UNDERSTANDING ANCIENT MAYA ECONOMIC VARIABILITY:
LITHIC TECHNOLOGICAL ORGANIZATION IN THE MOPAN VALLEY, BELIZE

AN ABSTRACT

SUBMITTED ON THE SIXTH DAY OF MARCH 2017

TO THE DEPARTMENT OF ANTHROPOLOGY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

OF THE SCHOOL OF LIBERAL ARTS

OF TULANE UNIVERSITY

FOR THE DEGREE

OF

DOCTOR OF PHILOSOPHY

BY

Rachel Anna Horowitz

APPROVED:

Marcello A. Canuto, Ph.D.
Director

Tatsuya Murakami, Ph.D.

Dan M. Healan, Ph.D.

Jason Yaeger, Ph.D.
Abstract

Given that the economy involves all actors in a society, anthropological archaeology studies of the economy tend to be reductionist in their modelling, particularly of the ancient Maya, as by failing to examine certain segments of the ancient economy the full range of questions and complexities concerning economic interactions cannot be addressed. While much of the current framework for studying the past economy is due to the fragmentary nature of the archaeological record, traditional approaches tend to emphasize top-down studies, focusing on elites and their use of the economy for obtaining and maintaining power, and bottom-up studies which focus on the economic independence of small-scale farmers and householders. Studies of the economy should take a middle ground as it should be seen as a system of multiple economies in which different goods circulated. This dissertation seeks to model the multiple ways economies articulated in the past focusing on utilitarian goods which circulated through different economies. The articulation of economies becomes apparent through studies of the extraction and production of raw materials as access to and exchange of such goods occurs at the intersection of various economies.

This dissertation asks, what was the relative role of various actors in the management of raw materials for utilitarian resource production? Examining the access to materials for utilitarian goods highlights the variability in economic practices and the
involvement of actors of varying socio-economic statuses in lowland Maya economies. This dissertation focuses on lithic production at a chert quarry and production area in the upper Belize River valley of western Belize during the Late to Terminal Classic Periods (A.D. 670-890). This dissertation finds that local residents managed resources to produce utilitarian tools, indicating economies were a source of integration with and insulation from regional political dynamics. These data suggest we should view lowland Maya economies as complex systems where individuals of different socio-economic statuses negotiated wealth and power.
UNDERSTANDING ANCIENT MAYA ECONOMIC VARIABILITY:
LITHIC TECHNOLOGICAL ORGANIZATION IN THE MOPAN VALLEY, BELIZE
A DISSERTATION
SUBMITTED ON THE SIXTH DAY OF MARCH 2017
TO THE DEPARTMENT OF ANTHROPOLOGY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
OF THE SCHOOL OF LIBERAL ARTS
OF TULANE UNIVERSITY
FOR THE DEGREE
OF
DOCTOR OF PHILOSOPHY
BY
Rachel Anna Horowitz

APPROVED:
Marcello A. Canuto, Ph.D.
Director
Tatsuya Murakami, Ph.D.
Dan M. Healan, Ph.D.
Jason Zaeger, Ph.D.
Acknowledgements

First I would like to thank Marcello Canuto, my dissertation adviser, for all his help with this project and with graduate school in general. Marcello and I started at Tulane the same semester and even though he might not have expected to have 4 first-year Maya advisees, he has always been supportive of my research, allowed me the freedom and flexibility to explore Maya archaeology, and helped shape the way I think about the Maya. I particularly appreciate his emphasis on large anthropological questions which encouraged me to broaden my thinking about economies. The rest of my committee, Tatsuya Murakami, Dan Healan, and Jason Yaeger, were all supportive throughout the writing process, providing guidance on economic theory, Mesoamerican lithic analysis, and regional comparisons. Although Grant McCall was not on my final committee, he provided advice and guidance on lithic analysis and technological organization; my methodology and use of organizational approaches were greatly influenced by conversations with Grant.

I would also like to thank other Tulane faculty, particularly Jason Nesbitt, Kit Nelson, and Chris Rodning, who all had a part in providing me with ideas about archaeology, comparative examples for work in Mesoamerica, and surviving graduation
school. Bob Hill helped me located ethnographic sources on resource specialized communities.

My fellow graduate students provided a wonderful community during my time at Tulane. While too numerous to name here, having a group of people with whom to exchange ideas and socialize has been a great experience. I have always felt as though I could wander down the halls of Dinwiddie and start talking to anyone about whatever topic I might be thinking of that day. A special thanks to my cohort, particularly the archaeologists – David Chatelain, Erlend Johnson, Jayur Mehta, and Jessica Wheeler – for their support throughout the years. Nicole Katin, another cohort member, provided moral support as we worked on finishing our dissertations.

A special thanks to the other Garfield Girls – Carrie Parris, Erin Patterson, and Haley Holt Mehta (at various times) – for putting up with me for the past 8 years. Living at Garfield St. has been a source of stability and comfort throughout these years. Our countless versions of the archaeology game and Monday dinners provided both opportunities to think about archaeology and research and for relaxing and socialization. And thanks for having all the fur creatures (Miss Paula, Macaroni, and Couscous), who are always amusing to be around.

I would not be where I am today without Tom Jones, Charlotte Beck, and Nathan Goodale. Tom and Charlotte introduced me to lithics when I was a freshman at Hamilton College, and I never looked back. Tom, Charlotte, and Nathan set me on my way and gave me all the tools I needed to succeed in graduate school. Bonnie Urciuoli was also a source of encouragement and guidance about anthropology as a discipline. Many other Hamilton grads are excellent colleagues, and I would especially like to thank Lisa Fontes
for her support and encouragement – going through graduate school and dissertation writing at the same time in very different places has been a great help and I look forward to our future collaborations.

Research at Callar Creek Quarry was conducted under the auspices of the Mopan Valley Archaeological Project (MVAP) directed by Jason Yaeger, with the permission of the Belize National Institute of Culture and History’s Institute of Archaeology, directed by Jaime Awe, at the time of research, and John Morris, the current director.

I will be forever grateful to Jason for allowing me to join the project and for his support in my work at the quarry. He was always available for advice on excavation, ceramics, and archaeology in general. Kat Brown was also a great source of support and ideas in the field.

Thanks also to the MVAP and MVPP (Mopan Valley Preclassic Project) staff and students for all their assistance and making the field an enjoyable experience, particularly Sylvia Batty, Sara Bratsch, Bernadette Cap, Becca Friedel, Eli Hernandez, Victoria Ingalls, Christie Kokel-Rodriguez, Sarah Kurnick, Tiffany Lindley, Whitney Lytle, Leah McCurdy, Mike Petrozza, Zoe Rawski, Aley Villarreal, and Jason Whittaker.

I would like to thank the lab directors during my excavation and analysis seasons – Bernadette Cap, Kit Nelson, Tiffany Lindley, and Becca Friedel – for their assistance and good humor in dealing with the literal tons of lithics I brought back from the field every day. Bernadette also provided me with regional maps, many of which I used in this dissertation. Thanks to Mark Eli for his logistical support in the 2013 field season which saved me from carrying all the lithics we excavated uphill at the end of the day. Christie Kokel-Rodriguez helped me map the placement of samples after the heat treatment experiment – braving both the residual heat from the fire and the sun! Tiffany Lindley
helped obtain chert samples from San Lorenzo for the heat treatment experiences. Rebecca Friedel performed paleobotanical analyses of all carbon samples before they were sent off for dating.

The land where Callar Creek Quarry is located is owned by Antonio Xix and David Xix. They allowed me to excavate there with good humor and helped keep the cows out of the pasture for much of my excavation seasons. I thank all the people of Succotz and Calla Creek who assisted me throughout the years, particularly Arnoldo Chuc, Ingmer Cocom, Carlos Perez, Armin Puc, Elifar Vasquez, Esequias Vasquez, Raduel Vasquez, Jamie (Panfilo) Vasquez, Jamie Vasquez Jr., Romier Vasquez, and Isaeul Vasquez for their excellent and dedicated work and good humor throughout my excavation seasons. In 2012 Don Manuel Perez allowed me to use his boat to cross the Mopan River every day and to store supplies in his house; in 2013 Pablo Guerra kindly allowed me to use his canoe to cross the river. I am indebted to them both for making the process much easier.

My home away from home in Belize is at Nabitunich. Thanks to the Juan family, particularly Dominic Juan, for all their support and conversation throughout the years and for letting us stay at the farm!

Working in the Belize Valley has been a wonderful experience. The many archaeological projects in the region provide a fun working environment and are a support network of other scholars and a source of ideas about the archaeology of the region.

Funding for the research presented in this dissertation was provided by a National Geographic Young Explorer Grant (Grant #9089-12), a National Science Foundation
Doctoral Dissertation Improvement Grant (BCS Grant # 1416212), and a Summer Merit Fellowship from the School of Liberal Arts at Tulane University. Thanks also to Jason Yaeger and Kat Brown and the MVAP/MVPP field schools for their logistical support throughout the project. I received write-up funding from a Summer Merit Fellowship from the School of Liberal Arts at Tulane University. Susie Chevalier administered my NSF grant and made the process as easy as possible.

Thanks also to Diana DiLeonardo and the Tulane Geology Department who lent me geology sieves for microartifact analysis I conducted at Tulane.

The staff at the Stone Center for Latin American Studies, particularly Denise Woltering Vargas, Sue Ingles, Barbara Carter, and Daniela Alvarez, have been excellent colleagues for the 4 years I worked part-time in the office while writing his dissertation. They were always supportive of my research and provided me with flexible work hours when I needed them.

Comments on parts of drafts of my dissertation helped me broaden my comparative examples and make sure what I was writing made sense to others. Thanks to Tatsuya Murakami for allowing me to have his political economy class read early drafts of Chapters 1 and 2. The members of the class, Luke Auld-Thomas, Mark Dennison, Ryan Hechler, Jocelyn Ponce, Andrew Shroll, Bobbie Simova, and Dave Watt, provided helpful comments on economic theory and non-Mesoamerican examples. Chloe Andrieu read an early draft of Chapter 6 and provided helpful comments. Talking with another Maya lithicist is always fun and rewarding. Thanks also to Francisco Estrada-Belli for his help with GIS when making maps of the quarry.

Finally, I would like to thank my family for all their support over the years.
Table of Contents

Acknowledgements.................................................................................................................. ii
Table of Contents................................................................................................................... vii
List of Tables ........................................................................................................................... xii
List of Figures .......................................................................................................................... xv
Chapter 1: Introduction ........................................................................................................... 1
  1.1 Introduction ......................................................................................................................... 1
  1.2 Studying Economies ........................................................................................................... 4
    1.2.1 Defining Socio-political Status ..................................................................................... 10
    1.2.2 Mississippian Economy ............................................................................................... 14
    1.2.3 Andean Economies .................................................................................................... 17
    1.2.4 Teotihuacan Economy: A Mesoamerican Comparison .............................................. 20
    1.2.5 Importance of Studies of Past Economies .................................................................. 23
  1.3 Maya Economic Variability and Technological Organization ......................................... 25
  1.4 Organization of the Dissertation ....................................................................................... 28
Chapter 2: Economic Studies in the Maya Area ...................................................................... 31
  2.1 Economic Studies in the Maya Area .................................................................................. 32
    2.1.1 Top-Down Economic Studies ..................................................................................... 36
    2.1.2 Bottom- Up Economic Studies .................................................................................. 43
  2.2 Storage and Economic Variability ................................................................................... 51
  2.3 Co-occurring Economic Modes ....................................................................................... 68
    2.3.1 Source Location ......................................................................................................... 70
    2.3.2 Production .................................................................................................................. 74
    2.3.3 Distribution ............................................................................................................... 76
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.3 Chert Descriptions and Use</td>
<td>143</td>
</tr>
<tr>
<td>6.3.1 Chert Description</td>
<td>144</td>
</tr>
<tr>
<td>6.3.2 Features Indicative of Chert Extraction</td>
<td>156</td>
</tr>
<tr>
<td>6.3.3 Temporal Use of the Quarry</td>
<td>161</td>
</tr>
<tr>
<td>6.3.4 Evidence for Possible Heat Treatment</td>
<td>173</td>
</tr>
<tr>
<td>6.4 Conclusions</td>
<td>188</td>
</tr>
<tr>
<td>Chapter 7: Household Investigations</td>
<td>189</td>
</tr>
<tr>
<td>7.1 Introduction</td>
<td>189</td>
</tr>
<tr>
<td>7.2 Callar Creek Quarry 1</td>
<td>189</td>
</tr>
<tr>
<td>7.2.1 Dating the Construction of CCQ-1</td>
<td>192</td>
</tr>
<tr>
<td>7.2.2 Household Occupation at CCQ-1</td>
<td>205</td>
</tr>
<tr>
<td>7.2.3 Summary</td>
<td>214</td>
</tr>
<tr>
<td>7.3 Callar Creek Quarry 2</td>
<td>215</td>
</tr>
<tr>
<td>7.3.1 Dating the Construction</td>
<td>217</td>
</tr>
<tr>
<td>7.3.2 Household Occupation at CCQ-2</td>
<td>223</td>
</tr>
<tr>
<td>7.3.3 Summary</td>
<td>228</td>
</tr>
<tr>
<td>7.4 Relations between the Households</td>
<td>228</td>
</tr>
<tr>
<td>7.5 Conclusions</td>
<td>233</td>
</tr>
<tr>
<td>Chapter 8: Technological Organization at the Quarry and Households</td>
<td>236</td>
</tr>
<tr>
<td>8.1 Lithic Reduction within the Quarry</td>
<td>236</td>
</tr>
<tr>
<td>8.1.1 Description of the overall assemblage</td>
<td>237</td>
</tr>
<tr>
<td>8.1.2 Reduction sequences</td>
<td>254</td>
</tr>
<tr>
<td>8.2 Quarry and Household Production Sequences</td>
<td>268</td>
</tr>
<tr>
<td>8.3 Quantification of Quarried Materials</td>
<td>283</td>
</tr>
<tr>
<td>8.4 Production Tools</td>
<td>287</td>
</tr>
<tr>
<td>8.5 Conclusions: The Utility of the Organizational Approach</td>
<td>295</td>
</tr>
<tr>
<td>Chapter 9: Discussion</td>
<td>297</td>
</tr>
<tr>
<td>9.1. Introduction</td>
<td>297</td>
</tr>
<tr>
<td>9.2 Continuity and Change</td>
<td>298</td>
</tr>
<tr>
<td>9.3 Regional Comparisons in the Belize Valley</td>
<td>300</td>
</tr>
<tr>
<td>9.4 Resource Variability and Production outside the UBRV</td>
<td>316</td>
</tr>
</tbody>
</table>
List of Tables

Table 2.1: Table of the three economic modes ............................................................. 69
Table 6.1: Counts diagnostic of sherds from quarry excavations .................................. 161
Table 6.2: T-test of technological characteristics from paleosol and non-Paleosol contexts .................................................................................................................................................................................................................................................. 167
Table 6.3: Chi-square statistic for technological characteristics from paleosol and non-paleosol contexts .......................................................................................................................................................................................... 167
Table 6.4: Chi-square statistic for raw material choice from Paleosol and non-Paleosol contexts .......................................................................................................................................................................................................................... 168
Table 6.5: T-test of scalar variables from paleosol and non-paleosol contexts ............... 169
Table 6.6: Surface collection and excavation contexts attributed to specific time periods. ............................................................. 171
Table 6.7: Characterization of samples prior to heat treatment .................................... 176
Table 6.8: Characterization of samples post heat treatment ......................................... 182
Table 7.1: Attribution of excavation units to time periods from CCQ-1 ......................... 193
Table 7.2: Counts of diagnostic sherds by Subop for CCQ-1 construction fill contexts 193
Table 7.3: Counts of objects typically found in households from CCQ-1 ...................... 205
Table 7.4: Counts of ceramics by form from CCQ and SL ........................................... 207
Table 7.5: Counts of materials, and the material amounts normalized by excavation area, from San Lorenzo and Callar Creek Quarry ........................................................ 208
Table 7.6: Ceramic and lithic densities by excavation volume for Strs. 4 and 5 and Platform 1 in CCQ-1 ...................................................................................................................................................................................................................... 214
Table 7.7: Objects associated with households from off-structure deposits at CCQ-2 ... 223
Table 7.8: Counts and percentages of cores from CCQ-2 construction fill and quarry deposits .................................................................................................................................................................................................................................................. 226
Table 7.9: Counts of formal tools from CCQ-2 construction fill and quarry deposits ... 227
Table 7.10: Frequency of percentages of cortex from the CCQ-2 construction fill and quarry deposits .................................................................................................................................................................................................................................................. 227
Table 7.11: Comparisons of the counts and percent of termination types between off-structure deposits at CCQ-1 and 2. .......................................................................................................................................................................................................................... 230
Table 8.1: Frequency of debitage and tools from the quarry ....................................... 237
Table 8.2: Types of flakes recovered from Callar Creek Quarry ............................................. 238
Table 8.3: Technological designation of flakes from Callar Creek Quarry ......................... 240
Table 8.4: Flake terminations from quarry contexts ............................................................ 241
Table 8.5: Size characteristics of debitage from Callar Creek Quarry (mm) .................. 241
Table 8.6: Cortex percentages for debitage from Callar Creek Quarry ............................. 244
Table 8.7: Frequencies of core types from Callar Creek Quarry ........................................ 249
Table 8.8: Descriptive statistics for metrics of the quarry bifaces ........................................ 252
Table 8.9: Types of debitage recovered in Late Classic and Preclassic period quarry contexts .................................................................................................................. 264
Table 8.10: Frequencies of platform preparation in Late Classic and Preclassic periods quarry contexts .................................................................................................................. 265
Table 8.11: Cortex percentages in the Late Classic and Preclassic periods quarry contexts .......................................................................................................................... 266
Table 8.12: Flake terminations from Preclassic and Late Classic periods quarry contexts ........................................................................................................................... 266
Table 8.13: Core types from Late Classic and Preclassic Quarry Contexts .......................... 267
Table 8.14: Percentages of flake terminations from Preclassic period deposits .............. 271
Table 8.15: Counts of cortex percentages for the quarry and household in the Preclassic period ......................................................................................................................... 272
Table 8.16: Percentages and counts of termination types during the Late Classic period in the quarry and household contexts ........................................................................... 276
Table 8.17: Percentage of cortex in the Late/Terminal Classic period quarry and household deposits .................................................................................................................. 278
Table 8.18: Ratios of rims and debitage from Callar Creek Quarry and Succotz ............ 282
Table 9.1: Callar Creek Quarry, San Lorenzo, and Succotz location and types of chert 302
Table 9.2: Extraction and production of materials at the three quarries ..................... 305
Table 9.3: Production intensity and distribution at the three quarries ............................ 307
Table 9.4: Characteristics associated with local production (after Costin 1991) .......... 311
Table 9.5: Characteristics associated with non-local involvement in production .......... 312
Table 9.6: Lithic Densities from San Lorenzo Households ............................................. 314
Table 9.7: Table showing lithic density for households from Chan (CN) Chaa Creek (CC), and Dos Chambitos (DC) ................................................................................. 315
Table I.1: Counts of lithic materials by location ............................................................... 355
Table I.2: Counts of obsidian materials by context ......................................................... 374
Table I.3: Description of all obsidian recovered from CCQ ......................................... 375
Table II.1: Count of sherds by context from Callar Creek Quarry ............................ 384
Table II.2: Table showing all special find ceramics ...................................................... 403
Table II.3 Count of shells by context .............................................................................. 413
Table II.4: Counts of groundstone by type ................................................................. 417
Table II.5: Counts of groundstone by context .............................................................. 417
Table II.6: Groundstone materials. ................................................................. 418
Table II.7: Special Finds from Callar Creek Quarry excavations......................... 428
Table III.1: Flotation sample contexts .................................................................. 430
Table III.2: Count of non-microartifacts from flotation samples by context .......... 431
Table III.3: Counts of microartifact by category and context. ............................... 433
Table III.4: Descriptive statistics of lithic microartifacts (2-4 mm). ....................... 435
Table III.5: Average count of lithic microartifacts from Callar Creek Quarry with counts from Chan and Buenavista ................................................................. 436
Table III.6: Descriptive statistics for counts of microartifacts from quarry deposits. 437
Table IV.1: Summary of the Ops of off-Structure Excavations at CCQ-2............. 456
Table IV.2: Excavation unit characteristics............................................................ 458
Table V.1: Provenience information for all radiocarbon samples ........................... 479
Table V.2: Paleobotanical Analysis of 13 Carbon Samples from Callar Creek Quarry. 480
Table V.3: Radiocarbon dates and 2-sigma calibrations ........................................ 480
List of Figures

