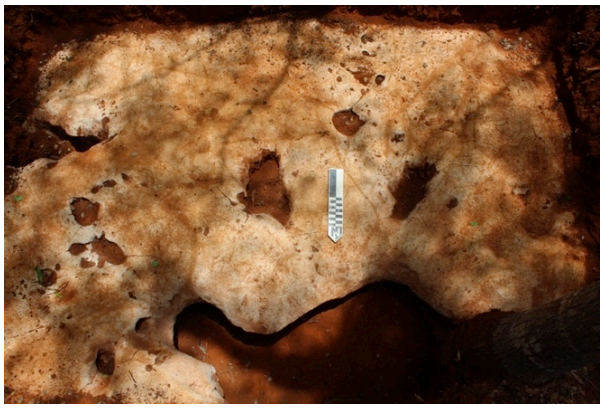

Figure 6.112 Bedrock in Trench 4

Figure 6.113 Bedrock in Trench 4

bedrock as you approach the Tzacauil Sacbe. This flat bedrock is riddled with cavities that can be used for seasonal water storage and container-style planting. Emphasizing these uses for bedrock, the survey team of *ejidatarios* and I identified a small reservoir (the Spanish word used was *charco*, pond) here (Figure 6.109). A natural depression

appeared to have been modified with the addition of crude stone alignments to help retain water, and possibly also dug into the bedrock slightly; discerning which attributes were natural and which were modified by humans was difficult, but the depression was clear. More convincing as far as I am concerned, the *ejidatarios* were convinced that it had been modified. This *charco* would have afforded the inhabitants of the Chamal Group with water during the rainy season.

Based on other lines of evidence present in this part of Tzacauil, it is also possible that the *charco* was dug out before the Chamal Group was built. Access to water is an essential part of construction in Yucatán, and as we will see, the building of the Tzacauil Sacbe seems to have relied on "stations" for lime processing and stone working along its trajectory. For instance, in the excavations of the Chamal group's ancillary structure (Structure 8C) we identified tentative evidence for a pit-kiln for burnt lime processing. This little pond reservoir may have been part of large-scale construction activities related to the Tzacauil Sacbe earlier in the Late Formative. This cannot be determined for certain, but if it is true it means that the Chamal Group settlers may have been attracted to this particular spot for pre-existing infrastructure.

Aside from this area to the south, most of the Chamal Group's surroundings are predominantly kancab. There is a broad expanse of kancab to the east, in the area between this group and the neighboring Jach Group. Immediately to the northeast there is more kancabal, but as you move further north the soil becomes visibly thinner; patches of bedrock are visible. Moving away from the house group to the northwest, you reach an area of flat bedrock (the kind with *sartenejas*) that eventually gives way to an area of rugged boulder bedrock. West of the Chamal Group's basal platform is a small area of kancab, but it too is visibly thin. This meets an area of exposed flat bedrock where the group's ancillary structure (Structure 8C) was built. There is kancab in this area west of the Chamal Group leading up to a large area of exposed bedrock (where the Jaltun Group is located; see Chapter 7), but it is notably thinner and characterized by a good deal of exposed bedrock.

Three trenches were excavated radiating out from the Chamal Group. Trench 3, which was discussed earlier, spans the kancabal on the group's east side, connecting

Figure 6.114 Stone-cutting tools found in Trench 4

the Chamal Group and the Jach Group. To reiterate, Trench 3 measured 34 meters in length. Soil depth across the trench ranged to almost a meter near the Jach Group, and thinning to depths of 0-30 cm as you move west towards the Chamal Group. We found a few discarded grinding stones in this excavation, but as in most trenches the artifact density was very light. Averaged across all its units, Trench 3 show elevated levels of phosphates compared to other trenches investigated at Tzacauil.

Trench 4 investigated the kancabal north of the Chamal Group basal platform (Figures 6.110, 6.111). The trench spanned 22 meters and terminated in an area where the kancab was quite thin and bedrock was exposed in patches. Soils were some of the deepest recorded at Tzacauil. In units closest to the house group, soil depth ranged from 20-50 cm, and sometimes were even excavated to 60 cm without finding bedrock. Where bedrock was exposed, it was exceptionally smooth and had been eroded off into

curving points and edges; bedrock of this kind was found nowhere else at the site. When we first started exposing this particular bedrock, several *ejidatarios* on the excavation team indicated to me that this kind of bedrock was the preferred kind for cutting stone (Figures 6.112, 6.113). As we moved north, the excavations began finding ground-stone lithics – artifacts that looked like many of the crude limestone edge tools so common at Tzacauil, except exponentially larger. The week we were excavating here, the excavation team included one of Yaxunah's most skilled masons. He at once recognized these as stone-cutting tools, and demonstrated how they would have worked to break off chunks of limestone from the bedrock (Figure 6.114). We found several of these broken tools as well as lots of broken fragments of bedrock that appear to have been stone cutting debris. These tools are not much to look at and they certainly could use more attention. Some archaeologists might be skeptical about this interpretation – these tools are so far removed from the obsidian and chert that most archaeologists working in the Yaxunah *ejido* have focused on. But given the considerable knowledge of many of the older *ejidatarios* about limestone processing, along with my respect for and trust in this particular mason, I defer to the *ejidatarios*' conclusion: these were stone-cutters' tools, used for cutting limestone out of the bedrock.

Trench 8 begins west of the Chamal Group ancillary structure (Structure 8C) and runs 28 meters west towards the Jaltun Group, a small structure built in the Classic period (Figures 6.115-6.117). In units closest to the Chamal Group, soil depth could go up to 50 cm without finding bedrock in some places, whereas in others bedrock was exposed. Overall most units reached bedrock after about 40 cm, and soils thinned as we moved further west. Units closer to the Jaltun Group averaged about 10-30 cm of soil. Artifact density was extremely light in this trench – almost no artifacts were found.

Soil chemistry analysis of samples from around the Chamal Group suggest that occupation here did not last particularly long (Figures 5.22-5.33; Appendix D). Phosphate levels are fairly unremarkable across Trench 4 and Trench 8, but these two trenches have the lowest average soil pH across all trenches at Tzacauil. Averaged

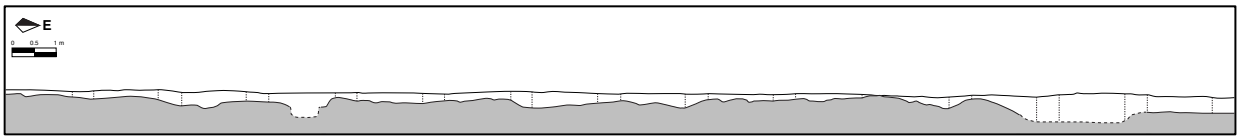

Figure 6.115 Profile of Trench 8

Figure 6.116 Trench 8

Figure 6.117 Trench 8

across its three intra-settlement trenches, the Chamal Group also has the lowest carbonate levels of any Formative house group at the site.

It may be tempting to interpret these soil chemistry data as evidence that the Chamal household was engaging in different activities than other Formative households, but I do not think we can substantiate this argument given the caveats associated with soil chemistry analysis in Yucatán. Such an interpretation might find support in the ample evidence of stone working associated with the house group: perhaps the Chamal household was more engaged with masonry than with intensive farming. This remains a possible explanation. However, another explanation could be that the Chamal Group simply was not occupied long enough to significantly impact the soil chemistry of its intra-settlement area. Yet this alternative explanation is not supported by the fact that the Chamal Group has the second highest ceramic density (see below) and the most number of renovations of the Formative groups at Tzacauil; these would suggest that the group *was* occupied for a relatively long time. This remains an open question, but I

do think we can suggest that the intra-settlement areas around the Chamal Group show signs of stone working *and* possibly cultivation.

6.8.4 Chamal Group material culture

The inventory of all artifacts found during excavations of the Chamal Group can be found in Appendices A, B, and C. Here I will provide a brief summary of what was found to facilitate inter-house group comparisons.

Ceramics from the Chamal Group indicate that it was built and occupied in the Formative period. A few occurrences of later Classic period sherds were also found, but not at densities or in contexts that suggest to me that this group was reoccupied. Of the Formative sherds, types from the Middle Formative, Late Formative, and Terminal Formative are all represented. There were 23 Middle Formative sherds, or 339.1 g. Of the 262 square meters excavated at the Chamal Group, 610 sherds or 5177.9 g of ceramics were recovered, giving a ceramic density of 2.33 sherds or 19.76 g per square meter. Compared to other Formative house groups, this is second only to the Jach Group.