Figure 1.1: Map showing the location of Mississippian Culture ........................................ 14
Figure 1.2: Map showing the extent of the Inca Empire ...................................................... 18
Figure 1.3: Map showing the location of Teotihuacan ......................................................... 21
Figure 2.1: Figure showing sites discussed in Mesoamerica ............................................. 33
Figure 2.2: Knossos during the Neopalatial Period in Crete ............................................. 53
Figure 2.3: South House at Knossos .................................................................................. 54
Figure 2.4: Knossos during the Final Palatial Period in Crete ........................................... 55
Figure 2.5: Figure of Huánaco Pampa storage structures ................................................... 58
Figure 2.6: Figure of the Ciudadela Rivera from the Chimu Capital of Chan Chan ........ 60
Figure 2.7: Plan of Aztec palaces showing the lack of large-scale storage areas .......... 67
Figure 3.1: The location of obsidian quarries in Mesoamerica ....................................... 91
Figure 3.2: Location of chert quarries in the Maya area ................................................... 93
Figure 4.1: Chart showing a model of the technological organization approach ........ 116
Figure 5.1: Map showing sites in the Belize Valley ......................................................... 121
Figure 6.1: Location of Callar Creek Quarry in the upper Belize River valley (UBRV) 137
Figure 6.2: Map of Callar Creek Quarry ........................................................................ 138
Figure 6.3: Map showing location of surface collection and excavations in the quarry. 140
Figure 6.4: East profile of Op 374F/1-9 ..................................................................... 142
Figure 6.5: Fossil within Callar Creek chert ..................................................................... 145
Figure 6.6: Picture of large chert cobble on the surface at Callar Creek quarry .......... 146
Figure 6.7: Picture of chert cobble showing variation in color and quality ................ 147
Figure 6.8: Images showing examples of clear chert ....................................................... 148
Figure 6.9: Images showing examples of white chert ...................................................... 149
Figure 6.10: Images showing examples of brown chert ................................................... 151
Figure 6.11: Images showing examples of gray chert ....................................................... 152
Figure 6.12: Images showing examples of tan chert ......................................................... 153
Figure 6.13: Images showing examples of pinkish white chert ................................ 154
Figure 6.14: Images showing examples of red chert ....................................................... 155
Figure 6.15: Quarry cut showing scalloped appearance .................................................. 157
Figure 6.16: Limestone blocks showing potential limestone quarrying ........................................... 157
Figure 6.17: In situ chert beds located in Ops 374B/1-8, 374C/1-7, 374D/1-10 .................. 158
Figure 6.18: Chart showing quantity of debitage is Ops 374A/1-7 and 374F/1-9 ............. 159
Figure 6.19: Quantity of debitage in Ops 374B/1-8, 374C/1-7, 374D/1-10 ...................... 159
Figure 6.20: Debitage mound profile ....................................................................................... 160
Figure 6.21: Drawing and photograph of knapped glass ......................................................... 161
Figure 6.22: North profile of Ops 381G/1-4, 381I/1-3, and 381GI/1-6 ............................. 165
Figure 6.23: Paleosol and Non-paleosol dorsal flake scars .................................................... 166
Figure 6.24: Paleosol and non-paleosol platform facets ...................................................... 167
Figure 6.25: Paleosol and non-paleosol contexts by weight ................................................ 169
Figure 6.26: Rim Profile of Mt. Maloney Late Classic I sherd ............................................. 172
Figure 6.27: Map showing the location of samples prior to heat treatment ....................... 180
Figure 6.28: Chart showing the temperature of fire during heat treatment ..................... 180
Figure 6.29: Map showing the locations of samples post heat treatment ....................... 181
Figure 6.30: Image of heat treated material ........................................................................... 186
Figure 6.31: High-quality chert post-heat treatment .............................................................. 187
Figure 7.1: Map showing structures and excavations from CCQ-1................................. 190
Figure 7.2: Photograph of Structure 2, the possible ancestral shrine, facing north .......... 191
Figure 7.3: Photograph of Structures 3 and 4, on Platform 1, facing east ....................... 191
Figure 7.4: Photograph of Structure 5, facing north ......................................................... 192
Figure 7.5: Drawing and photograph of burial vessel ......................................................... 195
Figure 7.6: Sherd profile of a Late Classic I Mt. Maloney bowl from Op 381 J/3 ......... 196
Figure 7.7: Sherd profile of an Alexander Unslipped, Cayo Variety jar ......................... 196
Figure 7.8: North profile of Ops 381A 1/-15 and 381B/1-14 ............................................ 198
Figure 7.9: Sherd profile of a Late Classic II Mt. Maloney bowl from Op 381 A/2 ..... 199
Figure 7.10: Sherd profile of a Late Classic Cayo Unslipped Cayo Variety jar ......... 199
Figure 7.11: Profile of an Early Classic Lucha Incised, Variety Unspecified sherd ..... 201
Figure 7.12: Photograph and drawing of an Aguacate Orange, Ramonal Variety
Mammiform foot .................................................................................................................. 202
Figure 7.13: Profile of a Savana Orange sherd, Op 381A/10. ........................................... 202
Figure 7.14: North profile of Op 381D/1-19 ....................................................................... 204
Figure 7.15: Photograph of the sherd with glyphs (CR – 145). ........................................ 210
Figure 7.16: Photograph of two sherds with pseudoglyphs (CR – 148 and 154) .......... 210
Figure 7.17: Photograph of the potential Buenavista Device sherd (CR – 143) .............. 211
Figure 7.18: Buenavista Device, redrawn after Ball and Tascheck 2004 ...................... 211
Figure 7.19: Photograph showing Buenavista style sherds from CCQ ......................... 211
Figure 7.20: Photograph of the shell pendants and beads from CCQ-1 ...................... 212
Figure 7.21: Photograph of marine shell from CCQ-1 (LT-707; Op 381D/8) .......... 212
Figure 7.22: Map showing excavations and locations of CCQ-2 ......................... 216
Figure 7.23: Photograph of the range structure, Structure 1, facing west ............ 216
Figure 7.24: Photograph of Structure 2, facing south .......................................................... 217
Figure 7.25: Photograph of the looter’s trench in Structure 2, facing east ...................... 217
Figure 7.26: Drawing of the profile of Op 373A/1-12 .......................................................... 219
Figure 7.27: Drawing of a Mount Maloney LC II bowl from Op 373A/3 ....................... 220
Figure 7.28: Drawing of the Saxche Orange Polychrome from Op 373A/2 ................. 220
Figure 7.29: Photograph and drawing of the Terminal Classic diagnostic piecrust rim. 221
Figure 7.30: Drawing of the profile of a Late Classic Belize Red vessel ....................... 222
Figure 7.31: Platform facet counts from off-structure deposits at the CCQ households. 232
Figure 7.32: Dorsal flake scar counts from off-structure deposits at CCQ households. 232
Figure 8.1: Representative flakes from quarry contexts .................................................... 239
Figure 8.2: Thinning flake from quarry context (Op 374B/2). ........................................... 239
Figure 8.3: Large (374B/5) and small (374D/2) flakes from the quarry ......................... 242
Figure 8.4: Probable retouched flakes (Op 374C/3, Op 384C/2, Op 374D/1) ............... 245
Figure 8.5: Drawing and photograph of multidirectional cores from the quarry ....... 247
Figure 8.6: Drawing and photographs of unidirectional cores from the quarry ......... 248
Figure 8.7: Drawing of discoidal core ................................................................................. 249
Figure 8.8: Image of a GUB from the quarry (Op 374E/3). .............................................. 251
Figure 8.9: Photograph of a scraper from the quarry (Op 374B/1) ................................. 254
Figure 8.10: Poor quality raw material .............................................................................. 255
Figure 8.11: Lithic reduction and associated behaviors from Callar Creek Quarry ...... 261
Figure 8.12: Schematic of the reduction sequence for lithic materials ...................... 262
Figure 8.13: Paneled histograms of quarry material weight by time period ............... 264
Figure 8.14: Counts of Platform Facets from the Quarry and Households in the Preclassic ................................................................. 270
Figure 8.15: Preclassic Period Dorsal Flake Scar Counts from the Quarry and Households .................................................................................................................. 271
Figure 8.16: Weight of quarry and household materials from the Preclassic Period. .... 273
Figure 8.17: Dorsal Flake Scar counts for Late/Terminal Classic quarry and household contexts ................................................................. 275
Figure 8.18: Platform Facet Counts for Late/Terminal Classic quarry and household contexts .................................................................................................................. 275
Figure 8.19: Weight of Late/Terminal Classic quarry and household materials .......... 275
Figure 8.20: Lithic reduction and associated behaviors for the materials from the households around Callar Creek Quarry ................................................................. 279
Figure 8.21: Schematic of the reduction sequence for lithic materials from the households around CCQ ................................................................................................. 279
Figure 8.22: Photographs of bifaces from the quarry ....................................................... 288
Figure 8.23: Photograph of hammerstone from the debitage mound ......................... 289
Figure 8.24: Photograph of bark beater from quarry ....................................................... 289
Figure 8.25: Photograph of mano fragments used as hammerstones .......................... 292
Figure 8.26: Two views of the chert core used as a hammerstone .................................................. 292
Figure 8.27: Hammerstones from CCQ -2 ......................................................................................... 293
Figure 8.28: Quartz fragments from CCQ -2 .................................................................................... 293
Figure I.1 Schematic of the length, width, and thickness measurements of whole flakes .................................................................................................................................................. 347
Figure I.2 Photograph showing the amount of space necessary for aggregate analysis. 364
Figure I.3: Relationship between cortex proportions for the attribute and aggregate analysis of Op 373A/1-12 ........................................................................................................................................ 369
Figure I.4: Relationship between surface area and volume for spheres. . ...................... 370
Figure I.5: Proportions of debitage in different size grades from aggregate analysis. ... 372
Figure II.1: Chronological sequences and phase designations from Barton Ramie, Xunantunich, and Uaxactun. ........................................................................................................................................ 381
Figure II.2: Microseriation of Mount Maloney bowls from the Late Classic period. . 382
Figure II.3: Late Classic II (Hats’ Chak) phase diagnostic Cayo Group jars. ............ 382
Figure II.4: Ceramics showing typical photography of ceramic artifacts. ....................... 383
Figure II.5: Shells illustrating typical photography of shell artifacts ..................... 412
Figure II.6: Photograph showing typical photography of daub artifacts. .................... 414
Figure II.7: Slate illustrating typical photography of slate artifacts. ....................... 415
Figure II.8: Photograph showing typical photography of groundstone artifacts ...... 417
Figure IV.1: Plan view of the retaining wall in Op 381B/1-14 ............................................. 443
Figure IV.2: Elevation drawing of the retaining wall in Op 381B/1-14 ......................... 444
Figure IV.3: West profile of Op 381D/1-19 showing construction phases of Str. 4. .... 445
Figure IV.4: South profile of Op 381C/1-10. ................................................................. 446
Figure IV.5: Drawing (top) and photograph (bottom) of CCQ Burial 1. ................. 449
Figure IV.6: South profile of Ops381F/1-9 and 381 J/1-5.............................................. 450
Figure IV.7: West profile of Op 373B/1-16 showing single construction episode. ...... 453
Figure IV.8: East profile of Op 373A/1-12 showing floor and construction episodes... 455
Figure V.1: Calibration curve for sample C-673. ........................................................... 482
Figure V.2: Calibration curve for C-681 Op 381A/12..................................................... 482
Figure V.3: Calibration curve for C-697 Op 381D/11....................................................... 483
Figure V.4: Calibration curve for sample C-701 Op 381D/13. ....................................... 484
Figure V.5: Calibration curve for C-702 Op 381D/17....................................................... 485
Figure V.6: Calibration curve for C-632 Op 373B/11....................................................... 486
Figure V.7: Calibration curve for C-634 Op 373B/11....................................................... 486
Chapter 1: Introduction

1.1 Introduction

An economy is, at its most basic level, the production, exchange, and consumption of goods and services. Studies of economies examine raw material acquisition, production, exchange mechanisms, use, and discard. An economy, however, is more than the sum of its parts; it is not simply these actions, but a sequence of individual activities and interactions which can shed light on how people live and interact. The mechanisms used for exchange (i.e. reciprocity, redistribution, market exchange, etc.), the involvement of individuals in production activities, and where (or if) they acquire raw materials, tells us about the interpersonal relationships of that individual. The economy then provides information on social and political relationships, and the role of the economy in these relationships, for different groups and individuals. Some individuals may benefit more socially or politically from certain economic activities than others. An economy can be simultaneously, but not exclusively, a source of legitimation of authority for leaders, important in ritual and ideology, a mechanism of integration and disintegration, and an activity performed by all households.

That being said, discussing a single economy is rather misleading. Even today, no one acquires all their goods from a single source. Although we, in the United States, have
a free-market economy, we do not acquire all goods through market exchange. People give gifts, reciprocate goods and services, and obtain money and services through redistributive programs. Multiple types of economies operate concurrently but they are not monolithic entities; within each economy, services may vary for different individuals.

Rather, economies co-exist with other economies and each has a different logic. Using the modern example, people do not approach the gifting of goods at holidays or around birthdays in the same way they approach purchasing basic goods at a grocery store or market. It is through the understanding of these multiple economies and their articulation that we can gain a complete picture of economic activities, their variability, and their importance for different peoples; economies cross-cut segments of society, serve as integrative and divisive mechanisms, and play different roles for different actors.

The presence of multiple economies and the fact that different actors play various roles in these economies creates difficulties in studying them and their relations with social and political systems, particularly in the past. Archaeologically, we are limited in what we can say about past economic activities as we can only see the material remains of a segment of past activities, those with remains which preserve archaeologically. Because of these difficulties, archaeologists tend to focus on a single economy or an aspect of an economy in reconstruction attempts. This study attempts to complicate our understanding of past economies by looking at their complexity, articulation, and importance to different actors through a focus on raw materials. The articulation of economies becomes apparent through studies of extraction and production of raw materials as access to and exchange of such goods occurs at the intersection of various economies.
By examining the role of different actors in access to raw materials, the complexity and embeddedness of past economies, and importance of such complexity for different individuals, can be discussed. Thus, this dissertation asks, what was the role of local actors in the management of utilitarian resources? Examinations of utilitarian resources allow the evaluation of the role of economies in other institutions and for evaluating the complex interactions between economic and other political and social institutions. These issues are addressed among the lowland Maya, of the Late/Terminal Classic Period (A.D. 670-890), through a study of lithic production at Callar Creek Quarry, a chert quarry and production area in the upper Belize River valley (UBRV) of western Belize.

This study finds that among the Late/Terminal Classic period Maya of the UBRV, chert materials were extracted and produced by part-time or periodic producers residing near lithic raw material sources. These householders participated in the regional economy through the exchange of these materials which encouraged regional integration, provided opportunities for economic diversification, and served as a method of risk reduction, in part buffering residents against the changing political dynamics of the UBRV. This research indicates lowland Maya economies were complex systems where individuals of varying socio-economic status negotiated wealth and power.

The data to examine the articulation of multiple, overlapping economies resulted from detailed analyses of lithic technology through a technological organization lens, a framework to link material culture and past behaviors. Using raw material source location and abundance, this project examines co-occurring economies and highlights the importance of different economies for elite and non-elite actors among the lowland
Late/Terminal Classic Period Maya. This model, and the importance of raw material location and abundance for understanding economies, is also applicable to other complex societies.

1.2 Studying Economies

The presence of multiple economies, and the difficulties inherent in studying these economies has led to generalizations about past economies which prevent the full understanding of their complexities. Anthropological studies of economies, influenced by western philosophy, began with a dichotomy between the domestic and political economy (e.g. Sahlins 1972; Smith 2008 [1776]; Weber 2002 [1904]; see Wilk and Cliggett 2007 for an overview). In archaeology, we see this dichotomy in the emphasis on top-down (prestige) and bottom-up (household) studies (e.g. Algaze 1993; Costin 2004; Garraty and Stark 2010; Halperin 1994; Ortiz 1983; Plattner 1989; Rathje 1972; Wells and McAnany 2008), which stem from the substantivist/formalist debate. Substantivists, such as Karl Polanyi (1944, 1957, 1977), see substantial differences between modern and past economic systems while formalists see similarities between them, particularly in the presence of rational actors. Many archaeologists took Karl Polanyi (1944, 1957, 1977; see also Sahlins 1972), and other substantivists discussions to indicate that market economies did not exist prior to modern economic systems (see Halperin 1994). While current understandings of ancient economies alter that perception, interpretations of Polanyi’s position greatly influenced the trajectory of studies of past economies, leading to skepticism concerning the presence of markets prior to the industrial revolution (Silver 1995; Smith 2004).
Despite the utility of previous frameworks for analyses of past economies, dichotomized theoretical orientations emphasize the roles of either elite or non-elite individuals when past economies were more complex with the roles of actors changing throughout the use-life of an object. To incorporate the variation in past economic systems, economic models must build on top-down and bottom-up approaches to consider the multiple economic systems which operated in the past (i.e. Appadurai 1986; Berdan 1989; Cheal 1989; Feinman and Garraty 2010; Garraty 2010; Hirth 2010; King and Shaw 2015; Kopytoff 1986; Masson and Friedel 2012; Mayer 2002; Storey 2004).

Understanding how different goods operated within economic systems provides an understanding of the presence of multiple economies, that barter, market exchange, reciprocity, redistribution, and other types of trade and exchange, co-exist. Utilitarian resources are a particularly important part of economic systems as the economic role of utilitarian goods has far-reaching consequences for the role of elite actors in past economic systems. In systems where elites managed utilitarian resources, elites controlled most of the economy, implying greater economic and political power. The remainder of this section provides an overview of the traditional frameworks for studying economies and how these have influenced their archaeological study.

Many studies of past economies focus on the importance and integration of economic systems with political systems, part of a substantivist economic framework. This dissertation considers economies as embedded within other institutions, generally a substantivist perspective (see Wilk and Cliggett 2007 for a discussion of embedded economies). Economies as such are impacted by other institutions operating within a society, such as political and ideological institutions, making it difficult to separate
economic activity from other realms of societies. However, in this study all types of economic exchange operate within embedded economies. That the embedded nature of economies does not discount the operation of individuals in self-interested ways within economic relationships, rather acknowledging that other factors, such as cultural expectations, also influenced economic activity (see Hirth 2010).

Exchange mechanisms, specifically reciprocity, redistribution, and market exchange, are a main focus for many studies of past economies (Polanyi 1944; Mayer 2002). Exchange, however, is only one part of an economy as resource acquisition, production, exchange (or distribution), and use (and re-use) of items are all aspects of economies. Materials may change use, function, or value throughout their use-life from raw material acquisition through production, exchange, and re-use. Value can be added through production (Helms 1993), possession by a specific individual, restriction of ownership to specific people, or the representation of a particular group (see Bayman 2002; Graeber 2001; Helms 1993; Lesure 1999; Murakami 2016; Papadopoulos and Urton 2012; Schortman and Urban 2004). As such, studying the life-history of objects (see Appadurai 1986; Kopytoff 1986), provides information about economic organization and the changes which occur throughout an object’s use-life. By studying the life-histories of individual objects or groups of objects, potential changes in the value of an object can be elucidated (see Appadurai 1986; Kopytoff 1986).

Due to the scholarly focus on studies of exchange mechanisms, issues exist in defining these terms. Market exchange is defined in many different manners (see Garraty 2010 for a review of various definitions). This dissertation follows Garraty (2010:5) in the distinction between market exchange and markets, both economic concepts, and
marketplace exchange, a physical manifestation of these concepts (see also Abbott 2010; Braswell 2010; Garraty 2009; Hirth 1998; Minc 2006; Stark and Garraty 2010; Stark and Ossa 2010). Marketplace exchange refers to market exchange which occurs in a specific, formalized location. Market exchange is defined as exchange which presupposes a shared valued system but not a price fixed system. That is, market exchange does not imply the presence of a set price negotiated through supply and demand but rather the presence of a shared valued system and a shared sense of values which permit mutually beneficial exchanges between parties (see Garraty 2010). Markets, on the other hand, are “institutions predicated on the principles of market exchange of alienable commodities” (Garraty 2010:5). This definition allows for the consideration of inter-personal relations in markets and market exchange. As discussed by Garraty (2010) and Hirth (2010), such a broad definition of markets indicates that it is when markets become institutionalized, or commonplace, that they become of real interest to scholars. Isolated incidents of market exchange provide little information about the overall functioning of past economic systems; it is the large-scale presence of these types of exchanges which has relevance for understanding past societies.

Markets, market exchange, and particularly marketplace exchange, can operate either independently or under the supervision of individuals (Cap 2015a; Garraty 2010). Marketplace management provides opportunities for leaders to tax exchanges or to benefit through the prestige produced by providing the marketplace location (Freidel 1981; Hirth 2010; Masson and Freidel 2013; Polayni 1957; Smith 1976; see Cap 2015a for an overview). Market regulation can involve elite individuals in the economy and provides a mechanism through which markets can serve as a source of economic power.
Redistribution is also a particularly controversial mechanism of exchange. In many classic anthropological studies of exchange, redistribution was associated with chiefdoms, thus the term has fallen out of vogue due to its association with evolutionary typologies (see Earle 1977; Pauketat 2007; Yoffee 2005 for a review; see also Algaze 1993; Blanton and Feinman 1984; Rathje 1972). A plethora of definitions for redistribution also exist, complicating its use in describing economic activity. At its most simple, redistribution refers to the gathering of materials in a central location and their distribution from this center (see Polanyi 1944). The redistribution of goods may serve an ideational goal or may be framed as a payment for labor (such as with the Inka), or serve another purpose (Polanyi 1944).

Due to the issues with this term, this dissertation alternatively refers to centralized economies where centralization refers to the association of exchange mechanisms with elite individuals. That is, elite individuals managed the distribution of specific goods. Distribution may occur through ceremonies, work parties, or in some other fashion; this definition aligns with what has been termed elsewhere asymmetrical or negative reciprocity (see Sahlins 1972; Earle 1977). This work preserves language used by other scholars, so when the term redistribution is utilized in works discussed, it will also be employed here, including in discussions of the Inka (Covey 2008; Earle 1987; Murra 1980; Stanish 1997, 2010) and Maya (Aoyama 1999, 2001).

Despite the complexity of terms and the overlapping meanings of various economic activities, economies are important to our understandings of the functioning of broader social systems. Economies serve as mechanisms of risk reduction, mechanisms of social integration and distinction, and sources of political power.
Studies of economies as mechanisms of risk reduction highlight relationships between individuals in the past, whether at a personal, household, community, regional, or inter-regional level. Risk reduction is frequently considered in the context of hunter-gatherer societies (e.g. Bousman 2005; Faulkner 2011; Gould 1980; Hiscock 1994; Weissner 1980), specifically in discussions of obtaining raw materials in resource-poor areas. Ethnographic studies of risk reduction illustrated that social networks are a main avenue with which to mediate risk reduction (Gould 1980; Weissner 1980). For instance, in the Kalahari, exchange networks of prestige goods provide individuals with connections to groups living in other areas so that in times of resource stress they may travel to these areas to obtain necessary resources (Weissner 1980). Within sedentary societies, economies and the connections created by these economic activities, are a means of mediating resource scarcity.

Economic activity mediates resource scarcity by integrating communities, thereby providing an avenue for exchange. For instance, some part-time craft producers occupy marginal agricultural land, which limits their acquisition of agricultural goods through farming. Instead, they rely on craft production to mediate resource stress as the crafted materials can be exchanged to obtain the necessary agricultural products (see Hirth 2009 for a discussion of risk reduction and household production). Furthermore, having multiple sources of income, whether it is multicrafting or agricultural activity, minimizes risk by diversifying economic activity, thus increasing the utility of these activities for households (Hirth 2009).

Economies also serve as sources of power, usually for elite individuals (see Earle 1977; Mann 2005; Pauketat 2007; Schroeder 2005 Pauketat 2007; Yoffee 2005). The
involvement of individuals in the production and exchange of goods provides opportunities for exploiting economies as a source of power. The role of individuals in the operation of various economic modes, i.e. subsistence goods, luxury goods, etc., impacts the ways in which we understand the relationship between economies, power, power structures, and displays of power.

To examine the ways in which economies are studied and used to examine broader social and political systems, three examples of studies of past economies are presented, the Mississippian, the Inka, and Teotihuacan, preceded by a discussion of terms used to refer to individuals of varying socio-political status and the role of economies in defining such status variability. These broad overviews of economic studies outside the Maya area illustrate the shortcomings and benefits of economic studies and the frameworks used to study them. These comparisons are particularly apt due to the similar trajectories in the frameworks used in early studies of Mississippian, Inkan, and Teotihuacano economies and those used to examine Maya economies. In each of these examples, however, more recent studies have expanded beyond elite-centric, household-centric, and substantivist/formalist frameworks to diversify views of past economies. These three case studies present models for how economic studies in the Maya area can expand our understandings of past Maya economies and their importance for a variety of past actors.

1.2.1 Defining Socio-political Status

Defining past socio-political status is a complex issue which is beyond the scope of this dissertation although some discussion must be put forth prior to exploring economic activity as previous studies of economies focus on individuals with different
socio-political statuses. In particular, the most commonly used terms to discuss actors of varying socio-political status, elite and non-elite, have complicated definitions and limited archaeological visibility. This section provides a brief discussion of definitions of these terms, issues with said definitions, and the ways in which they are utilized in this dissertation.

Elite and non-elite, as terms, are mostly useful as heuristic devices to explore the contrast between actors of different socio-political status. While the terms elite and non-elite create an excellent heuristic device, in reality the socio-political spectrum of past societies, particularly Mesoamerica, was much more complex, and the use of these terms obscures variation in other important aspects of social identity by creating a lens of uniformity across these categories (see Ardren 2002, 2015; Blackmore 2014). The use of these terms also obscures the variability in interactions between individuals of different statuses which can serve to create communities and to negotiate power and status (see Canuto and Yaeger 2000; Inomata 2004; Marcus 2004).

Attempts to define and examine these terms and actors are complex, as seen by the number of publications which attempt to do just that (i.e. Chase and Chase 1992a; Lohse and Gonlin 2007; Lohse and Valdez 2004a). Attempts to define elites and non-elites have often relied on the contrast between the two groups (Lohse and Gonlin 2005; Lohse and Valdez 2004b), which increases the focus on elite individuals, as they are more archaeologically recognizable. Elites are variously considered as those who run social institutions, or the rich and powerful of a society (Chase and Chase 1992b). Archaeologically, elites can be defined by the presence of luxury goods, access to goods from long distance exchange, sumptuous treatment of bodies in death, and the presence
of elaborate architecture including large structures which required large labor investment, and stonework architecture (Chase and Chase 1992b; Haviland and Moholy-Nagy 1992; Hirth 1992; Inomata and Houston 2001c; Pendergast 1992). Non-elites, sometimes referred to as commoners, are then the opposite (see Chase and Chase 1992b; Sinopoli 2001). That is, they can be defined through evaluations of settlement data, examinations of household goods, and access to long-distance trade goods (D. Chase 1992; Lohse and Valdez 2004b; Powis 2004; Sinopoli 2001; Hare 2000).

Archaeological and ethnographic discussions of elites and non-elites, particularly in Mesoamerica, illustrate that these are not dichotomous categories and that the archaeological correlates used to define them confound social status, political power, and wealth (see D. Chase 1992; Chase and Chase 1992b; Fox et al. 1992; Hare 2000; Hutson 2016). Elites and non-elites can be conceptualized as a spectrum which includes secondary elites, rural elites, nobles, royal, nonroyal, etc. (see A. Chase 1992; Charlton and Nichols 1992; Cowgill 1992; Hare 2000; Marcus 1992; Mehrer 2000; Robin, Meierhoff, and Kosakowsky 2012; Sinopoli 2001; Webster 1992). Thus, small rural sites can have elites who served as the leaders of those communities, (i.e. Robin, Meierhoff, and Kosakowsky; Yaeger 2010b; Yaeger and Robin 2004) as definitions of elites vary depending on the scale of analysis (see Lohse 2004; Masson and Peraza Lope 2004). Further issues in defining elites and non-elites are caused by the temporal and spatial variability in the constituent parts of socio-political organizations (Chase and Chase 1992c; Dunning 2004).