Analysis of vessel form revealed a similar emphasis on bowls over jars among diagnostic Formative sherds, but this same emphasis did not hold when non-diagnostic sherds were included (e.g., ceramic types that are common in nearly all time periods like Chancenote Estriado). Of identifiable Middle Formative bowls, there were more bowls (n=16) than jars (n=3). The same is true for all Formative bowls (n=253) and jars (n=75). The scattering of Classic sherds found at the group included a small number of bowl (n=13) and jar (n=5) fragments. Across all ceramics found at the Chamal Group there were slightly more jars (n=266) than bowls (n=254).

The assemblage of lithic artifacts from the Chamal Group is predominantly comprised of locally available limestone, though there were a few artifacts possibly made of non-local chert. A single obsidian flake was found, but it was from an off-mound context and I think it likely is associated with the Classic reoccupation of Tzacauil. Grinding stones were found in excavations of both the Chamal Group's basal platform (including Structures 8, 8A, and 8B) as well as in the ancillary structure (Structure 8C).

These tools include 5 metate fragments (2 in the basal platform, 3 in the ancillary structure), 5 two-hand grinding stones (3 in the basal platform, 2 in the ancillary structure), 8 one-hand grinding stones (5 in the basal platform, 3 in the ancillary structure), and 1 one-hand grinding stone (in the basal platform). As with most lithic assemblages at Tzacauil, the tools were rough and often eroded; assigning them a definite function was often difficult. In addition to grinding, I tentatively identified tools for polishing (n=2), scraping (n=3), chopping (n=2), cutting (n=3), perforating (n=1), and stone-working (including chipped stone debris) (n=36).

6.9 Southwestern Tzacauil in the Formative period: The Kaan, Mukul, and Pool Groups

6.9.1 Overview of southwestern Tzacauil in the Formative

The four house groups already described – Jach, P'aak, Sáastun, and Chamal – are exceptional for Yucatán archaeology because they are essentially "pure" Formative. They do not have Classic period overburden, and therefore these four house groups give us a much clearer picture of what life was like in an early northern Maya farming community. The southwestern part of Tzacauil was also settled in the Formative, but this was where Classic period farming households chose to live when the site was resettled centuries after the early village had been abandoned. This Classic resettlement is a fascinating part of Tzacauil's story (see Chapter 7) but it does complicate our understanding of what this part of the settlement was like in the Formative.

There are three house groups in this part of the site: Kaan, Pool, and Mukul (Figure 6.1). I directed horizontal excavations of both the Kaan and Pool Groups and found that they both include Formative and Classic components. The Mukul Group had been previously unrecorded by PIPCY, and I did not realize it was there until halfway through my 2017 season. We only had time for a test pit there, and confirmed that it was occupied in the Classic. Whether or not it had a distinct Formative occupation is unknown.

Figure 6.118 West side of the Kaan Group, with the Mukul Group visible to the right

Figure 6.119 The top of the Kaan Group basal platform

Findings from the Kaan and Pool Groups expand our understanding of Formative Tzacauil and need to be included here. But these structures cannot be treated in the same way as the other Formative groups; they require more caution. As such in this section I will focus only on the Formative construction history of the two groups, as well as on their location and intra-settlement area.

6.9.2 Formative Kaan Group construction history

The Kaan Group is a basal platform (designated Structure 5) with at least two superstructures (Structures 5A and 5B) located on the south side of the Tzacauil Sacbe, with the P'aak Group to the east and the Mukul and Pool Groups to the west (Figures 6.118-6.120). The group was first built in the Late to Terminal Formative period, was abandoned in the Terminal Formative, and then reoccupied in the Late Classic (see Chapter 7) (Figures 6.121, 6.122)

Like other early house groups at Tzacauil, the Late to Terminal Formative construction of House Group 5 suggests that builders were attracted to a large underlying bedrock outcrop "floating" in a soil-rich kancabal. The outcrop underlying the Kaan Group is huge and offers elevation above the surrounding kancabal. It is also flat on top – so much so that in many places on top of the basal platform, bedrock is exposed with little to no fill covering it because none was needed (Figure 6.119). Unfortunately, this also makes it more difficult to date the architecture and artifacts found on top of the platform.