Due to the archaeological difficulties in recognizing elite and non-elites, in this dissertation these terms are used as heuristic device to discuss peoples of varying socio-
political and economic classes. In particular, these terms are useful when discussing the history of economic studies, as previous studies examined economies from the viewpoint of elite and non-elite individuals. Thus, when discussing previous economic research, these terms are used.

When referencing elites and non-elites in regard to data collected in this dissertation, elites refer to ruling elites (those individuals with political power in a region) and non-elites to refer to the remainder of the populace. These definitions are difficult to operationalize archaeologically (as discussed above), but this dissertation employs common archaeological markers of elite and non-elite status in attempts to tease apart relationships between individuals of different socio-political and economic status. Thus, elites can be archaeologically identified through investment in stone architecture, access to goods with restricted distributions, and relationships to symbols of political and religious power. Non-elites on the other hand, are archaeologically characterized by their lack of many of these items, their association with subsistence practices and craft production of utilitarian items, little investment in architecture (or at least stone architecture), and less access to items with restricted distributions. As discussed above, these archaeological correlates have issues, but must be used to attempt to tease apart issues of status and wealth (see Hutson 2016 for a further description of attempts to examine social and wealth disparities).

Although the terms elite and non-elite are used throughout this dissertation, here I attempt to move beyond the dichotomy between these groups to examine the integration of people of different socio-political backgrounds through economic activity. In particular, this research examines how economies are embedded in other past institutions
(i.e. social and political institutions). As will be discussed in Chapters 6 and 9, Late
Classic Maya lithic producers in the upper Belize River valley show some signs of wealth
and access to materials whose distribution was probably managed by elites; but these
residents do not fit all of the characteristics that would be associated with elite individuals
– particularly political authority. Thus, this dissertation examines the ways in which the
lithic production helped actors integrate into regional socio-political processes through
their economic activity.

1.2.2 Mississippian Economy

The Mississippian (A.D. 900-1450) (Johnson 1994) is a culture found throughout
the southeastern and Midwestern United States (Figure 1.1). The Mississippian serves as
a useful point of comparison to Mesoamerica as studies of the Mississippian economy
focus on utilitarian and ceremonial goods and the multiple economies in which these
goods operate, a similar thematic issue to Mesoamerican economies.

![Figure 1.1: Map showing the location of Mississippian Culture.](image)
Ceremonial, or prestige goods, circulated in elite-controlled contexts with utilitarian goods illustrating a more complex picture. Some items, such as chert, operated independently of elite control, while others, including salt, operated with elite involvement. Studies indicate ceremonial goods, including shell gorgets, copper, and stone maces and arrowheads, part of the Mississippian Ideational Interaction Sphere (MIIS), circulated among elites. MIIS is a suite of objects which were circulated amongst elites during the Mississippian period; elites displayed MIIS objects during rituals for the display and maintenance of power (Brown et al. 1990; Cobb 1993; Dye 1995, 2007; King and Freer 1995; Marceaux and Dye 2007; Peregrine 1995). While limited information is known about the production of MIIS items, evidence suggests elites produced some items, including basalt axes and arrow points, during ritual activity (Kelly 2006).

The production and distribution of utilitarian items among the Mississippian presents a more complicated picture. Excavations at a salt production workshop in Virginia indicate elites controlled the production and distribution of salt, a utilitarian resource (Meyers 2006). A polity controlled the extraction and trade of salt through an administrative center constructed near the salt works which managed access to the salt and the flow of goods outside the site.

Production and distribution of chert hoes, used for agricultural activity (Cobb 1989; 1998; 2000; Kelly 1990), provides an example of the complex relationship between quarry materials and the role of elite and non-elite agents in the production and distribution of lithic materials. Chert hoes, found across the Mississippian world, reached these locations in their final forms (Carr and Koldehoff 1994; Cobb 1998, 2000;
The wide distribution of hoes (Carr and Koldehoff 1994; Cobb 2000; Koldehoff 1987; Muller 1997; Staneford 1982; Testler 1991) and their presence in caches in large Mississippian centers, indicate elite involvement in the distribution of some of these materials (Cobb 1988, 2000; Kelly 1990; Latchford 1984; Miller 1958).

While evidence suggests elite management of some chert hoe distribution (Brown et al. 1990; Cobb 1989; Muller 1995), an in-depth examination of one of the major production areas, Mill Creek, indicates that hoe production occurred within household workshops (Cobb 1988, 2000). That is, despite the proximity of production areas to the source area and to each other, these workshops operated independently, each one producing the same materials and performing all stages of lithic production. Large nearby sites, such as Wycliff Mounds, show no evidence of lithic production, supporting the independence of production at the workshops (Cobb 2000; Drake et al. 2005).

This brief overview of Mississippian economic systems illustrates that multiple types of economic systems can co-occur within complex societies. In the Mississippian, ceremonial goods operated in an elite-controlled and oriented economic system while utilitarian goods circulated through multiple avenues, with salt controlled by elite individuals and chert hoes produced by local, non-elite residents, while elites managed the distribution of some chert hoes.

The Mississippian provides a point of comparison for Maya economic studies due to the frameworks used to research the economies. Studies of Mississippian economies examine a variety of materials which demonstrated the presence of multiple economies and that goods circulated through different economies at various points in their use-life.
during the Mississippian. This case study illustrates the importance of understanding the
variability in management and circulation of various goods and of goods in various stages
of their use-life for understanding the complexity of past economies, an approach
advocated here.

1.2.3 Andean Economies

Contrary to the Mississippian, where studies of a variety of artifact types
illustrated multiple economies operating concurrently, studies of Inka economies center
on the elite management of economies and were greatly influenced by substantivist
economic models; the Inka are thought to have operated entirely with embedded,
redistributive economies lacking market exchange (Hirth and Pillsbury 2013; Murra
1980; Smith 2004; Stanish 1997). Although the majority of studies view Inka economies
this way, due to the impact of substantivist economic models, new studies suggest more
variability was present in the Inka economy.

All large Andean civilizations were once understood as nonmarket economies
based on Murra’s (1972, 1980) vertical archipelago, or ecological complementarity,
model. The Andes contain ecological zones where only certain goods can be produced;
Murra (1972, 1980) argued that elites established sites (colonies) in other ecological
zones to access a variety of resources. The vertical archipelago model emphasizes
political centralization and economic control by elites; rendering markets obsolete (Murra
1972, 1980; see also Dillehay 2013). Criticisms of the vertical archipelago model include
the presence of merchants in the northern Andean area (Salomon 1987; Topic 2013;
Uzendoski 2004) and the large areal and temporal extent to which this model was applied
(Goldstein 2010; Stadel 1990; Tripcevich 2010; van Buren 1996; see Dillehay 2013 for
an overview of criticisms of the model; but see Goldstein 2013; Knudson 2008; Stanish et al. 2010).

Figure 1.2: Map showing the extent of the Inka Empire.

Stemming from Murra’s arguments of vertical complementarity, studies of Inka economies (A.D. 1476 – 1533) (Covey 2008) (Figure 1.2) assume nonmarket exchange, focusing instead on redistribution. Corvee labor, to the state, and the redistribution of surplus goods by the state to participants in labor groups served to circulate quotidian and luxury goods (Covey 2008; Earle 1987; Murra 1980; Stanish 1997, 2010). This system
extracted wealth through labor, using the mita system, rather than taxation (Covey 2008; Murra 1980; Stanish 1997). Murra (1980) argues that the state acted like a market, absorbing surplus and redistributing it to the population.

Archaeologically, evidence for redistribution comes from large Inka store-houses, production enclaves, and Inka administrative and production centers containing Inka-style architecture. One such center, Huánaco Pampo, contained storehouses for storing comestibles for redistribution during labor parties and religious festivals (Covey 2008; Dillehay 2013).

In addition to controlling the staple goods economy, the Inka elite also controlled prestige goods distributions (Covey 2008). The Inka had strict rules for the possession of status symbols, including certain types of cloth; only individuals of certain statuses possessed, or wore, certain items. For instance, only Inka elites wore clothing of vicuña fiber, a relative of the llama (Murra 1980: 60). Inka rulers also managed the extraction and production of materials including obsidian, copper, and various pigments (Cantarutti 2013; Jennings et al. 2013; Ogburn 2011, 2013; Tripcevich and Contreras 2011, 2013). Evidence of the centralized elite management of these resources includes roads leading to or associated with the source area (Ogburn 2013), storage areas (Cantarutti 2013), state sponsored ritual activity in or near the quarry or mine (Vaughn et al. 2013), and increased volume and organization with the arrival of the Inca (Salazar et al. 2013).

More recent studies of the Inka question the complete absence of markets (Burger 2013; Mayer 2002, 2013; Stanish and Coben 2013). Stanish and Coben (2013) present evidence from contact-period dictionaries, histories, and indigenous accounts to argue that the Inka concept of markets differed from that of the Spanish and thus was not
understood or described in contact period documents. Mayer (2002; see also Stanish and Coben 2013) uses the quick emergence of markets after the Spanish Conquest to suggest that market activity existed during pre-Inka times. Mayer (2013) argues that the Inka suppressed market activity, but that market exchange occurred, at least for subsistence goods, prior to the Inka conquest.

This brief examination of Inka economies illustrates the exclusive focus of these studies on the role of elites in economic activity, particularly its importance for elite political power. The increasing diversification of studies of Inka economies results from studies of wider varieties of goods and careful reexamination of Colonial Period documents. The Inka case study illustrates the impact of previous theoretical frameworks on archaeological studies of economies and how such frameworks are only now beginning to be questioned by scholars, a trajectory which also occurred in Mesoamerican economies. As studies illustrate, the Inka economy was more complex than suggested by early studies, and thus must be reexamined through studies of a wider variety of goods.

1.2.4 Teotihuacan Economy: A Mesoamerican Comparison

In a comparison more geographically circumscribed to the Maya, the economic organization of Teotihuacan is an important comparison as the approaches to economies at Teotihuacan mirror those in the Maya area (see Figure 1.3). Early studies of economies at Teotihuacan tended to highlight the role of elite individuals in economic activity. Studies of the obsidian production at the site led to suggestions that the Teotihuacan elite managed craft production activities, access to specific obsidian sources, and the regional and long-distance distribution of these materials (Charlton 1978; Santley
1983, 1984, Santley et al. 1995; Spence 1967, 1981, 1986, 1987; Spence et al. 1984). Such studies relied on the distribution of easily sourcable commodities, most often obsidian, to suggest that much of Teotihuacan’s power, as well as that of the elites at Teotihuacan, came from economic activities, specifically the management of raw materials and goods production.

Figure 1.3: Map showing the location of Teotihuacan

More recent studies of production at Teotihuacan provide a nuanced understanding of the variability in the organization of production contexts and general economic organization. Studies of obsidian workshops by Andrews (1999, 2002) and Carballo (2005) suggest that Teotihuacan elites managed the production of obsidian prestige goods, based on the production of ritual and ceremonial objects in workshops adjacent to the Pyramid of the Moon (Carballo 2005). However, this does not imply that
Teotihuacan elites managed other aspects of obsidian production, an idea heavily critiqued elsewhere (see Clark 1986). Studies of obsidian extraction at the Pachuca source (Pastrana and Dominguez 2009; Pastrana 2002) found that extraction operated at the household level. Teotihuacan elites seem to have managed the production of prestige and status objects of obsidian but not that of utilitarian objects and did not manage the extraction of raw materials at obsidian sources, although they may have managed the distribution of those raw materials.

Other studies of craft production at Teotihuacan also point to variability in the types of production, and the organization of production, within Teotihuacan. Manzanilla (2009) proposes four scales on which craft production occurred and was managed: households, specialized crafting areas, neighborhoods, and elite-managed workshops (see also Manzanilla and Barba 1990; Widmer and Storey 1993). The various workshops which produced goods may have also participated in different exchange networks. Other materials may have been produced outside the city, including some obsidian (Charlton 1978) and Thin Orange ceramics (Rattray 1990).

Studies of exchange networks indicate that distribution of subsistence goods occurred through a market system while elites managed status goods distribution (Sullivan 2006, 2007). Production of many items, such as obsidian, lime, cotton, and ceramics, occurred in corporate-kin based groups with exchange occurring through periodic markets (Carballo 2013; see also Murakami 2016). Possible locations for these markets include within neighborhoods or at formal centralized market places, postulated to have been located in the Ciudadela or the Great Compound at Teotihuacan (Carballo 2013).
In studies of exchange outside of the site of Teotihuacan, evidence points to distribution networks which operated independently of elite individuals. Examinations of obsidian resource distribution in the Toluca Valley during and after Teotihuacan’s apogee show little change in obsidian procurement networks, indicating the decline of power at Teotihuacan had little effect on obsidian distribution (Benitez 2006). More broadly, studies of obsidian exchange, predominately Pachuca obsidian, outside of Central Mexico (Braswell 2004; Spence 1996) indicate obsidian from Central Mexico arrived in small quantities and was probably connected to ideological and political relations between Teotihuacan and the Maya area rather than an economic connection.

This overview of Teotihuacan economies illustrates the similarity in trends between studies of Teotihuacan and Maya economies. Early studies at Teotihuacan focused on elite managed goods and thus emphasized elite management, with later studies focused on household production, and the most recent studies emphasizing that different goods circulated through various mechanisms throughout their use-life. The subtlety in the circulation of different goods at Teotihuacan is an avenue which should be explored among the Maya and which will add nuance to our understanding of past Maya economic practices.

1.2.5 Importance of Studies of Past Economies

The comparative economic studies presented here illustrate the importance of the frameworks used to examine past economies. The Mississippian and Teotihuacan cases show that nuanced analyses of objects at different stages of their use-lives are necessary to fully understand economies and their importance for other aspects of past societies. For instance, a more thorough examination of obsidian resources at Teotihuacan
illustrated that elites did not monopolize this resource but that some obsidian circulated without elite involvement and other obsidian served as status symbols and was used in ritual, religious, and political contexts. Thus, the in-depth examination of this commodity led to a diversification of our knowledge of the multiple economies which operated concurrently, the ways in which we can distinguish these economies archaeologically, and their importance to different sectors of past societies.

Perhaps the greatest importance of the three examples discussed is that they illustrate that if we fail to understand the subtleties and variability in past economies our understandings of other past systems will also lack such nuances. By gaining a more nuanced understanding of past economic systems we can improve our understanding of relationships between individuals of differing socio-political status, the role of economies as sources of power, integration, and disintegration, and the relationships between actors of differing socio-political status at various levels (household, community, etc.). These interactions, seen through an economic lens, also shed light on other organizational factors of past peoples, thereby increasing the importance of studying past economic systems.

The discussion of the Mississippian, Inka, and Teotihuacan economies illustrates that, for similar studies in Mesoamerica, we must develop mechanisms to understand the economic complexity in the past. Researching a variety of material culture, in this case the organization of lithic production among the Late Classic Maya, highlights the operation of multiple economies.
1.3 Maya Economic Variability and Technological Organization

To fully explore past economies, we must build on traditional approaches to form frameworks to model economic variability. To further our understanding of ancient economic variability, this dissertation employs a life-history approach (see Appadurai 1986; Kopytoff 1986) based on source location, production location, and distribution extent. These three factors provide a framework through which to address economic variation. The resultant economic modes, further explored in Chapter 2, vary based on the local vs. non-local nature of sources, production activities, and the broad or limited distribution of materials. Although by its nature simplistic, as are most models, this model provides an analytical framework to understand the factors contributing to economic variation by examining the life-histories of classes of goods, based on local geographic variation.

The examination of utilitarian lithic materials provides an opportunity to explore and understand the causes of variation within the Maya economy. Here the role of utilitarian resources in Maya economies is examined through Callar Creek Quarry, a chert quarry in the upper Belize River valley (UBRV) of western Belize. Chert materials are readily available in the UBRV, making chert a locally available and plentiful resource in the region. Callar Creek Quarry was utilized from the Archaic through the Historic period with the most intense period of use in the Late to Terminal Classic period (A.D. 670-890), the focus of this research and the most intensive period of occupation of the two adjacent household groups. Previous research in the UBRV provides a comparative framework in which to place the activities which occurred in and around the quarry, as extensive research on economic organization has occurred in the valley.
The focus of this research on utilitarian objects is important as, other than utilitarian ceramics, this class of goods is rarely examined, due to their generally perishable nature. Furthermore, utilitarian goods tend to be produced (although not in all cases) on locally available material, and hence are not useful for studies of long-distance interaction and trade, limiting the study of such items. To fill this lacuna, this project uses lithic technology as a proxy for other similar materials.

Lithics provide a particularly important window to past economies as they are a non-perishable reductive technology which provides a plethora of information about their production. The reductive nature of lithic production means all stages of their production and use are present, making lithics an excellent proxy for examining economic organization. Utilitarian ceramics, another lens through which utilitarian economic activity could be examined, are produced through additive processes, so we have less information about some stages of their production. Lithics’ reductive nature provides a better vantage with which to examine economic processes, particularly as pertains to early stages of tool production.

Here lithic technology is examined through the lens of technological organization. Technological organization provides a link between material culture and past behaviors by examining how behaviors influence tool shape and production activities (Carr 1994a,b; Carr et al. 2012; Cowan 1999; Kuhn 1994; Lothrop 1989; McCall 2015; Nelson 1991; Shott 1989b; Torrence 1989). The use of an organizational framework, integrated with a detailed attribute analysis, permits an examination of the extraction and production processes and how they articulated with past economic systems. Such an approach, which includes an analysis of all detritus from the reduction process, including cores and
debitage and formal and informal tools, provides a holistic picture of past production processes.

Although lithic technology is widely employed in studies of mobile peoples, particularly hunter-gatherers, lithics are less widely studied in sedentary, complex societies. Lithics can provide an avenue for understanding past human behaviors in complex societies as the difference between understanding past behaviors among mobile and sedentary peoples is an issue of scale rather than substantive differences; the principles utilized to understand past behaviors in mobile groups are also applicable to sedentary groups (see Druart 2010; McDonald 1991; Parry and Kelly 1987; Sorensen 2010; Rosen 2010; Teltser 1991; Torrence 1984, 1986).

To fully understand past economic behavior, holistic studies of lithic production systems are necessary, including the extraction of raw materials and all stages of the reduction sequence. By examining the full suite of materials produced and utilized, lithics provide a well-rounded picture of the production and use of technology. The technological organization framework and detailed analyses of lithic attributes provides an examination of the subtleties of production practices which inform on the production and consumption behaviors of past peoples. Variation in production sequences allows an examination of the openness of the production group, including an assessment of the involvement of individuals of varying socio-political status in the extraction and production process. Analyses of the extraction of lithic raw materials provides information on the impact of lithic resource distributions on settlement, particularly in situations of widespread, though uneven, distributions of raw materials, such as in the
Lithic resource distributions’ impacts provide evidence as to the importance of resource access to different segments of the population.

Analyses of materials from all stages of lithic production provide the greatest understanding of the intersection of economic and technological systems; the inclusion of studies of production debris and formal and informal tools adds nuance to our understanding of past economic systems. By focusing on utilitarian items, this project contributes to our understanding of the role of production of quotidian items in past economic systems.

1.4 Organization of the Dissertation

This dissertation consists of ten chapters with Chapters 1-5 providing background information for the data presented in Chapters 6-8 and the discussion and conclusion in Chapters 9 and 10.

This chapter introduced the question of interest, the role of elite and non-elite individuals in the management of the ancient Maya economy, particularly of utilitarian chert tools. Chapter 2 continues with an introduction to previous studies of Maya economic organization and concludes with an elaboration of the model for multiple economic modes employed throughout the text.

Chapters 3 and 4 discuss previous studies of lithic technology (Chapter 3) and methods through which to analyze lithics (Chapter 4). Chapter 5 rounds out the background section with regional background in which to situate Callar Creek Quarry, focusing on the upper Belize River valley and information about its political and economic organization.
Chapter 6 provides a background to investigations at Callar Creek Quarry and a description of the investigations at the quarry. It discusses the results of the quarry excavations and the methods of extraction and reduction of lithic materials in the quarry. Chapter 7 examines the methods of excavations and analysis of materials recovered from the two household groups around the quarry. It includes a discussion of the use of the household compounds and their temporal use as well as a comparison of the reduction sequences between these two groups and between the household and the quarry. Chapter 8 provides an in-depth discussion of the reduction sequence of the materials from the household and the quarry.

Chapter 9 returns to the background information presented in earlier chapters to place the data from Chapters 6-8 in broader context. It contains comparisons with other lithic reduction sites in the upper Belize River valley and other household and quarry sites outside of the upper Belize River valley. It ends with a discussion of the economic model presented in Chapter 2 and the applicability of the model to this situation.

Chapter 10 is the conclusion, which returns to the broad questions of economies and the importance of knowledge about lithic economies to understanding the organization and role of elite and non-elite individuals in ancient economic organization. Furthermore, it emphasizes the variability in economic processes throughout the Maya area and the importance of regionally-specific examination of the economic organization of certain tools.

Appended to the main text are five appendices. These appendices contain additional details and information concerning the excavation and analysis of materials from the quarry and adjacent households. Additional tables of lithic counts are also
included. Appendix I relates the details of the lithic attribute and aggregate analyses.

Appendix II relates information on the analysis and count for all non-lithic artifacts (ceramics, daub, shell, slate, bone, groundstone, other, and special). Appendix III discusses the microartifact analysis. Appendix IV provides additional details on the excavations and the excavation technique applied while Appendix V discusses the radiocarbon dates obtained from the quarry and households and details concerning how the date were obtained and their contexts.
Chapter 2: Economic Studies in the Maya Area

The Maya economy has long been an important realm of investigation for scholars. Despite the amount of investigations concerning economic activity, we still lack a thorough understanding of Maya economic organization, particularly the variability present. One avenue for examining the variability in past economies is presented here and focuses on the role of source location for raw materials, production organization, and the intended distribution of materials on the ways in which economic activities involving these activities are structured. This chapter lays out a model for understanding ancient economic organization based on these characteristics which follows a life-history approach (see Appadurai 1986). This model allows for the assessment of a multiplicity of economic systems co-occurring for different goods, and different types of goods, at the same time. In order to understand this model, and its potential functionality in the Maya area, this chapter first discusses previous studies of Maya economic organization and the ways in which general anthropological and archaeological trends in economic studies impacted studies of the past Maya economies.
2.1 Economic Studies in the Maya Area

Studies of Maya economies have been a central area of research for many years (Feinman and Nicholas 2004; Graham 2002; Masson and Freidel 2002; McAnany 2010; Scarborough and Clark 2007). A major debate in Maya economic studies questions whether the economy was controlled by elites, with goods redistributed from the top, a substantivist perspective (Aoyama 1996; McKillop 2002; Pohl 1994); whether there was a market economy, with goods acquired based on the buying power of the individual, a formalist perspective (G. Braswell 2010; Braswell and Glascock 2002; Golitko and Feinman 2015; Dowling 2012; Guderjan 1995; Fry 1979, 1980; Masson and Freidel 2012; Santore 1993; Sheets 2000; Shaw 2012; Sunahara 1994); or a middle ground with some goods, such as prestige items, controlled by elites and other, utilitarian items, distributed through a variety of economic modes (G. Braswell 2010; Garraty 2010; Hirth 2010; King 2016; Masson and Freidel 2012; Masson et al. 2016; Scarborough and Valdez 2009, 2014). While we now understand that more variation existed within the ancient Maya economy than can be explained from either a purely top-down or bottom-up perspective, the following discussion will be divided into these categories for the ease of explaining past views of the Maya economic system. A new model for representing the multiplicity of the ancient Maya economy, based on a life-history approach, is presented at the end of this chapter.

While no clear consensus exists concerning the types of economies which operated during much of the Maya period, it is generally agreed that during the Postclassic period the Maya had a mercantile economy dominated by coastal trade routes (Andrews et al. 1989; G. Braswell 2010, 2012; Guderjan 1993; Isaza Aizparua 2004;
Ethnohistoric evidence indicates large trade networks operated around the Atlantic coast of Mexico and Belize and some scholars suggested merchants dominated the Postclassic power structures (Hauk 1975; Rathje and Sabloff 1975; Sabloff and Rathje 1975).

Figure 2.1: Figure showing sites discussed in Mesoamerica
Contact period documents from throughout Mesoamerica support the presence of a mercantile economy in the Postclassic with accounts, particularly those from Central Mexico, describing an extensive market system. Bernal Diaz del Castillo (1959 [1552]) perhaps most famously commented that he had never seen such a large market with so many people that was so well regulated. All the descriptions of Aztec market exchange list various market places, such as Duran’s (1964) descriptions of various market places which described the merchants who travelled between them to obtain and trade goods. The goods sold at the marketplaces included gold, silver, precious stones, feathers, cloth, animal skins, food (both prepared and raw), lumber, ceramics, construction materials, and firewood, among other items (Brumfiel 1987; Cortes 1969 [1526]; de las Casas 1992; Sahagun 1959; Duran 1964; Diaz del Castillo 1956 [1552]). These accounts all agree that the markets were overseen by authorities and that the Aztec elite benefited from the orderly distribution of market goods. Cortes (1969 [1526]) describes the Aztec leaders taxing materials which came into the city for sale, in which way they benefited from the mercantile system (see also Brumfiel 1987; Smith 2003).

Among the points of interest in these accounts of the Aztec system is the use of currency. For a mercantile system to operate efficiently, items must possess known values and equivalences (see Halperin 1994). In addition to bartering, the main forms of currency were cacao beans and cotton textiles (Smith 2003) with known exchange rates between the two (del Castillo 1946 [1552]; Sahagun 1959). Del Castillo also mentioned that gold inside geese quills was used as an equivalent measure of exchange. In Sahagun’s account he notes that one small cotton cape was equivalent to 100 cacao beans; similarly, Smith (2003: 116) reports prices from the early Colonial period.
illustrating the purchase of a single obsidian blade for five cacao beans and a turkey egg for three cacao beans. Cotton cloths valued up to 300 cacao beans apiece and thus were utilized for larger purchases. These depictions of the equivalences for cacao and cloth point to their consistent use as currency, an important sign of a mercantile economy (but see Appadurai 1986 for a discussion of the difference between currency and items with equivalencies; see also Storey 2004 for a discussion of degrees of monetization of economies).

We have less evidence from Contact Period and slightly later accounts for the Maya economic system, but Fray Diego de Landa (1978 [1566]) describes the Yucatec Maya economic system as market based. de Landa (1978[1566]) refers to trading as a ‘favorite occupation’ of Maya peoples which included exchange of salt, cloth, slaves, and food stuffs, among other items. de Landa (1978 [1556]: 38) also indicates that the Maya “gave credit, borrowed, and paid promptly, and without usury.” Credit and borrowing indicate a system of known equivalencies. de Landa also refers to a variety of currencies employed by the Maya such as cacao, stone counters, and red shells (also used for jewelry). In summary, evidence from the Contact Period in Mesoamerica indicates a mercantile system existed for the Aztec and the Postclassic and Contact Period Maya. The question of whether this economic system extended prior to this period is a matter of debate, which will be discussed further in the remainder of this chapter (see Freidel et al. 2017; King 2015 for an additional discussion).

Economic studies of the distribution of Maya goods, the main approach to studies of past economic organization, can be analytically divided into two categories: top-down economic studies, focused on prestige goods and long-distance trade, influenced by
substantivist perspectives, and bottom-up approaches, focused on market economies and household production, influenced by formalist perspectives. Studies focused on redistributive economies follow from mischaracterizations of Karl Polanyi’s (1944, 1957, 1977) model suggesting that true market economies never existed in prehistory (see Halperin 1994). The combination of Polanyi’s influences and the predominance of top-down and bottom-up economic studies lead to an argument about the market or non-market nature of past Maya economies. This section provides a brief overview of studies of the ancient Maya economy using top-down and bottom-up approaches as a heuristic device for organizing this discussion and then introduces the economic modes utilized in this dissertation.

2.1.1 Top-Down Economic Studies

Top-down economic studies, focused primarily on elite individuals and their actions, were an early area of study among Maya scholars. This is, in part, an outgrowth of the focus on political frameworks, which are by their nature top-down (i.e. Masson and Freidel 2002). Elite sponsored economic activity received attention due to the interaction between political and economic organization and the importance of these interactions for the growth of major political centers (Freidel 1979; Rathje 1971). One explanation for the rise of political complexity is elite-controlled long-distance trade (Rathje 1971, 1972). Rathje (1971, 1972) argued for an economic core and periphery where the core imported raw materials and produced goods for distribution to the periphery, thus providing an economic base for elite political power.

Additional avenues for elite involvement in the ancient Maya economy include depictions of elite activity, particularly tribute presentations, on carved stone monuments,
mural (i.e. Miller 2001), and on painted vessels. Depictions of tribute, particularly on polychrome vessels, show rulers, seated on thrones or at the top of stairways, receiving bundles containing a variety of goods (Delvendahl 2010; Foias 2002, 2004, 2013; Foias and Bishop 2007; McAnany et al. 2002; McAnany 2010, 2013; Reents Budet 1994, 2001); roughly 12% of depictions on polychrome vessels depict tribute presentations (Foias 2013: 177). The depictions illustrate the materials presented, most commonly cacao, cotton mantles, spondylus shell, jadeite, and quetzal feathers, represented by bundled objects, and described by glyphic texts which include words for tribute (patan), and cargo or burden (ikats) (Delvendahl 2010; Foias 2002, 2004, 2013; McAnany et al. 2002; McAnany 2010, 2013). Tribute presentations probably co-occurred with feasting, dancing, and captive presentations due to similarities in the depictions of these activities and their co-occurrence on vessels (Foias 2002, 2004, 2013; McAnany 2010, 2013; Reents-Budet 2001).

The materials most commonly depicted as part of tribute presentations (cacao, cotton mantles, spondylus shell, jadeite, and quetzal feathers) are wealth items rather than subsistence goods. In fact, no subsistence goods occur in such scenes, although McAnany (2010: 277-278) suggests platters of tamales symbolize large quantities of maize. Instead, the focus on wealth goods might indicate a wealth finance system, where the state uses luxury goods to finance its operation, by Maya elites (see D’Altroy and Earle 1985 for a further discussion of wealth finance). The depiction of wealth items as tribute emphasizes the role of elite involvement in the distribution of such goods and the lack of depictions of staple goods suggests that these items were not a main component of tribute activities. Among the Aztec, whom we know had a mercantile economic system,
taxation and tribute played an important part in state finance, particularly supplying luxury goods and materials necessary for elite crafting and costuming, as well as staple goods (Berdan 1987, 1996). Some of these items were then further distributed through the market system, emphasizing the complexity and variability in past economic interactions (Berdan 1987, 1996). It seems likely that in the Maya area, tribute served a similar role, to supply elites with certain items they required, but not necessarily with a surplus of subsistence goods.

The focus of tribute depictions on wealth items indicates the political importance of aspects of Maya economies which leads scholars to focus on wealth items and prestige goods – those items most closely connected with political institutions. Studies of such items are common as they preserve well in the archaeological record, and some can be easily sourced or come from restricted source areas (Dahlin and Ardren 2002). Prestige goods also reflect social and political dynamics, so their study addresses issues beyond economic organization (LeCount 1991).

Many items depicted in tribute presentations were acquired through long-distance trade. Examples of goods acquired through long-distance trade include obsidian, limited to highland, formerly volcanic areas; jade, found only in the Motagua Valley of Guatemala; and some perishable goods such as feathers from tropical birds or cacao (Andrieu et al. 2014; Braswell 2002; Demarest et al. 2014; Feinman 2004; Foias 2002; Freidel et al. 2002; Hammond et al. 1977; Kovacevich et al. 2001; Kovacevich 2011, 2013, 2014; LeCount 1991; McAnany 2004, 2010; Meadows 2001; Rochette 2014; Sievert 1992; Taube 2005; Wells and Davis Salazar 2007).
For the Maya, studies of the economic role of prestige goods and long-distance exchange, perhaps unsurprisingly, indicate elite control over the economy. For example, studies of obsidian suggest, in many cases, although not all, elite control of obsidian distribution (Aoyama 1996, 2001, 2008; G. Braswell 2002, 2010; Braswell and Glascock 2002; Ford et al. 1997; Hauk 1975; Renfrew 1977; Santley 1983, 1984; Sidrys 1977; for similar patterns in other areas see Clark 1997; Clark and Bryant 1997; Santley et al. 1986; Spence 1981, 1984). Aoyama (1996) performed a study of obsidian distribution in the Copan Valley and demonstrated obsidian redistribution from elite centers to more rural areas (but see Sheets 2000). Notably, obsidian was usually distributed as finished tools, such as prismatic blades, rather than as raw material.

In addition to studies concerning the acquisition and distribution of prestige goods, top-down studies focus on the production of prestige goods such as jade, shell, and obsidian; items with limited spatial distribution and ritual or symbolic importance in addition to economic importance (G. Braswell 2002; Demarest et al. 2014; Freidel et al. 2002; Hammond et al. 1977; Kovacevich et al. 2001; Kovacevich 2014; Meadows 2001; Taube 2005). Specialized elite production has been reported from Buenavista del Cayo, Belize; Aguateca, Guatemala; Motul de San Jose, Guatemala; and Cancuen, Guatemala. Specialization at Buenavista and Motul de San Jose focused on polychrome ceramic vessels. At Buenavista, production of polychrome vessels, associated with the ruling elites at Buenavista through iconographic and stylistic elements, occurred in a palace workshop (Reents-Budet et al. 2000; Reents-Bundet et al. 1994, 2000; Ball and Tascheck 2004). Production at Motul de San Jose focused on Ik’-style polychrome vessels and figurines (Halperin and Foias 2012). As at Buenavista, production occurred within the

Elite production at Cancuen adds complexity to our understanding of the variation in the control of jade by elites throughout the extraction and production process. Jade, normally considered an elite-controlled resource, has an open extraction; non-elite individuals independently extracted raw jade (Rochette 2009, 2014; Taube et al. 2011). Jade production in the Motagua Valley, the only confirmed jade source in Mesoamerica, occurred at households throughout the source area (Rochette 2009, 2014). This production was not limited to early stages of jade production, but included final stage finishing, and items were evenly distributed between households of varying socio-political status (Rochette 2009, 2014). Some jade was transported elsewhere for further reduction, including to the site of Cancuen, Guatemala (Kovacevich et al. 2001; Kovacevich 2006, 2007, 2011, 2013, 2014, 2015). At Cancuen, non-elite individuals performed some stages of the production process while elites performed others (Kovacevich 2006, 2007, 2011, 2013, 2014, 2015; but see Andrieu et al. 2014; Demarest
It seems, however, that elites limited access to the latest stages of production and finished products (Kovacevich 2013, 2015). Demarest (2013; Andrieu et al. 2014; Demarest et al. 2014) argues that elites controlled the entirety of the jade production sequence but did not perform any jade production. Regardless of the exact management of the various stages of jade production, it is likely that elites were involved in some elements of jade production as specialized knowledge (see Helms 1993) was required for certain aspects of production, such as the inclusion of glyphs and some iconographic elements (but see Rochette 2014).

Evidence of elite production at Buenavista, Aguateca, Motul de San Jose, and Cancuen demonstrates that items produced by elites circulated amongst elites, presumably through gift-giving. Elites produced items which marked their status as elites, such as the pyrite mirrors from Aguateca, and helped create and maintain relationships with other elites through exchange, such as the ceramics produced at Buenavista and Motul de San Jose. Items produced by elites were viewed by many people, as they served as part of elite costumes during ritual performances (Inomata 2006), thereby maintaining their status and prestige through production and display.

Elite control of prestige good production provided an avenue for prestige and power production through crafting; the act of producing an item can provide power to an individual while the individual imbues that item with symbolism (Helms 1993). Helms (1993) argues that skilled crafting is a political and ideological tool, rather than an economic one. This is logical given several examples discussed here. Items such as jade prestige items or the ritual paraphernalia produced at Aguateca were used for ritual purposes rather than economic ones. Alternatively, items could be produced for elites by
specific producers, as is the case with the Aztec. Among the Aztec, palace specialists produced items intended for use or display on by Aztec rulers (Brumfiel 1998). Helms’s (1993) discussion of ritual crafting speaks to Wells’ (2006, 2015; see also Wells and Davis-Salazar 2007) concept of the ritual economy. Wells (2006) argues that material circulated through a system of socially regulated values and beliefs and that all economic pathways involve ritual focus. Wells’ argument can be applied to some aspects of economic activity – including elite focused activities, or items produced and consumed by elites in specific circumstances (see Berdan 2007; Davis-Salazar 2007; Foias 2007; Kovacevich 2007; McAnany 2008; Spielman 2008), similarly to those illustrated by Helms (1993); however, Wells’ argument does not hold for the entirety of the Maya economy, as illustrated by an examination of the production and distribution of non-prestige goods. That is, the production and distribution of some items operated through a system influenced by elite religious practices, as suggested by Wells (2006) but not all goods circulated within such realms and, therefore, cannot be understood through a ritual economy viewpoint (see Sabloff 2008).

Elite production activities seem limited to the sphere of prestige-good production and distribution. The known examples of such activities include jades, elite paraphernalia, and polychrome ceramics, all usually associated with elite individuals (see also Masson et al. 2016). The limitation of elite production indicates that perhaps elite economic involvement was limited to prestige goods, or the segment of the economy which Wells (2006) calls the ritual economy. As pointed out by Helms (1993), such items are part of prestige production embedded within economic activity.
The examination of items from long-distance trade and prestige items provide an elite-centric view of the ancient economy. The examination of shell beads, jade, and polychrome ceramic production alone indicates that elites managed, or performed themselves, the production, distribution, and exchange of these items. As a reaction to these top-down, elite focused studies, a crop of studies of other materials, those which were not used for ritual or religious purposes emerged, to attempt to gain a clearer overall picture of the ancient Maya economy.

2.1.2 Bottom-Up Economic Studies

As a reaction to the primarily top-down economic studies, many studies began to use bottom-up approaches to Maya economic activities. The focus on household archaeology influenced bottom-up economic studies while providing ample opportunity for the study of household economies (e.g. Blanton 1994; Canuto and Yaeger 2000; Hagstrum 2001; Netting et al. 1984; Wilk 1989; Wilk and Ashmore 1988; see also Hirth 2009; Brumfiel and Nichols 2009). Bottom-up studies increasingly focus on market exchange through studies of regional distributions, examination of household materials, and the presence of marketplaces. Studies of non-elite production also fall into this category of economic studies.

Studies of artifact distributions, both across and within households and region, are perhaps the most common bottom-up approaches (Fry 1979; Fry and Cox 1974; Garraty 2009; Hirth 1998; 2010; Minc 2006, 2009; Santone 1993; Speal 2009; Stark and Garraty 2010). Such methods are used to identify market exchange based on Hirth’s (1998) distributional approach, which relies on the distribution of artifacts across regions as markers of different types of exchange. For example, Sheets (2000, 2001, 2002b; Sheets
et al. 2015) used the distribution of jade axes and Ixtepeque obsidian at Ceren, El Salvador, to argue for the presence of market exchange. Each excavated household at Ceren, El Salvador had one jade axe (Sheets 2000) while obsidian prismatic blades were distributed evenly between excavated households and discarded when too small to hold comfortably (Sheets 2002b; Webster et al. 1997). Sheets (2000, 2001, 2002b) takes these distributions to suggest that Ceren residents acquired the axes and obsidian from a nearby elite center, such as San Andres. The even distribution of goods suggests, to Sheets, equitable buying power. Sheets et al. (2015) argues that Ceren residents freely chose the markets from which they acquired wealth. They fail, however, to fully explain the mechanisms between this choice and how the choice of various markets is seen archaeologically. However, the distributional approach, and other studies of the distribution of goods, suffers from equifinality; the distribution of materials does not clearly indicate one distribution mechanism (Smith 2004; Renfrew 1977).

While distributions of goods can result in equifinality in terms of exchange mechanisms, marketplaces are a good identifier of market exchange. While market exchange can operate without marketplaces (Abbott 2010; Alden 1982; Garraty 2010; Stark and Ossa 2010; Minc 2006; Watts and Ossa 2016) their presence is an easily identifiable indicator of market exchange. Market exchange, and the presence of markets, only addresses the presence/absence of such areas not the frequency of their use; markets can occur regularly, like the weekly market we are accustomed to in the present day, or can be associated with occasional gatherings such as religious or political ceremonies (Abbott 2010; Coronel et al. 2015; Stark and Garraty 2010; Watts and Ossa 2016). Scholars identified marketplaces at sites as diverse as Actuncan, Buenavista del
Cayo, Calakmul, Caracol, Chichen Itza, Chunchucmil, Cobá, Maax Na, Motul de San Jose, Palenque, El Peru-Waka, Quirigua, Sayil, Seibal, Tikal, Trinidad de Nosotros, Xcambo, Xunantunich, Xuenkal, and Yaxha (Becker 1973, 2015; Blair and Terry 2012; Cap 2015a,b, 2016; Chase and Chase 2014, 2015; Coronel et al. 2015; Dahlin et al. 2007, 2009; Emery and Foias 2012; Eppich and Freidel 2015; Farrell et al. 1996; Fry 1979, 1980; Jones 1996, 2015; Keller 2006; Manahan et al. 2012; Maholy-Nagay 2012; Moriarty 2012; Shaw 2012, Shaw and King 2015). Marketplace identification uses a variety of lines of evidence including internal plaza architecture, plaza access, chemical soil characterization, and the presence of microartifacts indicative of a variety of production activities (Becker 2015; Blair and Terry 2012; Cap 2007, 2015a,b; Cap et al. 2015; Chase and Chase 2014; Coronel et al. 2015; Dahlin 2003; Dahlin et al. 2007, 2009; Farrell et al. 1996; Garraty 2010; Jamison 1996; Jones 1996, 2015; Keller 2006; Shaw 2012; Stark and Garraty 2010; Terry et al. 2015). Skepticism of the marketplace identifications arises from the equifinality of some markers of marketplace activity including architectural elements and soil chemistry (see Becker 2015).

The widespread distribution of potential marketplaces illustrates the geographic and temporal extent of such areas, suggesting the presence of a market economy and the market distribution of some goods. Based on items identified at these potential marketplaces, commodities operating through the market economy included lithic materials, formal chert tools and obsidian (Cap 2007, 2015a,b; Chase and Chase 2014; Blair and Terry 2012; Emery and Foias 2012; Shaw and King 2015) and foodstuffs (Dahlin et al. 2007, 2009).
Epigraphic and iconographic evidence presents a complicated picture for market exchange. The murals from Structure 1 of the Chiik Nahb complex at Calakmul show individuals engaged in production and identified with ‘name tags’ describing their activities. Activities illustrated include *aj ul* (maize-gruel person), *aj jaay* (clay-vessel person), and *aj atz’aam* (salt person) (Carrasco Vargas et al. 2009). While these depictions do not imply market exchange per se, they suggest specialization, which might indicate market exchange (Martin 2007; see above discussion of specialized production and market distributions). The murals do not show individuals in the act of exchanging goods, as would have occurred in a marketplace setting, so there is skepticism from some fronts as to whether these murals represent market activity as opposed to festival or feast preparation (e.g. Boucher and Quiñones 2007). Speal (2014) performed a linguistic analysis of Mayan languages to shed light on the economic organization of the Maya. While he argues that commercialization of the economy did not occur he also indicates that words indicative of exchange, such as marketplace, generalized reciprocal exchange (*jal*), and impersonal economic exchange (*k’aay*) were introduced as early as the Middle Preclassic period. The evidence Speal (2014) presents suggests exchange among peoples as early as the Middle Preclassic period, which supports the presence of a market economy among the Maya.

The possibility of market exchange among the ancient Maya brings to the fore unresolved issues concerning exchange mechanisms and currency, or equivalencies. In market systems, people may or may not have personal relationships with the individuals with whom they exchange goods, making market infrastructure, such as known equivalencies, a necessity (Plattner 1984, 1989). That is, the presence of a known (and
shared) value system increases the odds of success of any transaction, making individuals more likely to participate in such transactions (Plattner 1984). However, Halperin (1994) indicates that equivalencies are present in all types of exchange, not exclusively market exchange, increasing the importance of this issue no matter the economic system(s) operating amongst the ancient Maya (see also Graeber 2011). No direct evidence of currencies among the Classic period Maya exists, although Contact period documents indicate cacao, stone beads, and red shells served as currency (de Landa 1978[1566]). Similarly, among the Aztecs cacao and cloth served as currency, with known equivalencies between these items (Smith 2003). Such information, however, is not readily available for the Classic period Maya, as it was not recorded in texts and we cannot assume the same equivalency systems existed in the Classic and Postclassic periods. The matter of equivalencies and currencies bears further examination, particularly in light of the recent emphasis on market exchange among the ancient Maya.

To fully understand such exchange networks, we must determine what system of equivalencies, if any, the Classic Maya employed.

An additional component of bottom-up economic studies is the study of household production. Various types of production can occur within different economic systems. For instance, household production was a staple of the Inka economy, a primarily redistributive system (Stanish 1997). Studies of household production in the Maya area indicate a variety of economic modes. For instance, Straight (2012, 2016) examined household production in Late Classic Tikal and found production occurred at a scale indicating production only for household consumption. On the other hand, as discussed above, Sheet’s (2000; Sheets et al. 2015) investigations at Ceren led him to
suggest a market economy based on household production. Households at Ceren specialized in the production of agave and cotton cloth production, painted gourd production, and agro-specialization focused on growing cacao, agave, and cotton (Beaudry-Corbett and McCafferty 2002; Sheets 2000, 2001, 2006; Sheets et al. 2015). The specialized production at households within a small community suggest that the households exchanged goods at the village level (Beaudry-Corbett and McCafferty 2002; Sheets 2000, 2001, 2006; Sheets et al. 2015). Similar evidence at Chan, Belize, where households specialized in chert biface production and agro-specialization (Blackmore 2012; Hearth 2012; Kestle 2012; Robin 2012a,b, 2013; Wyatt 2012), and Mayapan, Mexico, where households and workshops specialized in lithic, ceramic, shell, and agricultural production (Masson et al. 2016) supports exchange between community members.

Non-elites also produced a variety of items including utilitarian ceramics, lithic tools, wooden tools, agricultural production, limestone processing, and construction (Ardren 2015; Becker 1973; Blackmore 2012; Cortes-Rincon et al. 2015; Emery and Foias 2012; Haviland 1974; Hearth 2012; Kestle 2012; King 2000; Lawton 2007; Michaels 1989; Rice 1981; Robin 2012a,b, 2013; Shafer 1982; Sheets 2000). Non-elite household production also involved multicrafting, multiple types of items produced in the same area (Shimada 2007; see also de Lucia 2013; Joyce et al. 2014). Examples of multicrafting include the production of the pigments for painting gourds and the gourds themselves at Ceren households (Sheets 2000, 2006). The variety of materials produced at the non-elite household level supports a high degree of involvement of non-elites in the operation of the household economy; elites presumably did not manage the day-to-day
operations of the household economy if many goods were produced in the households. Also, as shown at Ceren, not all households produced the same items, indicating exchange between households occurred to obtain all goods necessary for the proper functioning of the household. Even at Ceren, however, residents obtained some items, such as obsidian, from the closest regional center, San Andres (Sheets 1997, 2000, 2002, 2006; Webster et al. 1997), indicating the concurrent operation of multiple economic types (see Sheets et al. 2015).

Attempts to study economies at an intermediate level between top-down and bottom-up approaches resulted in a focus on resource specialized communities. Resource specialized communities focused primarily on the utilization and production of one resource (Hyde 2011; Masson et al. 2016; Scarborough and Valdez 2003, 2014; Scarborough et al. 1999), such as lithic production. The presence of resource specialized communities creates dependency relations between communities (Scarborough and Valdez 2003) which could be managed through multiple types of economic systems, including but not limited to, market exchange between communities or aggregation and redistribution of goods by elite individuals. Evidence from the Three Rivers Region of Belize indicates that exchange occurred directly between different outlying settlements rather than through the large center of La Milpa (Hegemon and Lohse 2003; Tourtellot et al. 2003). Valdez (2015) expands the resource specialized community model of the Three Rivers Region to suggest that major Maya centers served as service specialized cities focused on particular services. He suggests that although architectural remains of large structures, like palaces, have similar architectural plans, they potentially served a variety of functions, which varied at different sites, hence attracting people to certain
centers for specific goods and services. Despite the similarities to the resource specialized community model for economic activity, little archaeological evidence supports the service specialized city model, although as Valdez (2015) notes, the archaeology of major centers does not focus on materials which might support the model.

Archaeological studies of salt production also support the presence of resource specialized communities. Salt resource extraction appears centrally organized but not necessarily by a centralized authority (Andrews 1980, 1985; Andrews and Mock 2002; McKillop 2002; Murata 2011). The limited and fairly restricted nature of salt production areas, for the most part in coastal areas, lead to the presence of settlements in salt-rich areas which specialized in salt production (McKillop 2002).