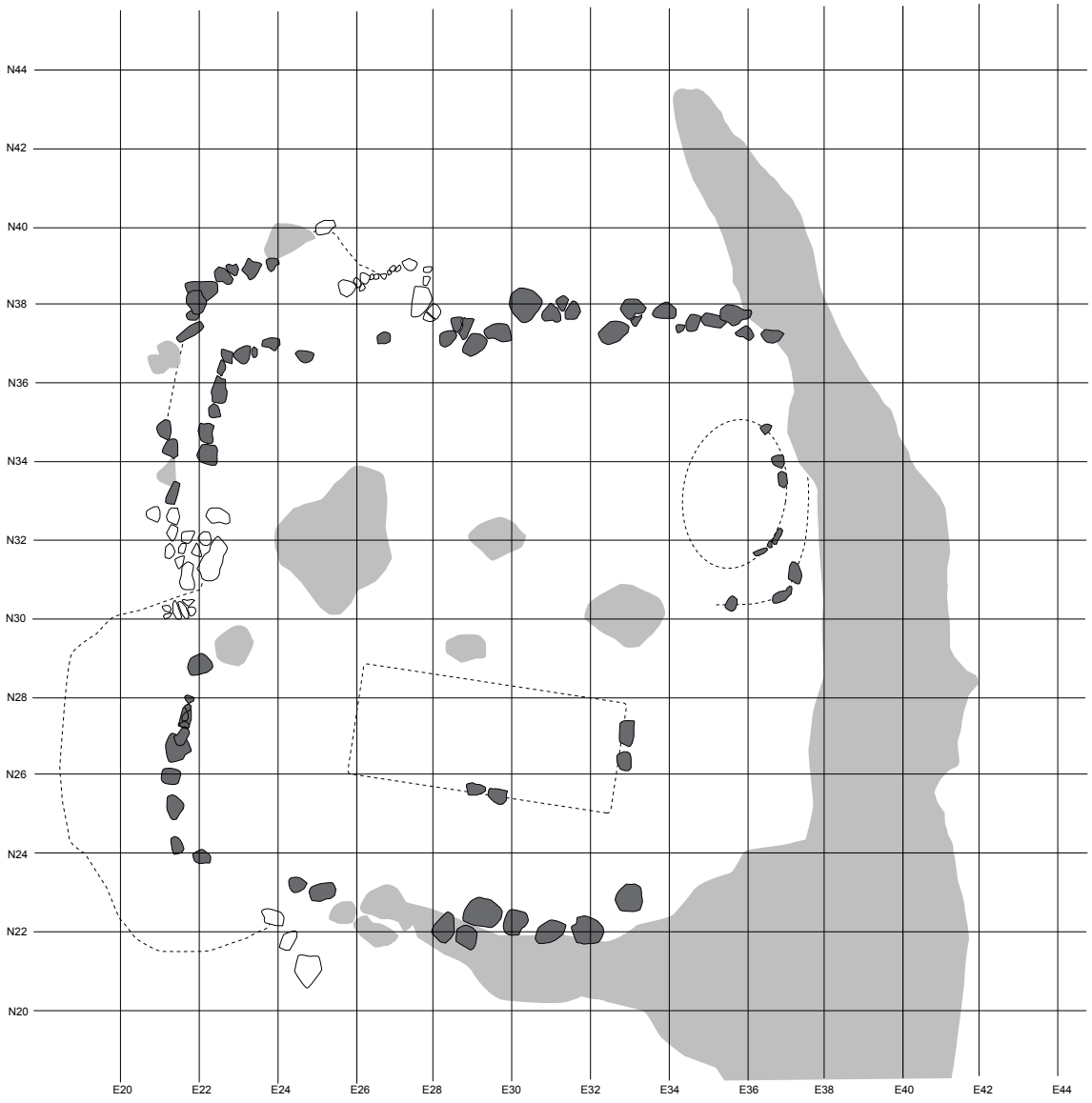

Figure 6.120 Plan of the Kaan Group excavations

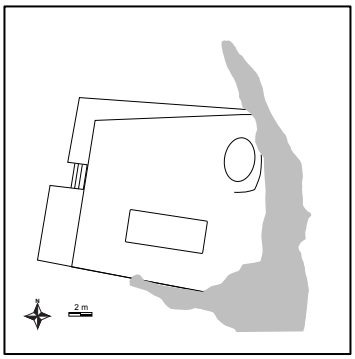

Figure 6.121 Stylized plan of the Kaan Group, with both occupation phases

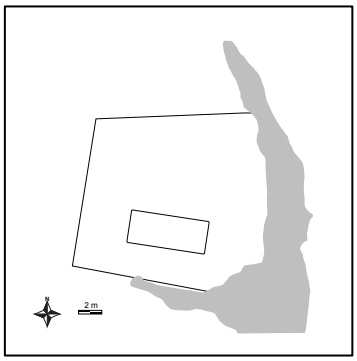

Figure 6.122 Stylized plan of the Kaan Group, showing just the Formative occupation phase