Evidence for resource specialized communities, however, exists in both the ethnohistoric and ethnoarchaeological record from Mesoamerica. Studies of ceramic production found that some towns specialized in the production of specific types of ceramics or simply served as regional ceramic producing centers, such as Ticul, Yucatan or Chiautla, Guatemala (Arnold 1985; Reina and Hill 1978; see also King 2015). Feldman (1985), in an ethnohistoric study of eastern Guatemala, found nine major zones of ceramic production some of which specialized in specific vessel shapes. Evidence for resource specialization in the Colonial period and in the ethnographic record lends credence to the existence of these communities in the past.

The study of economies from a bottom-up perspective highlights the economic importance of non-elite households. The interdependence of non-elite households indicates some reliance on exchange, whether that be through a market exchange system or not. Both top-down and bottom-up approaches to the Maya economy illuminate
important aspects of the ancient Maya economy. The self-sufficiency and exchange relationships with other non-elite households illustrates the importance of bottom-up studies while the circulation of prestige goods illustrates the importance of top-down economic studies; research concerning economic organization indicates prestige goods are more likely to operate in a centralized, or elite controlled, economic mode while utilitarian goods might exist in a market economy (Aoyama 1996; G. Braswell 2010; Braswell and Glascock 2002; Guderjan 1995; Fry 1979, 1980; McKillop 2002; Masson and Freidel 2012; Pohl 1994; Santore 1993; Sheets 2000; Shaw 2012; Sunahara 1994). The review of top-down and bottom-up economic perspectives demonstrates the multiplicity of past economic systems, particularly the possibility of multiple systems operating concurrently. By examining specific items, the role different classes of materials might have held in past economies can be examined.

2.2 Storage and Economic Variability

Prior to introducing the model proposed for understanding variability in past economies, this section addresses the relationship between architectural form and economic organization. Its variability in conjunction with various types of economic activity renders storage a useful, and frequently observable, archaeological correlate for certain forms of economic activity. For instance, a common feature of centralized economies is the presence of large-scale storage areas within elite residences or ritual areas.

Storage serves several functions within economies; most basically, storage serves as a mechanism of risk reduction for periods of resource shortage, whether these are caused by environmental or other factors (D’Altroy and Earle 1985), but storage also
plays an important role in upholding political and economic institutions (D’Altroy and Earle 1985). Large-scale storage areas can serve as a staging ground for the distribution of goods to non-elite individuals. Storage, by its nature, varies cross-culturally (Halperin 1994), so the following discussion of storage examines storage conventions in several complex societies across the world. This section address the architectural evidence for storage in centralized economic systems around the world, specifically the Inka (Covey 2008; Earle 1987; Murray 1980; Morris and Thompson 1970; Dillehay 2013), Chimu (Keatinge and Day 1973; Moore 1981, 1992), New Kingdom Egypt (Janssen 1982; Robbins 2008), and Minoan and Mycenean Crete (McEnroe 2010). The comparison between the Maya and storage architecture in various types of economies provides an avenue for evaluating the centralization of the ancient Maya economy. Storage, when identifiable archaeologically, can contribute to our understandings of the organization of various parts of past economic systems. As such, storage markers play an important role in determining the economic models developed in the model presented below for understanding past economic variability.

Minoan Palaces, particularly during the Neopalatial Period (1750-1490 B.C.) (McEnroe 2010), were areas of highly centralized storage, which scholars use as evidence of a highly redistributive economic system amongst the Neopalatial Period Minoans. Five palaces are found across the island of Crete – Knossos, Phaistos, Malia, Galatos, and Zakros – all of which contain storage spaces in spatially segregated areas along the western edge of the palace (McEnroe 2010). At Knossos, the most well-known of these palaces, the storage rooms are small, poorly-lit rooms, without windows or ventilation, with limited accessibility. Evidence for storage includes the presence of large storage
jars; each storage magazine could hold up to 30 storage jars, each with 590 liters of storage capacity, for a total of up to a quarter million liters of storage capacity (McEnroe 2010). The magazines also contained cavities below the floor which provided additional storage space (Figure 2.2).

![Figure 2.2: Knossos during the Neopalatial Period in Crete showing evidence of storage (redrawn from McEnroe 2010 Fig 7.2)](image)

In comparison with the palaces, elite structures outside Neopalatial palaces lacked large-scale storage magazines. The South House, located to the south of Knossos, contained a cache of bronze tools, but no large-scale storage areas, indicating the residents of this house, and other adjacent structures, depended on the Palace to obtain goods (Figure 2.3) (McEnroe 2010). The differential presence of storage at Minoan
Palaces and other structures provides further evidence for the centralized Neopalatial economy.

Figure 2.3: South House at Knossos demonstrating the lack of storage outside the Neopalatial Palaces in Crete (redrawn from McEnroe 2010 Figure 9.4).

During the Final Palatial period (1490-1360 B.C.) (McEnroe 2010) and the Mycenaean occupation of Crete, Linear B tablets, from Knossos, describe the materials stored in the palaces. These tablets record large quantities of goods such as 960,000 liters of grain and 100,000 sheep on one tablet (McEnroe 2010). The materials listed on the tablets indicate that Knossos controlled an export based economy with a focus on textile production (McEnroe 2010). Once again, the Palace at Knossos provides evidence of large-scale storage in magazines located in the western part of the Palace (Figure 2.4).
Although during the Final Palatial Period textual evidence provides support for the presence of centralized storage in the Palaces, architectural evidence of large-scale storage exists during both the Neopalatial and Final Palatial periods. The Palace-based economy, with distribution of goods from the palaces, relied upon the presence of large-
scale storage areas in the Palaces and, in the Neopalatial period, a lack of storage areas in other residential structures. The materials stored in these structures seem to have been staple goods, particularly grain, oil, and sheep, as well as textiles which were distributed through ceremonies and feasting to other individuals (McEnroe 2010). Elites also obtained items through long-distance exchange, which were stored in palaces areas, although the circulation of these items was restricted to elite individuals (Sherrat and Sherrat 1991).

Similarly, to the palaces on Crete, particularly Knossos, in the New Kingdom of Egypt, temples were locations of large-scale storage of goods for distribution. Temples, dedicated to various gods, received offerings from neighboring communities and support from elites, these materials supported the temple and its staff, maintained the gods, and provided food for festivals (Robbins 2008). Temples contained restricted areas, open only to the support staff, and open areas, used for processions and festivals (Robbins 2008); the presence of storage within restricted temple areas supports the centralized nature of storage of some economic goods. Temples also controlled estates, which produced food and other goods for the temple, making them major economic centers. These estates, and the storehouses which contained the resultant agricultural products, supported large segments of the Egyptian population (Shafer 1997). Distribution of goods also occurred in other contexts, including as payment for workers, such as those who lived at Dier el Medina, building the tombs and temples for the Pharaohs (Janssen 1982). The temples management of land, production, and goods, illustrates the centralized nature of the Egyptian economy. The store houses associated with temples provided the storage capabilities to maintain the centralized economic system.
The centralized nature of aspects of the Inka economy is best seen architecturally through the presence of Inka store-houses, production enclaves, and administrative centers (Covey 2008; D’Altroy and Earle 1985; Dillehay 2013; Earle 1987; Gyarmati 2015; Morris 1967; Morris and Thompson 1970; Murra 1980; Murra and Morris 1976). The Inka constructed administrative centers at regular intervals throughout the territories they controlled; these administrative centers contained a residential zone, a central plaza area, and areas for the storage of perishable and non-perishable local goods (Morris 1967; Morris and Thompson 1970). The administrative centers utilized Inka architectural techniques, indicating Inka control (Morris and Thompson 1970; Morris et al. 2011). The distribution of goods contained in the storage structures occurred during state-sponsored religious ceremonies and feasting events and through provisioning to labor parties (Morris 1967).

Spanish sources describe Huánuco Pampa, the Inka capital of the Huánuco region, as a center for the collection and storage of goods, with specialized storehouses or qollqa, for both local consumption and transportation back to the capital, Cuzco (Morris 1967, 2004; Morris et al. 2011; Murra and Morris 1976). Huánuco Pampa contains 497 storage structures, which have a total floor area of 12,680 m² and could contain a volume of over 37,900 m³ (Morris and Thompson 1970) (Figure 2.5). The storehouses, some of the earliest structures constructed at the site, consist of freestanding rows of adjacent circular or rectangular structures with small entrances and without windows (Morris and Thompson 1970; Morris et al. 2011). Excavations revealed that materials stored in the houses focused mostly on foodstuffs, such as root crops and maize, some of which were stored in jars, although excavations also indicate storage of ritual items (Morris 1967;
Morris et al. 2011; Morris and Thompson 1970). Extensive storage capacity also existed at other Inka sites (e.g. Gyarmati 2015); during the Inka occupation at Pachacamac, residents utilized 98 storehouses with a total of 4,515 m$^2$ of floor area and 9,030 m$^3$ of storage capacity (Eeckhout 2010).

![Figure 2.5: Figure of Huánaco Pampa storage structures showing the evidence of storage in the Inca administrative area – each box represents a storage structure (after Morris et al. 2011).](image)

As seen in both the Cretan and Egyptian cases, the centralized nature of the Inka economy is seen in architectural layouts (see Figure 2.5). The large storage areas, identifiable by their distinctive architectural forms, frequent occurrence, and consistent artifacts, are found across the Inka Empire. The storehouses allowed the Inka elites to distribute goods to people through religious ceremonies and when people performed service to the state, thus reinforcing state power through the distribution of staple goods.

The Chimu economic system also focused on elite management particularly of the production, storage, and distribution of materials (Keatinge and Day 1973; Kolata 1990; Moore 1992; Moseley 1990; Topic 1990). The nature of the Chimu economic system, during the Late Intermediate Period (A.D. 1,000 – 1476), is best seen from the capital Chan Chan, in the Moche Valley of Peru. The site contains large, elite structures,
ciudadelas, and small, compact, non-elite dwellings, Small Irregularly Agglutinated Roomblocks (SIARs) (Keatinge and Day 1973; Kolata 1990; Moore 1992; Topic 1990). The ciudadelas contain areas for administration, including U-shaped audiencias for receiving visitors, residential areas, kitchen and food preparation areas, and storage areas (Keatinge and Day 1973; Kolata 1990; Moore 1992; Pillsbury and Leonard 2004). The storage areas, small (2 x 2.5 x 2 m), contiguous, adobe structures with a single entry point, inconvenient for regular access (Keatinge and Day 1973; Kolata 1990; Pillsbury and Leonard 2004), lack typical domestic refuse, indicating their use for storage (Kolata 1990). The architectural form of the storage areas, particularly the presence of a single, inconvenient access point, and their general placement within the ciudadelas indicates restricted access (Figure 2.6) (Keatinge and Day 1973; Kolata 1990; but see Moore 1992). The range of storage space in ciudadelas varies from less than 3,000 m$^2$ to 6,000 m$^2$ (Kolata 1990: 130). Evidence from other Chimu sites, such as Manchan, also show evidence of centralized storage locations, with storage facilities associated with elite Chimu architectural forms (Mackey and Klymyshyn 1990; Moore 1981). Manchan has less than 1% of the storage capacity of Chan Chan, which indicates a concentration of economic goods at Chan Chan, rather than at regional outposts (Mackey and Klymyshyn 1990; Pillsbury and Leonard 2004).

When compared with the Inka, the storage capacity of Chan Chan and Chimu outposts seems small (although not compared with other areas of the world). Topic (1990) explains the difference in storage capacity through the types of items stored. Topic (1990) suggests Chimu elites controlled craft production of small amounts of highly valued goods, which they stored in the ciudadelas (see also Cutright 2015). On
the other hand, the Inka stored not only high status goods, but also large quantities of subsistence goods, explaining the larger volume of storage for the Inka.

Figure 2.6: Figure of the Ciudadela Rivera from the Chimu Capital of Chan Chan showing the presence of large storage capacity. (Redrawn from Pillsbury and Leonard 2004; Figure 6).

This rather lengthy foray into the architectural evidence for storage in the centralized economic systems of the Minoans and Myceneans, ancient Egyptians, Inka,
and Chimú illustrates the necessity of large-scale storage in centralized economies. Given this information, we should expect to find storage areas in Maya architectural complexes they possessed a centralized economy. However, the evidence for storage of any kind, let alone large-scale storage areas for large-scale redistribution activities, is scant in the Maya area.

Chultuns represent the most commonly referenced storage area in the Maya world (Puleston 1971). Chultuns, natural depressions in the limestone bedrock or reused quarry pits, served for storing goods, generally dry goods, for household subsistence (Puleston 1971; but see Dahlin and Litzinger 1986; Smyth 1989). Not all households, however, exhibit associations with chultuns (Dahlin and Litzinger 1986); ethnographic evidence for storage indicates use of perishable storehouses, organized on the household and community level, as well as chultuns (Smyth 1989). The storehouses lack strongly differentiable characteristics from domestic architecture, making them difficult to identify archaeologically (Smyth 1989). Furthermore, in ethnographic studies, only maize requires the construction of separate storage structures, to preserve the maize, while other goods were not stored in specialized areas, again limiting the archaeological visibility of such storage (Smyth 1989). The presence of household storehouses, even if unevenly distributed, is not supportive of a highly redistributive economy in the Maya area. Rather, we would expect a lack of storage areas around households if a highly centralized, redistributive economy existing among the ancient Maya.

In contrast with the lack of storage facilities at households in the Maya area, in central Mexico, we find cuexcomates, circular above ground storage bins, for grain, commonly made of wattle and daub structures on stone foundations, within the bounds of
household groups (Hernandez Xoloctzi 1949; Plunket and Uruñela 1998, 2000; Plunket et al. 2004). These cuexcomates are similar in form to storage structures still used today in parts of central Mexico (Ahrens 2013; Buge 1987; Plunket and Uruñela 1998, 2000). In addition to their function as storage locations, the placement of these structures near boundaries of house groups and in prominent locations suggests they may have been an indicator of wealth and status in addition to their function as grain storage locations (Plunket and Uruñela 2000). These storage areas highlight the environmental constraints both to storage in the Maya area, as the tropical climate is poor for long-term storage of perishable items, and to the comparatively poor archaeological record, which makes it more difficult to identify such perishable structures archaeologically in the Maya area; although in the majority of locations in central Mexico, only the circular stone foundations remain (Plunket and Uruñela 1998). It is through specialized preservation contexts, such as that at Tetimpa, which was covered by volcanic ash from the eruption of the Popocatepetl volcano, and ethnographic comparisons by which these structures are identified as storage structures (Ahrens 2013; Buge 1987; Plunket and Uruñela 1998).

To fully examine the possibility of large-scale storage in the Maya area, we must turn to elite structures, where large scale storage areas are found in other redistributive economic systems. One example of such storage includes the use of chultuns for water storage, particularly in the northern Maya lowlands (Kurjack 2003). These storage facilities are closely associated with elite residential structures and illustrate elite management of the collection and storage of water, necessitated by the lack of above ground water sources in the northern lowlands.
Perhaps the best evidence for storage in elite contexts comes from the Postclassic occupation of Cozumel, Mexico. Freidel and Sabloff (1984) identified storage on the island, up to 16 possible storage locations, by the presence of round structures, which they suggest elites used as ritually sanctified storehouses. The highest concentration of storage units, at Chen Cedral, presumably operated under management of elites from the major center of San Gervasio. The storehouses provided storage for materials awaiting transport through long-distance trade routes, mostly by sea (Freidel and Sabloff 1984). The evidence for storage on Cozumel dates to the most mercantile period of the ancient Maya economy, rather than to earlier periods during which scholars suspect more centralized economies operated.

Despite the plethora of examinations of ancient royal courts prior to the Postclassic (e.g. Christie 2003; Evans and Pillsbury 2004; Inomata and Houston 2001a,b; Jackson 2013), evidence of storage in elite Maya residences is rare. Evidence from the site of Aguateca, Guatemala, which provides excellent evidence of architectural function due to its rapid abandonment, indicates a lack of large-scale storage. Elite households contained between 12 to 35 storage jars which contained food for household consumption (Inomata 2001a; Triadan 2000; Webster and Inomata 2004). Triadan (2000:52) states “Interestingly, we have not found structures dedicated solely to food storage, either within elite residential groups or the royal palace, which indicates that food storage was not centralized or controlled above the household level.” If Aguateca, with its superior preservation and broader range of information about the past, illustrates a lack of centralized storage, at least for foodstuffs, it is unlikely that we will find good archaeological evidence of such storage elsewhere. Some caution must be taken when
considering architectural form at Aguateca as the royal occupation at Aguateca occurred as a result of warfare in the region, and hence the architecture present may not represent the full suite of elite architectural areas.

Examinations of the palace areas at Copan and Tikal demonstrate little evidence of large-scale storage. Harrison and Andrews’ (2004) comparison of these two areas indicates they served as multifunctional spaces for performances, rituals, and administration. Some indication of storage comes from Copan, where Harrison and Andrews (2004) refer to possible ‘domestic or storage spaces;’ the size of these areas indicates their utility for household storage rather than storage on a grander scale (Harrison and Andrews 2004; Martin 2001; Webster 2001; Webster and Inomata 2004). Traxler (2003) identified possible storage areas in the Northeast Group of the Copan Acropolis. The possible storage areas possess characteristics similar to storage in other areas of the world, including their small size and restricted access.

At other Maya sites, no consensus exists as to the function of possible storage sites (Foias 2013; McAnany 2010). X-ual-canil, a possible administrative center in Belize, contains structures which are alternatively thought to be storage or administrative structures (Foias 2013). The multiple functions attributed to the structures at X-ual-canil illustrates the lack of a model for identifying large-scale storage areas in the Maya area. Other Maya sites show a similar lack of evidence for large-scale, centralized storage. Cross-culturally, storage structures tend to be small rooms with limited access; at many Maya sites, such areas do not exist – particularly within the palace or temple complexes, although the possibility exists that range structures, long structures with many rooms, could have served as storage locations.
An alternative view of the lack of storage in Maya centers is not that storage is not present or that we cannot (or have not) identified it archaeologically, but instead that storage occurred in the hinterland with materials brought into site centers when necessary, a storage technique referred to as appropriational storage (Halperin 1994; McAnany 2010; Smyth 1996). Appropriation storage is advantageous in tropical environment where items rot quickly as items are brought from their location of production (or growth) only when necessary, decreasing the need for large scale storage in city centers and increasing the convenience of specialized storage for crops which rot easily.

An additional point of variation in types of storage in complex societies stems from the manner of state financing. Societies where tribute extraction occurs in the form of labor necessitate storage for the raw materials and finished products while tribute extraction in the form of finished products does not necessitate as much storage or utilizes appropriational storage (Smyth 1996) which results in a lack of large-scale storage facilities. Smyth (1996) suggests the lack of archaeologically visible storage in Mesoamerica results from dispersed storage practices and relatively decentralized political power, which did not utilize labor as part of state financing. As Smyth (1996) points out, long-distance trade in Mesoamerica deals mostly with exotics, rather than foodstuffs. Exotics require relatively small storage areas, which could be located within royal residences. If the Maya collected mostly wealth goods, as opposed to foodstuffs, as tribute, large-scale storage would be unnecessary. If we follow Smyth’s (1996) argument, the lack of storage in the Maya area results from the presence of storage mostly of exotics, such as cacao, feather, cloth, and some ceramics, which would not
require large, specialized storage areas. While some evidence of storage exists in the Maya area, the limited evidence indicates storage focused on items received in tribute (mostly high status goods) rather than on materials used in quotidian subsistence practices, which suggests the lack of a redistributive economy for items utilized in quotidian subsistence.

An additional method of evaluating the possibility of storage and a centralized economy among the Maya is to compare the architecture and presence of storage among the Maya with the Aztecs, an economy known to rely on market exchange, tribute/taxation, and long-distance exchange (Brumfiel 1980; Minc 2009; Smith 2003). Excavations of elite residential units revealed that elite Aztec residences contained storage jars (Elson 1999). However, at Aztec elite residential areas, palaces, and temple complexes no evidence exists for large-scale storage (Evans 2004). Evans (2004) describes Aztec palaces, which functioned as administrative areas, households, and retreats for nobility, but she does not describe specialized storage facilities (Figure 2.7). Spanish accounts of Aztec palaces fail to mention large-scale storage, but some archaeological excavations revealed areas of storage, probably for household use or for storage of prestige goods (Evans 2001, 2004). The variability in storage between the Aztec and the Inka, Chimu, Minoans, and Egyptians, points to relationships between storage practices and economic activity.
The similarities in archaeological evidence for Maya and Aztec storage might suggest similarities between their economic activities. Archaeological evidence for variation in Aztec economic practices includes the presence of market exchange, taxation/tribute, and long-distance trade of some goods. These are similar to the variation in economic activity seen in the Maya area.

An additional element of the lack of archaeological evidence for storage of subsistence goods in the Maya region might be the environmental conditions of the lowlands; the climate is not conducive to long-term storage of perishable goods. Given the lack of architectural evidence for large-scale subsistence good storage, among the ancient Maya, the next section will evaluate the history of economic studies amongst the Maya from an artifactual standpoint to further evaluate the economic system of the ancient Maya.
2.3 Co-occurring Economic Modes

The above review of Maya economic studies illustrates the confusion surrounding the complex economic systems which operated in the past. The top-down and bottom-up approaches reveal at least two economic modes operated in the ancient Maya economy. This dissertation builds on these studies of economic activity to better understand that multiple economies which operated concurrently. To develop our understanding of past economic systems, recent studies propose new ways to examine ancient economic systems including allowing the articulation of multiple economic systems (Masson and Freidel 2012) or applying the concepts of inalienability (Callaghan 2014; Clark and Coleman 2014; Inomata 2014; Kovacevich 2014; Kovacevich and Callaghan 2014) and surplus (Bolender 2015; Brown and Kelly 2015; Costin 2015; Earle 2015; Morehart and De Lucia 2015) as analytical frames through which to consider the dynamic nature of past economic systems and emphasize the changing nature of past economic systems (Golitko and Feinman 2015).

Masson and Freidel (2012) propose a model of articulated economies where goods are distributed through a variety of systems depending on their value. The model emphasizes market exchange while acknowledging the presence of other types of exchange, including redistribution. Masson and Freidel suggest that a system of articulated economies allows for risk reduction; that is, an economic system based on the value of goods could adapt to unpredictable conditions, such as shortages. Masson and Freidel recommend further research to identify the relationship between producers of economic goods and royal elites, which this project performs through an examination of
chert resource production and the roles of individuals of differing socioeconomic status in said production.

Building on Masson and Freidel’s (2012) model, I present a framework for examining ancient economies through a life-history approach focusing on raw material source location, production location, and extent of distribution. The ways in which objects circulate through economic systems, and the values and importance of these objects, changes throughout their life (Appadurai 1986; see also Murakami 2016), hence a discussion of objects at different points in their production and use-life expands our understanding of the variation in past economic systems and the changes which single items pass through at various points in their use-life. I propose a three-tiered economic system describes a variety of goods and the multiplicity of manners in which each could operate. I argue that the different modes in the ancient Maya economy can be best understood as a system in which different types of goods, influenced by their source location, production, and distribution, operated through varying economic modes. A model for examining these modes, each with two variants based on source location, production, and distribution, is laid out below (Table 2.1).

<table>
<thead>
<tr>
<th>Mode</th>
<th>Source</th>
<th>Production</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A</td>
<td>Non-local</td>
<td>Non-local</td>
<td>Limited</td>
</tr>
<tr>
<td>1 B</td>
<td>Non-local</td>
<td>Local</td>
<td>Limited</td>
</tr>
<tr>
<td>2 A</td>
<td>Non-local</td>
<td>Non-local</td>
<td>Widely</td>
</tr>
<tr>
<td>2 B</td>
<td>Non-local</td>
<td>Local</td>
<td>Widely</td>
</tr>
<tr>
<td>3 A</td>
<td>Local</td>
<td>Local</td>
<td>Limited</td>
</tr>
<tr>
<td>3 B</td>
<td>Local</td>
<td>Local</td>
<td>Widely</td>
</tr>
</tbody>
</table>

A caveat which must be raised in any discussion of generalized models is that they are just that, generalized. Much greater variation exists in ancient economic
systems, including the source, production, and distribution of materials, than can be contained within a simplified model. While here source, production, and distribution are dichotomized, in reality they exist on continuums. The model of articulated economies presented here aims to provide a framework and way in which to consider variation in past economic systems and provide a mechanism for identifying such variation from easily quantifiable aspects of the archaeological record. The nature of models requires simplification, and variation within models always occurs. This does not harm the utility or helpfulness of creating such models. Furthermore, the nature of the model presented here means that goods in each mode vary depending on the location of the study and the available resources in the study area. That is, this model is site specific, and while useful in all studies of ancient economies, does not lend itself to overarching, broad generalizations of ancient economic systems which do not consider regional variation. Instead, such variation is at the heart of the model. This model is not meant to explain or model the entirety of past economic organization, but rather to help explain and elucidate some of the variability present in past economic systems. Using this model provides a framework through which comparisons between economic systems in different regions can be compared.

The following sections discuss the source, production, and distribution of items at greater length and provide a discussion of the economic modes and items within these modes in the Maya area.

2.3.1 Source Location

Sources are an important aspect of economic studies as the location of and activities at a source impact the economic role of the materials. Sources involve areas
such as chert and obsidian quarries, limestone quarries, or salt flats, among numerous other such areas. While discussing economic modes, the location of the source is dichotomized as local or non-local, a characteristic dependent on the location of the site, rather than the source, under discussion. Local, here, refers to anything found within a 10 km radius of a site (see Carr 2005; Earle and Smith 2012 for other definitions). That is, local or non-local items vary depending on the area. Obsidian, for instance, is local in much of the Mexican and Guatemalan highlands, but not the central or northern lowlands (Braswell 1996; Charlton 1969; Charlton and Spence 1982; Garcia-Barcena 1974; Gaxiola G. 2005; Gaxiola G. and Nelson 2005; Healan 1989, 1997, 2003; Holmes 1900; Lopez Aguilar and Nieto Callejo 1989; Michaels 1975; Pastrana et al. 2011; Pastrana and Dominguez 2009; Sidrys et al. 1976; Weigand and Spence 1982, 1989). Chert is a local resource in most of Belize and parts of southern Mexico, but not in northern Yucatan and parts of the Peten, Guatemala (Andrieu and Roche 2015; Dahlin et al. 2011; Hearth and Fedick 2011).

In the Maya area, studies of source locations include limestone quarries (J. Braswell 1992, 1993, 1998, 2010; Church 1996; Folan 1978; Keller 1993, 1997; Kestle 2012; Yaeger and Connell 1993), jade quarries (Rochette 2014; Taube et al. 2011), and various lithic quarries for obsidian and chert. Chert quarries and source areas have not been the focus of extensive investigation with the major exception of the site of Colha, Belize, a major chert source and production area (Dockall and Shafer 1993; Hester and Shafer 1980, 1984, 1991, 1992; Hester 1982; King 2012; McAnany 1989; McSwain 1991; Santone 1997; Shafer and Hester 1983; Shafer 1985).
Source location influences the economic organization of extraction and production, particularly in terms of elite versus non-elite control. In areas of jade sources, production occurred independently while outside these areas elites controlled at least some segments of the production process (Andrieu et al. 2013; Demarest 2013; Kovacevich 2006, 2007, 2013, 2014; Rochette 2014; Taube et al. 2011). We shall return to this issue in Chapter 9, after a discussion of Callar Creek Quarry and the role elite and non-elite actors played in lithic extraction and production at the quarry.

The role of storage in an economic system is also dependent on the source location of materials. Non-local sources increase the necessity of storage of materials, as particularly if production occurs locally, the raw materials necessary for production must be stored to decrease the cost of acquiring such resources on a regular basis. For locally sourced materials, storage becomes less urgent as the cost of accessing the source location is lower; storage utility increases with the use of non-local raw materials. Depending on the material, the scale and temporal length of storage can vary. Non-perishable goods can be stored indefinitely while, in the lowlands, perishable goods must be used rather quickly to avoid spoilage. The scale of storage depends on the material as well; some goods are rather bulky, requiring large-scale storage, such as subsistence goods, while others, including most luxury goods, require relatively small, non-specialized storage areas, due to their relative scarcity and lack of large size.

Production levels and the importance of raw material conservation also vary with proximity to source areas. In lithic reduction, areas in close proximity to raw material sources show more wasteful reduction techniques, with less emphasis on the conservation of lithic materials, whereas when located further from lithic sources, reduction tends to be
more conservative. Conservation of lithic resources results in intensive reduction, seen through reduction of cores into small fragments, the use of bipolar reduction techniques, which are useful on smaller raw material fragments, and extensive retouching (McCall et al. 2015).

The difference in reduction techniques dependent on source location explains variation in obsidian and chert reduction techniques. For instance, at Callar Creek Quarry, obsidian is highly reduced, presumably due to its non-local nature and the difficulty in obtaining obsidian. The chert, however, shows little evidence of intensive reduction, not unexpectedly as it is a chert quarry. Similarly, at Chalcatzingo, Mexico, intensive chert reduction occurred, due to the difficult which non-elite residents had in obtaining large amounts of chert, while obsidian items were not highly reduced, suggesting easier access to obsidian materials (McCall et al. 2015). An additional factor affecting reduction intensity is the possibility of excessive source exploitation. In situations where all materials could be easily expended, reduction becomes more conservative than in situations with larger raw material sources which had additional possibilities for future reduction. Again, at Chalcatzingo, fewer chert resources exist, compared with obsidian, despite the fact that chert occurs locally and obsidian does not, leading to intensive chert reduction and non-intensive obsidian reduction (McCall et al. 2015).

The proximity to sources and the size and makeup of a raw material source impact the nature of the extraction and production of materials. The intensity and organization of production also influences the nature of the management of the resource, an aspect of raw material sources which will be discussed further elsewhere.
2.3.2 Production

Studies of production frequently relate to economic organization; in fact, such studies elucidate economic organization from the fragmentary archaeological record (e.g. Blackman et al. 1993; Blackmore 2012; Beaudry-Corbett and McCafferty 2002; Brumfiel and Earle 1987; Clark and Parry 1990; Costin 1991; Costin and Hagstrum 1995; Hearth 2012; Kestle 2012; King 2000; G. Michaels 1989; Parry 2001; Robin 2012a,b; Schortman and Urban 2004; Seivert 1992; Sheets 2000, 2006; Stein 1996; Torrence 1986; Wailes 1996; Wyatt 2012). Here, I dichotomize production, for the purpose of creating a model of economic modes, between local and non-local production. This model underestimates the complexities of production as production can be segmented with different production stages performed in different locations. In some cases, ‘local’ may mean production in various locations in the same general area, while ‘non-local’ might apply to segmented production which occurred elsewhere. The local/non-local distinction, presented in this model, makes no claim as to the segmentation or continuity of production.

Many production studies focus on the relationship between production and actors of different socio-political status (e.g. Clark 2007; Costin 1991, 2001, 2004, 2015; Flad and Hruby 2007; Hirth 2009; Inomata 2001b; Janusek 1999; Shiamada 2007; Torrence 1986). The determination of the involvement of individuals of varying socio-political statuses can be difficult to identify through archaeological remains, although several models propose such identifications based on the associated structures, organization of production areas, and evidence for administration (see Costin 1991, 2001, 2004, 2015). Although an important component of economic organization, the determination of the role of individuals of different socio-political status, particularly political elites, is
sometimes difficult, whereas the location of production is more easily determined from archaeological correlates; production locations contain waste products, but, in the absence of formal production areas, attachment or independence remains difficult to determine. As such, production location is the focus in this model.

Production location affects the economic organization of materials as objects produced non-locally are more difficult to obtain, due to the distance between the production and use areas, and provide more opportunities for management by individuals, to bring them to specific regions. Many non-locally produced items are wealth items, due in part to their non-local production. Locally produced items are easier to obtain and provide fewer opportunities for management, due to their direct accessibility. As such, production location remains an important component of this model.

Non-locally produced items are also more likely to necessitate storage. Items produced non-locally might be stored locally prior to distribution, or stored along a trade route. Similarly, local production on non-local raw materials increases the likelihood of storage facilities as storage of non-local materials reduces acquisition costs. The location of production does little to impact the size of storage areas or the possible length of storage.

In the Maya area, production occurred in a variety of settings, including among elites and non-elites. Studies of production areas are widespread and include studies of the production of agriculture (Foias et al. 2012; King 2000; Lentz et al. 2012; Robin 2013; Sheets 2006; Wyatt 2012), ceramics (Becker 1973; Reents-Budet et al. 2000; Rice 1981; Sheets 2000), construction (Becker 1973), dental workers (Becker 1973), fiber production (Beadry-Corbett and McCafferty 2002; Hutson et al. 2007; Kamp et al. 2006),
jade (Cook et al. 2006, Kovacevich 2007, 2011; Kovacevich et al. 2001; Taube 2005; Taube et al. 2011), lithic materials (Becker 1973; Haviland 1974; Michaels 1989; Shafer 1982), scribes/artists and other ceremonial items (Inomata and Triadan 2000; Reents-Budet 1994; Sievert 1992), stoneworkers (Becker 1973; Inomata and Triadan 2000; Sheets 2000), and woodworking (Becker 1973). Some instances support specialized production, which occurred on the household and community level, implying exchange functioned to distribute goods between specialized households and communities (Beadry-Corbett and McCafferty 2002; Hendon 1996; Lewis 1995; Manzanilla 2009; McAnany 1989; G. Michaels 1989; Robin 2012 a,b, 2013; Sheets 2000, 2001, 2006; Shafer and Hester 1986, 1991). Other situations, such as elite production of restricted items, like that at Aguateca, indicate production for specific events, such as religious activity. Items used in religious ceremonies may not have been available to all individuals, although many individuals would see these items during ceremonies. The variation in production location, scale, and intensity affects the manners and mechanisms through which distribution occurred.

2.3.3 Distribution

Studies of distribution are widely used as markers of different types of economic activity. The Distributional Approach, introduced by Hirth (1998) and applied by many others (i.e. Garraty 2009; Hirth 2010; Sheets 2006; Sheet et al. 2015; Shults 2012; Stark and Garraty 2010; Sullivan 2007), is a way of evaluating the presence of market, and other economic systems, through the distribution of specific types of goods. In the model presented here, the focus of distribution is not how items were distributed but rather the extent of item distribution. That is, if many individuals possess goods, then they a
widespread distribution; if only a few individuals possess goods, then they have limited or restricted distributions. The mechanism of distribution may co-vary with the widespread or limited nature of the distribution; thus, the focus here is only on the extent of distribution.

In the Maya area, goods with limited distribution include certain types of ceramics, decorative items, and some tool types. For instance, eccentrics are found in specific contexts, typically caches or burials, and have limited distributions. Some ceramic types, particularly polychromes, are found in elite contexts more than commoner contexts, thus showing their limited distribution. Items with widespread distribution include lithic materials and utilitarian ceramics.

2.3.4 Expanding the Economic Modes

The palimpsest of economic modes leads to difficulties in teasing apart which goods operated in which mode (see Table 2.1). To alleviate this difficulty, each mode must be defined by the types of items within the mode; thus, allowing mode differentiation from the archaeological record. For heuristic purposes, each has been dichotomized to either be local/non-local (source and production) and limited/widely distributed (distribution). The main differences between the three modes are that the first consists of objects with nonlocal sources and limited distribution; the second also contains widely distributed items with nonlocal sources. Production location varies in both modes. Mode three consists of locally sourced and produced items, although the distribution varies. Within each mode the utility of storage, including its relative necessity, scale, and possible length of storage, is also discussed. The presence of different types of storage, for different materials, might help elucidate the nature of the
ancient Maya economy, and provide a better understanding of the variation in management of certain resources. Storage, when identifiable, represents a useful archaeological indicator which may help differentiate the proposed economic modes, the similarities and differences in behaviors associated with production and exchange of materials in different modes, and the specific activities which occurred to materials from the three modes. Storage is not considered in the production of the modes as the variables overlap each mode, rendering distinct patterns for each mode difficult to create.

Mode One: Non-Local Sources and Limited Distribution

The first mode consists of items with a non-local source, limited distribution, and non-local (Variant A) or local (Variant B) production. The limited distributions indicate the items political leaders managed their distribution as the objects lend status and prestige. Such items are found only in political elite contexts, or contexts managed by political elites, and the source of these items is non-local. The non-local nature of these sources requires long-distance trade, providing additional avenues for control of access to such resources. Production can be local or non-local; for instance, at both Motul de San Jose and Buenavista elite ceramic items were locally produced, although the production location may vary in other situations.

The long-distance nature of the source, and in some cases production, of mode one items necessitates storage at some point during the extraction and production of the material. Whether the materials stored are the raw materials, at the location of extraction or production, or finished products, along the journey (such as in the storage areas found at Postclassic Cozumel (Freidel and Sabloff 1984), the nature of the distance of the extraction, and sometimes production, or these materials necessitates storage. The
storage spaces could be small, as many items in this mode are prestige items, which tend to be quite small. Many of these items could be stored for lengthy periods of time as they are non-perishable, such as jade, and shells. Others, including feathers and skins, have a much shorter shelf-life, and could be stored for shorter periods of time. Archaeologically, I would expect associations between items in this mode with small scale, perhaps unspecialized, storage areas associated with elite architecture.

For the Maya, items in this economic mode include jade, some feathers and skins, some shells, and some ceramic types, among other items (Braswell 2002; Freidel et al. 2002; Hammond et al. 1977; Kovacevich et al. 2001; Meadows 2001; Sievert 1992; Taube 2005). Scholars believe many of these items were prestige goods distributed by elites (Feinman 2004; Foias 2002; Freidel et al. 2002; LeCount 1991; McAnany 2004, 2010; Wells and Davis Salazar 2007; Wells and McAnany 2008). These types of goods remain the most studied in Maya archaeology due to the relative abundance and archaeological preservation of prestige items, its tie to ritual economies, the ease of sourcing many of these items, and the overarching biases toward elite activities present in much of Maya archaeology (Braswell 2002; Feinman 2004; Foias 2002; Freidel et al. 2002; Hammond et al. 1977; Kovacevich et al. 2001; Kovacevich 2011, 2013; LeCount 1991; McAnany 2004, 2010; Meadows 2001; Sievert 1992; Taube 2005; Wells and Davis Salazar 2007).

**Mode Two: Restricted Sources, Wide Distributions**

A second mode of exchange includes items with non-local sources, non-local (Variant A) or local (Variant B) production, and wide distribution. Such items include obsidian, salt, basalt, and copal (Andrews 1985; Andrews and Mock 2002; Aoyama 1996,
Restricted source areas require long-distance transport to arrive at most Maya sites. The limited source location and ubiquity in all archaeological contexts, not just elite contexts, unites these items and differentiates them from items in the first mode.

The production location of these items may vary. The best example of such variation is obsidian; obsidian frequently arrives at Maya sites in the form of prismatic blades or prepared blade cores, indicating non-local production. On occasion, however, production areas exist away from obsidian sources, such as Laton, Belize and Cancuen, Guatemala (Ford 2004b; Demarest et al. 2014). The non-local sources of mode two items influence how individuals obtained the items; in this case through long-distance trade. Again, the non-local source of these items indicates storage probably occurred for most items, whether at some point along a trade route or as a raw material. Some of the commodities in this mode, such as salt, are relatively bulky, and might require specialized storage areas. For the most part these items are non-perishable and could be stored for a relatively long time. Archaeologically, I would expect associations between items in this mode and large-scale, perhaps specialized, storage facilities near source areas or along trade routes.

Aguilar et al. 1989; Pastrana 1998, 2002; Pastrana and Dominguez 2009; Spence 1981, 1984; Spence et al. 1984; Stocker and Cobean 1984; Suyuc Ley 2011; Weigand and Spence 1989). Most studies indicate political leaders managed obsidian production and distribution (Aoyama 1996, 2001, 2008; Clark 1997; Clark and Bryant 1997; Spence 1981, 1984; but see Cap 2015a; Sheets 2000), while our understanding of salt production and distribution presents a more complicated picture. Salt, particularly during the Postclassic, operated under a mercantile economic system, although other mechanisms may have operated in other periods. Differences between the management of obsidian and salt resources illustrate the possibility of differences in the economic role of items within the same economic mode, or differences through space and time in the management of the production and distribution of these resources, a further reminder of the complexity of ancient economic systems. The economic modes are not monolithic and can have variation within them, as illustrated by the fact that both salt and obsidian are mode two items whose management varied at different time periods.

**Mode Three: Locally Produced and Consumed Resources**

The third economic mode consists of items with a local source, local production, and either limited (Variant A) or wide (Variant B) distribution. In the Maya area, such items include food stuffs, limestone blocks, and chert. Items within the mode change depending on the region; for instance, chert is widespread in Belize and Guatemala but in much of Yucatan it is not locally available (Dahlin et al. 2011; Hearth and Fedick 2011). The majority of items in this category are perishable and preserve only in rare situations, such as Ceren (Beaudry-Corbett and McCafferty 2002; Beaudry-Corbett et al. 2002; Sheets 1997, 2000, 2002a,b, 2006; Sheets and Simmons 2002), and thus have not been
subject to intensive analysis. For this reason, chert, a durable good, serves as a proxy for a discussion of this category of goods. Local source and production removes some of the imperative for storage at different points in the production processes. Storage of surplus, particularly foodstuffs, presumably did occur, and, from the ethnographic record (Smyth 1989) occurred mainly on the household level. Some materials within this mode, such as foodstuffs, could be stored for only relatively short periods of time while other materials, such as chert, could be stored indefinitely. Storage of such items would require large areas, as these goods are quite large. Archaeological signatures of such storage are unlikely, but probably occurred as unspecialized and specialized storage areas associated with households, raw material sources, and agricultural areas.

Locally sourced and produced items, such as those mentioned above, are generally considered utilitarian items. Utilitarian items, used in households or on a daily basis, are most closely connected with non-elite individuals due to their ubiquity and necessity in households. Storage of such items might occur, but at different scales than in the other modes. However, due to the perishable nature of the majority of such items, little investigation of such materials occurs. This study focuses on the third economic mode, specifically chert materials, as a proxy for other items within this mode.

2.4 Conclusions

Previous studies of past Maya economies illustrate common trends between the Maya area and economic organization in other complex societies around the world, illustrating the complex and multi-faceted composition of ancient economies involving various economic modes and variability in goods circulating through these modes. The model discussed above creates analytical divisions in past economic activity through
traits determinable from the archaeological record, the source location, production
location, and extent of distribution, and aims to reframe the discussion of past economies
to provide a better understanding of the diversity and complexities of these systems. The
three economic modes contain goods which circulated through various mechanisms, each
of which must be explored through careful examination of particular goods. Here I focus
on items in the third economic mode, locally sourced and produced items, to shed light
on their importance in the Maya economic system and their importance as integrative
mechanisms, sources of power, and risk-reduction mechanisms. I will return to this
model in Chapter Nine to evaluate its utility for application to the Late/Terminal Classic
Maya economy, particularly through the lends of lithic technology.
Chapter 3: Lithic Studies in Mesoamerica

Lithic technology provides a view of past economic activity, particularly when examined through the lens of technological organization, a framework for integrating material culture with past behavior. Lithic technology can provide the basis for addressing questions of broad anthropological interest such as studies of economies, subsistence, mobility, and social organization (i.e. Bamforth 1991, 1992, 2006; Beck et al. 2002; Carr 1994b; Doelman 2008; Douglass 2010; Hiscock 1994; Ingbar 1994; Jones et al. 2003, 2012; Kuhn 1995; Manninen and Knutsson 2014; Marwick and Mackay 2011; McCall 2009; Newlander 2012; Sassaman 1994; Shott 1986; Smallwood and Goodyear 2009), particularly among hunter-gatherer populations. Lithics are particularly advantageous for such studies due to their reductive nature, which increases ease of studying production activities, and their excellent archaeological preservation.

Within studies of sedentary societies, such as those in Mesoamerica, lithic studies are rarely at the forefront of analysis, perhaps in part due to the plethora of other material types present in the archaeological record of such societies such as architecture, ceramics, epigraphic texts and iconographic depictions. As such, the Maya area follows an unfortunate trend in studies of complex societies around the world which have generally neglected lithic technology and its potential to contribute to important issues of
anthropological interest, most specifically in this case, economic organization. Instead, studies of lithic technology in Maya area, and Mesoamerica more broadly, are frequently relegated to grey literature, particularly site reports and purely descriptive lists, a way of discussing lithics which neglects the relationship between lithic technology and important economic, political, and social aspects of Mesoamerican society (see Braswell 2011; Clark 2003; Fowler 1991; Johnson 1996; Levine 2014; Sheets 1977, 1979, 2003 for overviews of lithic technology in Mesoamerica).

The state of lithic analysis in Mesoamerica led Clark (2003:45) to issue a theoretical call to arms, “I am less concerned that Mesoamerican lithic studies are not at the very cutting edge of issues in method and theory than that they are theoretically lifeless.” While more recent studies attempt to bring lithic studies to the fore of interpretation in Mesoamerica, they remain on the periphery of theoretical developments in Mesoamerican archaeology, due in part to traditional approaches to lithic analysis.

This chapter reviews previous studies of Mesoamerican lithic technology, with a focus on the interpretive potential of scholarly trends for furthering the understanding of Mesoamerican economic practices. The chapter provides a review of three past frameworks for studying Mesoamerican lithics, specifically 1) typological studies; 2) functional studies; and 3) behavioral studies. The ways in which these past studies of lithics could be applied to questions of economic organization, will be discussed throughout.

### 3.1 Typological Studies

Early studies of lithic technology in the Maya area, and throughout Mesoamerica, focused on artifact typologies. Typological studies (i.e. Clark 1988; Fowler 1987;
Johnson 1976; Kidder 1947, 1948; Kidder et. al 1946; Lee 1969; Ricketson 1937; Smith and Kidder 1951; Stoltman 1978; Willey 1971) created a common language through which to identify and describe lithic materials. Lithicists still employ many of these typological designations, such as polyhedral blade cores and obsidian prismatic blades. Typological studies utilized tool types as indicators of artifact function, particularly to identify activity areas within sites.

While such typological designations are necessary for ease of communication between scholars, and are indeed helpful in identifying activity areas, many early typologies were created prior to developments in the understanding of morphological changes to stone tools and the impacts of these changes on typological designations. Early typologies included high numbers of categories, such as Willey’s (1972) 17 broad biface categories from Altar de Sacrificios. The basic categorization divided ‘fine’ and ‘crude’ bifaces (see also Kidder 1948) to differentiate thinner and thicker bifaces. Recent understandings of lithic use and retouch reveal that some variation in biface (and other tool) shape results from morphometric changes due to use and retouching (Ashton and White 2003; Frison 1968; Iovita and McPherron 2011; Justice 2001, 2002a, 2002b; Lerner 2014; McPherron 1999, 2000, 2003; see also Dibble 1988; Jelinek 1988 for a discussion of this phenomenon in other tool types). That is, tools wear unevenly, and the original shape of a tool will change throughout its use-life. The ways in which tool shape changes result from use, raw material characteristics, and retouching. Thus, some biface typologies merely illustrate different stages of biface use-lives1 (see McPherron 1999, 2000, 2003 for a discussion of this phenomenon in Achulean Handaxes).

---
1 Some bifaces, and other tool types, are temporally diagnostic, although less so in Mesoamerican than other world areas. See Hester 1982 for a discussion of temporally diagnostic tools in Mesoamerica.
Additionally, more recent studies of lithics illustrate that function can result in morphological differences. To use bifaces, the most widely typologized tool in Mesoamerica, as an example, early typologies differentiated bifaces based on thickness (Kidder 1947; Willey 1972). While thickness is in fact an important factor in tool function, a factor which should be reflected in typologies, these early typologies were created prior to our understandings of the significance of certain properties to tool function and the design properties which lead to such variation (see Bleed 2001). These typologies instead relied on preconceived notions of what tools used for different purposes, particularly utilitarian versus ritual, should look like. Thus, advances in understandings of lithic technology limit the utility of some of the early typologies created for Mesoamerican lithics.

The typological focus of early Mesoamerican lithic studies also restricted studies to formal tools rather than debitage from production processes. Most lithic assemblages consist of approximately 99% debitage, so studies with exclusive foci on tools are restricted to a very limited segment of the archaeological record, thus restricting the analytical utility of lithic materials. Studies of greater percentages of the lithic assemblage would provide further avenues to address issues such as the relationship between production and economic organization.

Typological studies provide the foundation of Mesoamerican lithic studies. Prior to early typological studies, lithics were not studied at all. Our current understanding of lithic production, particularly the impact of design and reduction on tool form, has limited the utility of some early typologies. The continued use of certain typologies, for comparability, is helpful in lithic analysis, but more focus on debitage analyses and the
properties behind tool form brings Mesoamerican lithic technology more in line with advances in lithic analysis.

3.2 Functional Studies

Functional studies in Mesoamerican archaeology arose from interest in tool use and as a reaction to typological studies (Hester 1979). Early functional interpretations of stone tools are apparent in tool names, i.e. projectile point/knives or scrapers, but it was not until long after the establishment of these typologies that functional studies first occurred (see Jeske and Sterner-Miller 2015 for a discussion of the importance of use-wear on lithic naming conventions). The increase in functional studies in Mesoamerica was part of a trend in lithic research influenced by the advent of microwear analysis which began with the publication of Smenov’s (1964) treaties on use-wear analysis and the utility of microwear. Microwear studies determine possible tool function by examining the materials under a microscope and comparing them with experimental replicas (Keeley 1980; Smenov 1964).

Aoyama (2009, 2011) identified lithics used in warfare through a functional analysis. His analysis of points from Aguateca indicates that many of the points served as arrowheads, suggesting earlier use of the arrow than previously thought, while others were used as dart or spear points and knives. The microwear analysis of these items, and their utilization in warfare, provides evidence for a violent end to Aguateca’s occupation.

Functional studies allowed examinations of the role of Maya lithics in day-to-day activities. Determinations of tool function informed us about economic activity and socio-economic differences in tool use and production (Kaneko 2003). As such, functional studies are extremely important parts of lithic analysis. Advances in functional studies could help further discussions of economic and socio-economic organization in past societies. In particular, functional analyses of informal tools would provide us with a broader window into tool function.

3.3 Behavioral Studies

The current focus of many Mesoamerican lithic studies is behavioral studies (see Clark 2003; Fowler 1991 for a summary of their importance). The study of a wide variety of activities through the lens of lithic technology falls into this broad category. For our purposes, the most important are those studies focusing on lithic production and distribution as these activities communicate information about their economic role. This section addresses studies of lithic extraction, production, and distribution in Mesoamerica, with particular attention to the organization of these activities and their role in economic activities, so as to provide comparative data for Callar Creek Quarry.
3.3.1 Raw Material Extraction

Studies of raw material extraction in Mesoamerica focus mostly on quarries\(^2\), particularly obsidian quarries (Benitez 2006; Braswell 1996, 2004; Charlton 1978; Clark 1978, 1979; Daras 1999; Garcia-Barcena 1974; Gaxiola G. and Guevara H. 1989; Healan 1997, 2002, 2003; Lopez Aguilar et al. 1989; Pastrana 1998, 2002; Pastrana and Dominguez 2009; Spence et al. 1984; Stocker and Cobean 1984; Suyuc Ley 2011; Weigand and Spence 1989) (Figure 3.1). William Henry Holmes (1900) performed the first study of an obsidian quarry in Mesoamerica at the Pachuca, or Sierra de las Navajas, source in central Mexico (see also Breton 1902)\(^3\).

Studies of obsidian quarries focus on the extraction techniques, production, and distribution of goods from the quarry areas (Braswell 1996; Healan 2002, 2003; Suyuc Ley 2011)\(^4\). Braswell (1996) surveyed obsidian source and production areas around the San Martin Jilitopeque (SMJ) source area in highland Guatemala. This regional survey provided evidence of changing access to and management of resources over time. Braswell (1996) found that the production and exchange of SMJ obsidian was not highly politically centralized or controlled within the source region. Instead, access to obsidian resources was decentralized and open to area residents. Evidence of decentralization

---


\(^3\) The early study of quarries in Mesoamerica is part of a trend in early archaeological studies around the world. Early quarry researchers focused on quarries as easily identifiable locations on the landscape (Dorsey 1900; Holmes 1890, 1891, 1893, 1894, 1897, 1900; Jenney 1891; Mercer 1894; Phillips 1900). These early archaeologists examined quarry function, the activities performed there, and identified the peoples utilizing the sources (Holmes 1890, 1900).

\(^4\) Quarries are notoriously difficult to date. Most quarries are palimpsests (Purdy 1984); and generally lack temporal control (Healan 997; but see Mohogen et al. 2004. Additionally, later use of a quarry destroys evidence of earlier extraction (Pastrana 1998, 2002; Pastrana and Dominguez 2009).
includes irregular and unstandardized production activities throughout the region and the lack of indications of long distance or integrated exchange systems. The variability in production activities suggested independent producers extracted and reduced obsidian outside the preview of centralized authority.

Figure 3.1: The location of obsidian quarries in Mesoamerica.

Healan (1997) performed an investigation of the Ucareo source area and found widespread intensive utilization of the quarry area beginning in the Classic period. The Ucareo source, in Michoacán, consists of donut shaped quarry pits with large open pits surrounded by circular mounds of debitage and debris from extraction and production activities (Healan 1997). The careful discard of materials suggests a higher level of organization of extraction than at the SMJ quarries (D. Healan, personal communication 2013).
Studies of chert raw material extraction are much less common in Mesoamerica, although chert is a readily available raw material in much of the Maya lowlands. Many areas of chert raw material extraction are known but have not been investigated, including Calzado Mopan, Curcuitz, El Chal, El Naranjal, Ix Ek, Ixcocol, Ixtonton, La Estrella – Chak Mommon Tok, La Puente, Maringa, Machaquila, Panorama, Ronrón, Rosario 5, and Suk Che, all located in the Eastern Peten region of Guatemala (Alonzo 1995; Ciudad Ruiz 1994; Ciudad Ruiz et al. 2003; Doyle 2012; Flores 1994; Laporte et al. 1996; Laporte et al. 1999; Lawton 2007; Mejia 2002, 2005; Mejia et al. 1999; Quezada 1998; Quezada et al. 1998; Ramos et al 1993; Torres and Laporte 1988; Urbana 1998). Additional chert extraction areas subject to limited investigation include Maax Na (King and Shaw 2006), Chau Hiix (Ausel 2012), San Estevan (Paris 2012), and Chan Chich (Houk and Zaro 2015; Meadows 2000), all in northern Belize (Figure 3.2).

In-depth studies of chert source areas and extraction are limited and include Ix Ak, Ixtonton, Maringa, and El Naranjal in eastern Guatemala (Ciudad Ruiz 1994; Flores 1998; Laporte et al. 1989; Mejia et al. 1999; Ramos et al. 1993; Urbana 1998), Sayaxché (Aoyama 2011), and El Pedernal, near Rio Azul. El Pedernal, named after the chert source, is a settlement near a chert source with evidence of extensive production (Adams 1987; Black 1987; Black and Suhler 1986). No studies of extraction or quarrying techniques have been performed at these sites. Three sites in the Motul de San Jose settlement sphere have large quarries and production areas: Buenavista-Nuevo San Jose, Trinidad, and Chak Maman Tok’-La Estrella (Emery and Foias 2012; Foias and Emery 2012; Foias et al. 2012; Lawton 2007; Moriarty 2012). Although only limited investigations have been performed due to the destruction of some of these sites by
encroaching settlement, all three sites contain evidence of chert extraction and production. Chak Maman Tok’-La Estrella showed evidence for the extraction of raw materials in large cavities dug into chert bearing soils to extract the chert materials (Lawton 2007).

Figure 3.2: Location of chert quarries in the Maya area.
Further evidence of chert quarries, and perhaps the most intensive studies of chert extraction occurred in northern and western Belize. Quarry areas in northern Belize include Chan Chich (Meadows 2000) and Bajo Vista, Blue Creek, Bedrock, Dumbell Bajo, La Milpa, Nojol Nah, and Sotohob, in the Blue Creek Region (Barrett 2004, 2006, 2011). Barrett (2004) looked at the differential access to local raw materials from the Bedrock source to determine social relationships within the community. Barrett’s focus on the distribution of local raw materials determined that elites controlled chert resources from the Early to Late Classic periods. Although Barrett performed some examination of the quarry area itself, he focused on the distribution of the raw materials from the source areas, rather than the processes of extraction and reduction of the raw materials.

The Belize Valley is another region of widespread chert extraction. There are three quarry areas at El Pilar (Yaxox, 272-229, and LDF) (Ford 1984, 2004a). Little investigation of these areas has been performed although Whittaker et al. (2009) investigated the LDF area. The focus of that study was on the production of materials and identifying the production process.

San Lorenzo (Yaeger 2000) and Succotz (VandenBosch 1999; VandenBosch et al. 2010) are the two best known quarries in the upper Belize River valley and are located most proximately to Callar Creek Quarry. Previous investigations of the Succotz quarry were conducted as part of VandenBosch’s dissertation work (VandenBosch 1999). He looked at the production and consumption of tools throughout the Xunantunich Settlement Survey (XSS) region. The Succotz quarries, identified as T/A1-002 and T/A1-003, are quarry areas with adjacent workshops. Quarrying at Succotz consisted of excavations to depths of between five and eight meters to extract raw materials. Cobble
testing occurred within or next to the quarry areas while tool production took place in the nearby houselots (VandenBosch 1999). Analysis of debitage from production discard areas suggests spatially segmented production of bifaces with early stage production at T/A1-002 and later stage production and rejuvenation activities at T/A1-003 (VandenBosch et al. 2010).

The extraction and production of materials at the Succutz quarries occurred on the household level; the economic strategies of the households closest to the quarries focused on the production and utilization of chert resources. There is no indication of control or involvement of elites in the distribution of these goods, based on analysis of the distribution of chert goods from the Xunantunich hinterlands. Instead, the variability of this distribution points to much diversity in lithic production and consumption activities throughout the Belize Valley (VandenBosch 1999; VandenBosch et al. 2010).

The San Lorenzo quarry, located within the small settlement of San Lorenzo and investigated by Yaeger (2000), contains a scalloped hillside (SL-82), which results from the more intensive extraction of buried chert resources from some areas of the quarry over others. Three adjacent structures contained chert cobbles and debitage, which indicates production included cobble testing and early stage reduction, adjacent to the quarry, with tool manufacture, particularly of flake tools, in the adjacent structures (Yaeger 2000). While all households at San Lorenzo contained evidence of lithic production, the production of materials adjacent to the quarry represents a higher density of materials (Yaeger 2000). The spatially proximate households depended more on chert for economic activity, producing at a level beyond that necessary for household consumption, although other San Lorenzo households also produced lithic materials.
Studies of the extraction of lithic material in Mesoamerica provide us with information concerning the economic role of this stage of the production process. The overview presented here illustrates the variability in the management of lithic extraction processes throughout Mesoamerica, particularly as seen from the differences between the extractions of various material types. That is, both obsidian and chert extraction illustrate variability in the organization of extractive activities, particularly the role of elite and non-elite individuals in resource extraction. The possible causes for this variation will be further explored using the information presented from extraction and production activities at Callar Creek Quarry and the surrounding households.

3.3.2 Lithic Production

The study of lithic production in Mesoamerica is the most common of the behavioral studies of lithic technology. Production contexts are particularly well-studied as they are relatively easy to identify archaeologically due to the plethora of debitage which results from lithic production. Aspects of production which will be addressed here include craft specialization and household production, both of which have important implications for understanding the economic organization of lithic production activities and the importance of elite and non-elite individuals in these activities.

Studies of craft specialization occur in a variety of venues, many of which focus on the relative role of individuals of varying socio-political status in specialized production contexts. Studies of craft specialization are complicated by the number and complexity of definitions of specialization and related terminology (i.e. Alchian and Allen 1969; Blackman et al. 1993; Brumfiel and Earle 1987; Childe 2009; Clark 1995; Clark and Parry 1990; Costin 1991, 1998, 2001, 2004, 2016; Costin and Hagstrum 1995;
In Mesoamerica, most studies of craft production do not indicate full-time craft specialists, instead supporting the presence of seasonal or intermittent craft production and multicrafting (see Hirth 2009a,b; Healan 2009). These periodic production activities are a way for householders to diversify their economic activities and mediate risks through such diversification. That is, lithic producers were utilizing lithic production as a supplement to other forms of economic activity, either through agricultural production or multicrafting (Hirth 2009a,b).
Similarly to the controversy surrounding the amount of time utilized for craft production activities, the relative role of elite and non-elite individuals in craft specialization is also a subject of great debate (Clark 2003; Clark and Bryant 1991; Costin 1991; Feddick 1991; Hirth 2009, 2011; Michels 1979; Moholy-Nagy 1979; Neivens and Libbey 1979; Pastrana and Hirth 2003; Thompson 1991). Costin (1991, 2001, 2004, 2015) proposes that the involvement of political leaders in production activities can be seen from the access to production areas, formality of production areas, proximity to political elite structures, and the standardization of production activities. These markers provide a benchmark for archaeological contexts with which it is possible to evaluate the potential for political rulers’ involvement in production contexts.

Examples of lithic specialization managed by political leaders in Mesoamerica, include the production of eccentricos at the Pyramid of the Moon at Teotihuacan (Carballo 2005, 2007) and the production of lithics at Piedras Negras, Guatemala (Hruby 2006). At Teotihuacan, craft producers created eccentricos, predominately of obsidian, for use in burials and other offerings adjacent to the pyramid complex (Carballo 2005, 2007). The placement of these production activities within the ceremonial precinct of Teotihuacan indicates production was managed by religious leaders. The producers, however, do not appear to have worked full-time at these workshops, and Carballo (2005,2007) proposes that lithic specialists produced materials at the pyramidal workshops occasionally, when there was a need to produce items for ritual or religious events, possibly as part of tribute or taxation. At other times, the producers may have worked at other obsidian production areas within the city.
The evidence of political leader’s involvement in production at Piedras Negras also focuses on production of goods for ceremonial activities. Hruby’s (2006) study of lithic production indicated that elite individuals managed the production of eccentrics used during rituals at Piedras Negras. These two examples provide evidence of elite involvement in lithic production activities in Mesoamerica, in this case focusing on items used for ritual and religious purposes.

Examples of production outside of these political contexts include household production and the production of lithic implements at Colha, Belize during the Classic period (King 2000). Colha, Belize represents the most in-depth and formal study of lithic production and distribution in Mesoamerica and has been subject to intensive investigation since the late 1970s (Ausel 2012; Brown et al. 2004; Chiaurulli 2012; Dockall and Shafer 1993; Hester and Shafer 1980, 1984, 1991, 1992; Hester 1982; King 2000, 2012; McAnany 1989; McSwain 1991; Santone 1997; Shafer and Hester 1983; Shafer 1985). Colha is located in Northern Belize, in the Northern Belize Chert Bearing Zone (NBCBZ) (see Figure 3.2), and contains a total of 89 chert production workshops ranging from the Preclassic to the Terminal Classic periods with a brief reoccupation in the Postclassic period (Hester 1982; Shafer and Hester 1983). The large numbers of lithic workshops suggest site-level specialization (e.g. Barrett et al. 2011; Dockall and Shafer 1993; Hester and Shafer 1980, 1984, 1991, 1992; Hester 1982; Hester et al. 1980; King 2000, 2012; McAnany 1989; Shafer 1991; Roemer 1991) while the production was organized at the household level.

The Late Classic workshops at Colha clustered in the southern and western parts of the site and manufactured utilitarian implements such as tranchet axes (Shafer and
Hester 1983). These workshops were associated with specific households and with production organized at the household level (King 2000). Some households cooperated in production activities, as seen from the segmentation of production stages between households, but this organization occurred on the household level (King 2000; Masson 2001). The presence of segmented production indicates exchange between households, a mechanism supported by the presence of non-lithic producing households which specialized in wetland agriculture (King 2000).

Studies at Colha also discuss the distribution of materials outside Colha, developing a producer-consumer model. Those areas located within the NBCBZ, including Colha, produce chert implements for exchange with consumer sites, located outside the NBCBZ (Dockall and Shafer 1993; McAnany 1989; McSwain 1991). Distribution of Colha lithics occurred primarily within a 75 km zone (Shafer and Hester 1983) and consumer sites within that zone, such as Pulltrouser Swamp, Santa Rita, and Laguna de On, do not contain evidence of chert production (Dockall and Shafer 1993; Dockall 1994; Galup 2007; McAnany 1986; McKillop 1991, 2005).

The management of Colha chert production varied over time. Shafer and Hester (1983) suggest that political leaders, first at Colha and then at Altun Ha, managed the production of Colha chert, while King (2000) posits that, at least during the Late Classic, chert production and distribution occurred independently of elite individuals.

Household production and consumption, particularly that at a much smaller scale than at Colha, remains an important component of lithic studies as household lithic production is common in much of Mesoamerica. Studies of differential lithic production and consumption provide information about the relative wealth and status of residents as

Studies of household lithic production in Mesoamerica illustrate both the production of materials for use within the household and production at a scale beyond that required for household use. Production of lithic materials at a scale beyond that necessary for use in a single household indicates that goods were exchanged between households. At Xochicalco, Mexico, studies found that four households produced obsidian tools on a part-time basis as part of multicrafting activities (Hirth 2009a). The part-time household specialization in obsidian blade production permitted the producers to diversify their subsistence activities to reduce risk by creating another avenue through which householders could obtain goods.

The production of obsidian blades by specialists at Xochicalco mirrors the production of bifacial technology by specialized households in much of the Maya area (see Cap 2015a,b; Hearth 2012; VandenBosch 1999). Several studies in the Maya area indicate that in small communities, one household specialized in biface production, as seen from greater numbers of bifacial thinning flakes at these residences (Hearth 2012; VandenBosch 1999). These bifaces were then presumably distributed to other households within the settlement (see Sheets 2000 for a description of the ways in which such exchange mechanisms functioned).

Studies of lithic production throughout Mesoamerica illustrate great variability in the organization and management of these contexts. Obsidian production occurs in workshops organized by political leaders, such as at the Pyramid of the Moon at
Teotihuacan (Carballo 2005), in households, such as at Xochicalco (Hirth 2009a), and in marketplace contexts such as at Buenavista and Xunantunich (Cap 2015a, 2017). Chert production more commonly occurs as part of household production, such as of bifacial materials, but production possibly associated with political leaders did occur, such as at El Pilar (see Whitaker et al. 2009). The variability in lithic production contexts provides evidence for economic variability, which will be examined in greater detail using the information gathered from Callar Creek Quarry.

3.3.3 Distribution

Studies of lithic distribution, and the consumptive behaviors of past individuals, remains largely in the sphere of obsidian studies in Mesoamerica. Scholars use obsidian, an easily sourceable commodity, as a proxy for elite economies and trade relationships (Aoyama 1996, 2001, 2008; Clark 1997; Clark and Bryant 1997; Spence 1981, Spence et al. 1984). Such studies are limited mostly to the distribution of the final products, in particular examining the changes in obsidian distribution patterns through time (Braswell and Glascock 2002; Glascock 2002; Hammond 1979; Hammond et al. 1977; McAnany 1991; Nelson 1989; Santley 1989; Shackly 2002; Yacobaccio et al. 2002). Temporal shifts in lithic distribution patterns are used as proxies for changes in long-distance trade routes and shifts in the elite power structures which managed these routes. For instance, the presence of green obsidian, from Pachuca or Sierra de las Navajas, in the lowland regions of the Maya area, is used as an indicator of interaction between Teotihuacan and the Maya area (G. Braswell 2004b). Similarly, the relative abundance of El Chayal obsidian in the Preclassic period is used as a marker of interactions between Kalminaljuyu and other areas of the Maya lowlands (Michaels 1975, 1979).
Most lithic sourcing studies are focused on the political and economic implications of trade and exchange (Aoyama 2011; Braswell and Glascock 2011; Johnson 1979; G. Michaels 1989; Nelson and Howard 1986; Vogt et al. 1989) which provide information on the role of elites in these activities and the mechanism of the distribution of such goods, i.e. whether they were distributed through elite redistribution, markets, or other mechanisms. The emphasis on obsidian distribution, however, does limit the generalizability of such studies, as lithic materials produced on other raw materials could face different constraints in their distribution.

Studies of the distribution of other lithic materials are more complicated than obsidian materials, due to sourcing issues. Although chert sourcing is possible given certain chert formation processes (see Speer 2014 for more information), no chert sourcing studies have been performed in Mesoamerica. Instead, studies of the distribution of chert materials depends on visual sourcing, which is unwieldy at the best of times, and only useful in studies of cherts with distinctive appearances, such as Colha chert and a dark-brown chert found in southern Campeche. Thus, few studies trace the sources of chert materials and analyses of their distribution instead rely on the presence or absence of lithic reduction debris and its relative frequency. Such distributional approaches (see Hirth 1996) have great utility, but are not as commonly applied as chemical sourcing methods, thus limiting the focus of lithic material distribution to materials which are easily sourced.

3.3.4 Summary Thoughts

Behavioral lithic studies in Mesoamerica examine a wide variety of topics, particularly resource extraction, production, and distribution, to better understand the
socio-political and economic contexts under which lithic materials were produced and consumed (Emery and Foias 2012; Foias et al. 2012). More recent behavioral lithic studies in Mesoamerica (Levine and Carballo 2014) emphasize the ritual and religious importance of lithic materials, which while an important component of lithic studies, lies outside the scope of this dissertation.

3.4 Conclusions

In describing the history of lithic studies in Mesoamerica, two main themes come to light: 1) the prominence of obsidian studies rather than chert; and 2) the emphasis on formal tools rather than informal tools and debitage. The importance of obsidian in Mesoamerican lithic studies results from a focus on trade and exchange, and the importance of obsidian prismatic blade production. The number of edited volumes discussing obsidian production and use exemplifies the emphasis on obsidian studies (Gaxiola and Clark 1989; Hester 1978; Hirth 2003, 2006; Hirth and Andrews 2002; Levine and Carballo 2014).

Chert, however, is a ubiquitous resource in much of Mesoamerica but with an uneven geographic distribution. Chert is common in much of southern Mexico, Belize, and eastern Guatemala (Aoyama 2011; Barrett 2004, 2006, 2011; Black and Suhler 1986; Ciudad Ruiz 1994; Eaton 1982; Flores 1998; Foias et al. 2012; Ford 1984; Laporte et al. 1989; Meadows 2000; Mejia et al. 1999; Ramos et al. 1993; Urbana 1998; Whittaker et al. 2009), although it is not found in the northern lowlands and some areas of the Peten (Andrieu and Roche 2015; Dahlin et al. 2011; Hearth and Fedick 2011). Chert is, however, the principal lithic raw material utilized at most Maya sites (Andrieu 2009). The ubiquity of chert resources in much of Mesoamerica increases the importance of the
study of such areas, but a bibliography of worldwide chert studies lists 24 citations discussing chert in all of Mexico and Central America, just 1.1% of the total citations listed in the volume (Delage 2003; see also Shott 2014).

A second important issue raised in this examination of Mesoamerican lithic scholarship is the almost exclusive emphasis on formal tool technology. The majority of the studies discussed here focus on formal tools, such as bifaces (e.g. Andresen 1979; Aoyama 2009; Ausel 2012; Eaton 1991; Hirth 2003; Kaneko 2003; Kwoka 2014; Lewenstein 1987; Meadows 2000; Potter 1991; Sheets 2003; Titmus and Woods 2003) or obsidian prismatic blades (e.g. Andrews 2003; Flenniken and Hirth 2003; Gaxiola and Clark 1989; Healan 2002; Hester 1978; Hirth 2003, 2006; Hirth and Andrews 2002; Hirth and Flenniken 2002; Hirth et al. 2003; Levine and Carballo 2014; Parry 2002; Pastrana 2002; Sheets 2003; Trachman 2002). While these tools provide us with important information about certain activities, informal, or flake, tools provide us with information about a wider range of activities and are more common than formal tools (see Fedick 1991; González Cruz and Cuevas García 1998).

Studies of lithic technology in Mesoamerica have come a long way since their early relegation to appendices and mere typological analyses. In the following chapter, I propose the application of the organizational approach to Mesoamerican lithic technology, an approach that allows lithics to be used to study questions of broad interest to archaeologists studying complex societies, that has been used successfully in other world areas.
Chapter 4: Lithics and the Organizational Approach

Lithic analysis in Mesoamerica has focused mostly on prosaic aspects of lithic technology; by using an organizational approach to lithic analysis, lithic technology provides an avenue through which to expand studies of extraction and production processes to address broad questions such as economic organization. Technological organization addresses how material culture integrates with larger systems and the factors which influence tool manufacture and use, such as economic and social organization (Andrefsky 2012; Carr 1994a,b; Carr et al. 2012; Kelly 1988; Koldehoff 1987; McCall 2015; Nelson 1991; Odell 2012; Shott 1989b; Shott and Nelson 2008). Organizational approaches base analyses of lithic materials on studies of hunter-gatherers and the factors which influence tool form in such societies. These approaches occur commonly in lithic studies around the world, although less commonly in Mesoamerica. This chapter discusses the organizational approach (also referred to as technological organization), the development of this approach, its utility in complex societies, and with studies of quarries and production activities.
4.1 The Organizational Approach

Technological organization, a framework for integrating the study of material culture into social and economic behaviors, relates tactile features of material culture to broader anthropological issues. Technological organizational frameworks identify factors which shape tool production, resulting in differences in size, weight, form, and functional attributes of tools, including, but not limited to, mobility, access to raw materials, risk, and time and energy costs (Carr 1994a,b; Cowan 1999; Kuhn 1994; Lothrop 1989; McCall 2015; Nelson 1991; Shott 1989b; Torrence 1989). The constraints imposed on tools by these factors result in visible morphological differences used by archaeologists to model tool qualities including reliability, maintainability, transportability, flexibility, versatility, curation, and expediency (Nelson 1991; Shott 1989b). That is, the lithic assemblage is influenced and created through the behaviors of individuals, and the limitations and constraints on tools which result from these behaviors.

Technological organization operates by creating a sequence of operations which describe the material’s use-life, including raw material acquisition, production, use, and discard of an object or a family of objects. These schematics, referred to as sequence models\(^1\), describe all of those stages or focus on one aspect, such as raw material acquisition and production activities (Beck et al 2002; Bleed 2001; Ericson 1984; Law

---

They provide insights into the behaviors, activities, and locations of the utilization and modification of lithic materials. Perhaps most importantly, they clarify tool use-histories (Bleed 2001; Ericson 1984; see Appadurai 1986).

Sequence models developed out of the need to provide an “analytical grid” to examine tool production and use (Audouze 2002), describe the technological operations from raw material acquisition to the use and discard of a manufactured tool, and understand the cognitive behaviors associated with these actions (Bleed 2001). The utility of sequence models is increased by the creation of visual representations of the production process (Andrefsky 2009; Bleed 2001; Shott 2003), which allow scholars to see the steps taken by past producers to create the objects identified archaeologically. Factors considered in sequence model creation include the intensity of reduction and the relationship between reduction and artifact form, to account for the effects of reduction on tool size and design (Clarkson 2005; Holmes 1897; Shott 2005), and determining the goals of the producers (Audouze 1998; Bar Yosef et al. 1992; Close 2006; Karlin and Julien 1994; McCall 2015; Schlanger 1994; Sellett 1993; Shott 2003; Van der Leeuw 1994).

This dissertation takes an organizational approach to the study of lithic production, involving the creation of a reduction sequence for lithic materials. The production sequence integrates with the technological organization framework to explain the relationship between economic organization and lithic technology. That is, the economy and tool production and distribution have a feedback relationship where one influences the other. By examining measurable qualities of lithic materials, such as artifact form, activities (procurement, manufacture, etc.), design, and technological strategies, the manners in which economic activities influenced these decisions can be
determined. This chapter introduces traditional uses of organizational approaches, their utility in quarry studies, and their applicability to studies of complex societies.

4.1.1 Traditional Uses

The main use of technological organization, even that focusing on studies of quarries and production areas, occurs in hunter-gatherer studies (but see Parry and Kelly 1987; Torrence 1984, 1986). Technological organization emerged from studies of contemporary foraging peoples and thus was first applied in similar archaeological cases.


An organizational approach allows a nuanced examination of the characteristics of the lithic materials to permit a broader understanding of mobility, sedentism, and their relationship with formal and expedient tool types (Douglass 2010). For instance, McCall (2009) uses a chaîne opératoire analysis of Early Stone Age (ESA) lithics from Namibia to reconstruct mobility patterns while Lurie (1989) examined technological organization to discuss changes from residential to logistical mobility in the Middle Archaic at Koster, Illinois. Factors considered in technological organization studies of mobility include raw material sources and tool production and discard.

Subsistence studies relate to technological organization through analyses of tool function and the number and diversity of lithic materials present in an assemblage. Vierra (1995) analyzed changing subsistence strategies in the Mesolithic based on lithic technology and determined that subsistence diversification was a factor in the emergence of geometric microliths as the predominate lithic technology in the Late Mesolithic, demonstrating a relationship between subsistence changes and technological change.

More recent organizational studies employed the approach to describe lithic producers and their interactions, through analyses of lithic materials. Close (2006) traced the sequence of tool manufacture on San Juan Island, Washington through the classification of lithic materials into flake, core, and tool typologies and the identification and measurement of a variety of attributes. The chaîne opératoire linked artifact histories to examine the culturally determined ways in which everyday tasks occurred.

The focus of technological organizational studies on hunter-gatherers arose from the historical basis for the approach, it was created as a result of patterns observed in ethnographic and ethnoarchaeological studies of mobile hunter-gatherers. However, the
mechanisms of analysis and interpretation can be utilized to study non-hunter-gatherer contexts, including studies of lithic technology in sedentary, complex societies.

4.1.2 Use with Quarry Studies

The organization approach is also frequently used in studies of quarries (Barkai and Gopher 2009; Burke 2007; Carr 1994a,b; Close 2006; de Leon 2008; Doelman 2008; Ingbar 1994; Lamb 2011; Law 2005, 2009; McCall 2009; Mitchell 2000; Root 1992; Thacker et al. 2012), thus providing an avenue to discuss the economic factors which impact lithic raw material extraction and tool production. Quarries, areas of raw material resource extraction, have been explored by archaeologists for over 100 years. The early interest in quarries has led to their study in virtually all world areas and time periods (Abbott 2004; Andrews et al. 2004; Babel 2008; Bamforth 1992, 2006; Barkai and Gopher 2009, Bloxam 2011; Bostyn et al. 2008; Braswell 1996; Brumbach 1987; Cobb 2000; Daniel and Butler 1996; Doelman 2008, 2005; Ericson 1984; Goodyear and Charles 1984; Hatch and Miller 1985; Ives 1975, 1984; James 1977; Law 2009; Lollet et al. 2008; Monoghan et al. 2004; Paton 1994; Pearson 2003; Petraglia et al. 1999; Soles 1983; Stanier 2000).

Organizational approaches to quarries follow similar trends to other organizational approaches. For instance, Boone Law (2009) examined the relationship between mobility and quarrying in Australia. He found differences between quarry areas based on the distance between habitation sites and the quarry and the position of the raw material sites on the residential circuit. He found that the distance between the production location and location of tool use most impacted tool size and form. Boone Law’s (2009) study fits within the trend of organizational approaches in hunter-gatherer
societies, particularly the emphasis on mobility as a guiding factor in tool form and size. Other organizational approaches to quarries emphasize technological choice and the strategies of lithic extraction and production as the main cause for variation in lithic form. Burke (2007) found that, at a quarry in Quebec, the form and manner of the outcrop of lithic materials influenced the final form of a tool and the nature of its manufacture.

Organizational studies of quarries conform to general trends for traditional approaches to organizational studies in mobile societies, with a focus on the relationship between mobility and lithic variation and the impact of the form of lithic materials on their manufacture. Quarries are ideal locations for organizational approaches due to the plethora of lithic materials found in those sites, and the multiplicity of factors which might contribute to variation in quarrying and production. Most organizational approaches to quarries focus on mobile societies and what quarries can tell us about raw material acquisition and its role in elucidating mobility patterns. Such approaches, however, can also be applied to quarries in complex societies which would provide important connections between raw material acquisition and economic and socio-economic practices.

4.1.3 Applications in Complex Societies

An organizational approach to complex societies stems from the application of similar techniques and methods at a different scale. Although less common than organizational approaches in hunter-gatherer societies, its utility in complex societies is clear (Druart 2010; McDonald 1991; Parry and Kelly 1987; Sorensen 2010; Rosen 2010; Teltser 1991; Torrence 1984, 1986).
A main avenue of organizational approaches in complex societies revolves around the technological constraints operating on lithic technology in sedentary and mobile societies. Generally, mobile tool kits conserve raw materials while sedentary tool kits use more wasteful tool technologies, a result of lithic stockpiling (Parry and Kelly 1987). Parry and Kelly’s (1987) seminal article led to an acceptance of the idea that informal lithic tool use in sedentary societies was simply a result of easy access to raw materials and a lack of raw material stress. This model became so entrenched that informal lithic materials in Epipaleolithic Egypt served as a mark of sedentism (McDonald 1991).

Further study of the role of informal tools and generalized core technology in sedentary societies is warranted as more recent studies provide evidence which questions the direct relationship between sedentism and informal tool technology proposed by Parry and Kelly (1987). Testler (1991) examined Mississippian lithic assemblages and found that the generalized core technology and expedient flake tools resulted from a need for a flexible toolkit rather than an unstructured one. She argued that the influences on generalized core technology, including raw material availability and procurement, structure the technology in a manner that requires more flexibility and multifunctionality than a technology focused around biface production. Similarly, studies of lithic production at the Preclassic period site of Chalcatzingo in Morelos, Mexico (McCall et al. 2015) found that the use of expedient chert tools, utilized down to small nubbins, were a result of raw material stress and the lack of readily available resources. The lack of chert resources calls into question Parry and Kelly’s (1987) suggestion that expedience results from plentiful and easily accessible raw materials and instead implies the opposite. These two studies illustrate the importance of careful examination of lithic
materials in complex and sedentary societies to tease apart the factors which contribute to expediency and further our understanding of the relationship between mobility, sedentism, and tool use.

Torrence’s (1984, 1986) examination of lithic production and distribution in the Aegean represents an alternative application of an organizational approach focused on the management of obsidian production and distribution. Torrence (1984) suggested that obsidian distribution operated without the involvement of political leaders due to the lack of systematic extraction practices at quarries and the lack of standardization in production.

In Mesoamerica, use of technological organization in lithic analysis is limited (but see de Leon 2008; Kwoka 2014; McCall et al. n.d.). Other applications of the organizational approach in Mesoamerica focus on reduction sequences, (i.e. Aldenderfer 1991; Barrett 2004; Clark 1989b; Clark and Bryant 1991; González Cruz and Cuevas García 1998; Hester and Shafer 1984; Hirth et al. 2003; Mitchum 1991; Moholy-Nagy 1991, 2011; Titmus and Wood 2003) while not employing the full analytical potential of such an approach.

Although applications of organizational approaches in complex societies are limited, such approaches would aid in the integration of technical studies, such as lithic analysis, with questions of broader anthropological interest in complex societies. The nuances of lithic production, and the relationship between resource stress, economic activity, political organization, and technological choice, all provide us with important information about complex societies. By analyzing the physical manifestations of past technological decisions, we better understand the factors which lead to those decisions,
whether those factors relate to mobility economic structure, resource scarcity, or tool functionality.

4.1.4 Conclusions

The organizational approach to lithic technology provides a framework for using lithics to address questions of broader interest within these past societies, such as economic, socio-economic, and political structures. Torrence’s (1984, 1986) examination of economic organization in the Aegean, the analysis of the socio-economic and political impact of chert production and distribution at Chalcatzingo (McCall et al. n.d.), would not have been possible without organizational approaches. These studies revealed the importance of political rulers in long-distance obsidian trade in the Aegean (Torrence 1984, 1986) and the impact of access to chert raw materials, a socio-economic and political issue at Chalcatzingo, on the form and distribution of chert materials (McCall et al. n.d.), thus shedding light on important issues to scholars of these regions. The organizational approach, in both cases, provided a new, nuanced perspective to questions long-studied by scholars in these regions. Although the organizational approach stems from studies of contemporary hunter-gatherers, and is most frequently utilized in studies of mobile populations, this chapter has illustrated the utility and importance of implementing such frameworks within sedentary societies.
In this dissertation, the organizational approach creates a bridge between the analysis of lithic materials and lowland Classic Maya economic organization. Carr et al. (2012) provide a schematic (Figure 4.1) demonstrating the relationship between economic organization and quantifiable aspects of lithic technology; the economy affects the manners in which tools are produced and distributed, and hence, the means and mechanisms of their production (see also Nelson 1991). As shown from the schematic, artifact form, activities (procurement, manufacture, etc.), design, and technological strategies influence and, are influenced by, economic strategies. An examination of raw material procurement, the earliest stages of production, and the most basic attributes of lithic technology, including artifact form, all directly observable from the Callar Creek
Quarry assemblage, elucidates the technological and economic strategies which affect the use of specific extraction and production strategies and tool designs.

By utilizing an organizational approach to lithic production, I demonstrate the utility of lithics for examining questions of broad interest to archaeologists studying complex societies.
Chapter 5: Belize River Valley

The previous chapters in this dissertation introduced the importance of examining lithic materials as an avenue for exploring variability in economic systems, previous lithic studies in Mesoamerica, and a framework for integrating lithic analysis with past economic activity. This chapter situates Callar Creek Quarry within the geographic and cultural-historical bounds of the region in which it is located, the upper Belize River valley (UBRV) in western Belize. The discussion of the UBRV illustrates the advantages to investigations in the region, particularly at Callar Creek Quarry; the amount of information available about production activities, and other aspects of past economies, in the UBRV provide avenues for comparison to Callar Creek Quarry which are not available elsewhere in the Maya area. As such, broader comparisons and conclusions concerning the organization of economic activity in the region can be developed.

5.1 Geographic Bounds of the Upper Belize River Valley

The UBRV lies within the Maya lowlands in a geographic region separating the northern lowlands of Belize from the Maya Mountains (Mountain Pine Ridge) to the south (Furley and Crosbie 1974). The region has high average temperatures, high
quantities of seasonal rainfall (Sharer and Traxler 2006), and sub-tropical forests and riverine environments.

The Belize River valley is defined by the Macal, Mopan, and Belize Rivers and is divided into the upper and central valleys. The upper Belize River valley is characterized by hilly terrain to the west of the joining of the Macal and Mopan Rivers. The central Belize River valley is characterized by alluvial plains along the Belize River (the river changes names after the joining of the Macal and Mopan). Most of the known Maya settlements lie to the south of the Belize River, although this may be a result of the areas in which intensive archaeological survey have occurred (Chase and Garber 2004).

Callar Creek Quarry’s location within this geographic area is particularly important due to the access this location provides to a wide variety of resources. The riverine nature of the region provides accessibility throughout the region, with the river serving as a trade route to connect the interior regions of the Peten, Guatemala to the Atlantic Coast (Chase and Garber 2004). The presence of a trade route near Callar Creek Quarry might facilitate access to non-local goods such as marine shells and obsidian, to name a few. Furthermore, Callar Creek Quarry lies in close proximity to several environmental zones, increasing the number of locally available resources. Locally available resources include chert, found at concentrated areas, like Callar Creek Quarry, as well as in secondary deposits along riverbeds, and abundant limestone resources, useful for architecture, lime production, and the production of limestone tools. Granite is available in the Mountain Pine Ridge, located only about 20 km to the south of Callar.

---

1 The northern Belize lowlands feature a dry tropical forest with a deciduous seasonal forest, a mean annual rainfall less than 80 inches and a mean annual temperature greater than 24° C. The region has seasonal rains, with the dry season from January to April, and the rainy season from May to December, although September and October have the heaviest rains (Romney 1959).
Creek Quarry. The diverse resource availability and importance of riverine activities within the UBRV impacted the settlement history of the region, discussed in the next section.

5.2 UBRV Research and Site History

Archaeological research in the UBRV has been ongoing since the early 1900s with visits by early archaeologists including J. Eric S. Thompson, Thomas Gann, and Sylvanus Morely. Systematic archaeological research began in the 1950s when Gordon Willey performed a settlement survey of the region (Chase and Garber 2004; Willey 2004; Willey et al. 1965) (Figure 5.1). Continued investigations in the region, aided by the relative ease of working in the region, has led to a plethora of research, at a variety of major and minor centers, such as Actuncan, Arenal, Baking Pot, Buenavista del Cayo, Blackman Eddy, Callar Creek, Cahal Pech, Chaa Creek, Chan, Dos Chambitos, El Pilar, San Lorenzo, and Xunantunich (Ball and Taschek 2004; Braswell 1998; Cap 2015; Chase et al. 2014; Conlon and Powis 2004; Connell 2000; Ford 1991, 2004a; Garber 2004; Garber et al. 2004a,b; Houk 2015; Keller 2006; Kurnick 2013; LeCount 1996; LeCount and Yaeger 2010; McGovern 2004; Peuramaki-Brown 2012; Robin 1999, 2012, 2013; Taschek and Ball 1986; VandenBosch 1999; Yaeger 2000, 2010b; Yaeger et al. 2016).
The large quantity of research in the region renders a systematic discussion of all research beyond the scope of this dissertation (see Chase and Garber 2004; Houk 2015; Willey 2004 for overviews of research). Instead, this section focuses on 1) the role of elite political dynamics in the UBRV and interactions with other areas of Mesoamerica; and 2) the impact of these political dynamics on smaller sites in the region. These two avenues of discussion place Callar Creek Quarry within the broader culture-historical framework of the Maya area and provide information of the dynamics of elite and non-
elite interaction in the region, which will elucidate the potential involvement of these actors in lithic extraction and production activities in the region.

5.2.1 Political Dynamics

Political dynamics in the UBRV involve both internal political dynamics and interactions with political centers in other regions of the Maya area. Within the UBRV, there is a high site density for major sites from the Preclassic to the Terminal Classic periods, with major centers located with a distance of only about 9.9 km between sites, as opposed to about 26 km in other regions (Driver and Garber 2004; Helmke and Awe 2008). The close spacing of these centers suggests to some scholars that the region hosted a segmentary state (Ball and Taschek 1991), indicating less political and economic centralization than other areas of the Maya world. Although this has become a subject of great debate, the close spacing of these sites probably resulted from the ongoing fluctuations of political power in the UBRV. Such fluctuations, or cycling, (see LeCount and Yaeger 2010) began in the Preclassic period, the period of the earliest intensive construction and occupation in the region. In the Preclassic period, Actuncan, Cahal Pech, and Xunantunich vied for power, with a probable switch in regional power from Xunantunich to Actuncan near the end of the Late Preclassic period (Brown 2010; Healy et al. 2004; McGovern 2004).

Actuncan continued to be a major power into the Early Classic, although evidence from Buenavista del Cayo (hereafter Buenavista$^2$) indicates it was also a major political

---

$^2$ Buenavista, located on the alluvial plan on the east bank of the Mopan River, was excavated in the 1980s by the Mopan-Macal Triangle Project (MMT) (Ball and Taschek 1991) and starting in the 2000s by the Mopan Valley Archaeological Project (MVAP) (Cap 2007, 2015; Haley et al. 2007; Yaeger 2007; Yaeger et al. 2008, 2009, 2011). Investigations focused on the site core and settlements surrounding Buenavista (Ball and Taschek 1991; Cap 2015; Peuramaki-Brown 2007, 2012; Yaeger 2007). The earliest occupation at Buenavista dates to about 950 B. C. and Buenavista became an important regional center by about 650 B.
player in the Early Classic period (Yaeger et al. 2015). The exact nature of the interaction between these two powers during this period is unknown and merits further investigation. Evidence from Buenavista also points to interactions with Naranjo (see Martin and Grube 2008; McGovern 2004 for background on Naranjo) during the Early Classic period, as seen from glyphic inscriptions (see Yaeger et al. 2015).

The majority of the interactions between Naranjo and Buenavista occurred during the Late Classic period, when Buenavista is thought to have been the major political power in the UBRV. Texts from Naranjo, referring to Buenavista by its Maya name of *Kokom*, or the “Dotted Ko” place, indicate the site was subjugated by Naranjo as part of a Star War event (Yaeger et al. 2015). Archaeological evidence of this incident includes a possible stockade in a relatively unfortified area of the site (Yaeger et al. 2015), and the presence of ceramics from Naranjo such as the “Buenavista Vase” (Ball and Taschek 2004; Martin and Grube 2008; Taschek and Ball 1992). Scholars also attribute the massive building activities at Buenavista in the Late Classic I (A.D. 600-670) to interest in the governance of the region by Naranjo (Ball and Taschek 2004; Martin and Grube 2008; Taschek and Ball 1992).

In the Late Classic II (A.D. 670 - 780), Naranjo’s attentions in the UBRV, and the seat of political power in the valley, switched to Xunantunich³, although occupation at Buenavista continued through the Terminal Classic (Ball and Taschek 2004; Escobedo

---

³ Xunantunich, a hill-top center on the west side of the Mopan River near the modern town of Succutz, is only 13 kilometers from Naranjo. Thomas Gann conducted the first investigations at the site in the 1890s but the first scientific investigations occurred in the early 1990s under the direction of Xunantunich Archaeological Project (XAP) (Leventhal et al. 2010) with additional research by the Belize Tourism Development Project (TDP) (Leventhal et al. 2010) and current investigations by the Mopan Valley Preclassic Project (MVPP).
1993; Peuramaki-Brown 2012; Taschek and Ball 2004). The Classic period site core of Xunantunich, was constructed mostly in the Late Classic I, or Samal phase, and the Late Classic II, or Hats’ Chaak phase (Ball and Taschek 1991, 2004; LeCount et al. 2002; LeCount and Yaeger 2010a,b; Leventhal and Ashmore 2004; Taschek and Ball 2004). During the Late Classic I, Buenavista and Xunantunich were rivals for power in the region, with Xunantunich eclipsing Buenavista in the Late Classic II (LeCount and Yaeger 2010). As the rapid construction of Xunantunich’s Classic period monumental core in the Late Classic occurred contemporaneously with the expansion of political power at Naranjo, its construction is presumed to be associated with encouragement and supervision from the ruling dynasty of Naranjo (Leventhal and Ashmore 2004; MacKie 1985), a theory supported by similarities in site layout and construction history between Xunantunich and Naranjo (LeCount et al. 2002; LeCount and Yaeger 2010; Leventhal and Ashmore 2004; Martin and Grube 2008).

Although the logic behind Naranjo’s influence in the region, particularly the encouragement of first Buenavista and then Xunantunich as political powers in the region, is unknown, the impact of this cycling of political centers from the Preclassic to the Terminal Classic period on smaller settlements in the UBRV can be discussed. The impacts on non-major centers and the individuals residing in these settlements provide information about the relative independence or interdependence of residence of major centers and surrounding areas in the UBRV.

5.2.2 Political Cycling and Small Settlements

The shift of political power within the UBRV over time affected different minor settlements in a variety of ways, illustrating the variability in relationships between these
areas in the UBRV (Leventhal and Ashmore 2004, Yaeger 2010b). Sites addressed here, Callar Creek, Chaa Creek, and Chan, and the settlement zone of San Lorenzo all interacted with major centers in varied ways, ranging from showing affiliations to local political powers to increase power within their own communities, to subsistence economies which insulated residents from shifting political alliances.

Callar Creek, a low-level residential and administrative center first inhabited in the Middle Preclassic period, maintained close ties with Buenavista, and through this connection, with Naranjo (Kurnick 2013, 2016). Excavations revealed artifacts and architecture resembling those found at Buenavista, and sherds with the Buenavista device and glyphic texts which support a connection with Buenavista and Naranjo (Kurnick 2013, 2016). Callar Creek maintained its connections with Buenavista, even during the turbulent political periods, despite its location equidistant between Buenavista and Xunantunich.

The connection between Callar Creek and Buenavista appears to be based mostly on a political connection and was a way through which the local elites maintained power in the region. Leaders at the site displayed their ties with Buenavista to illustrate their legitimacy (Kurnick 2013, 2016). Due to these close ties, the fates of the settlements are more closely connected than in some other cases, and settlement at the site fades around the same time as at Buenavista (Kurnick 2013). Callar Creek elites’ use of affiliations with Buenavista as a mechanism for maintaining power illustrates one way in which minor elites and non-elites interacted with elite individuals. Other sites in the UBRV, like San Lorenzo and Chaa Creek, illustrated similar trends, although in the case of these sites, site residents maintained close ties with Xunantunich.
San Lorenzo, a settlement zone on the east bank of the Mopan River, occupied from the Preclassic to the Terminal Classic period (Yaeger 2000), and Chaa Creek, several adjacent minor centers located near Xunantunich, occupied from the Preclassic to the Terminal Classic period (Connell 2000), illustrate ways in which residents used allegiance and affiliation with Xunantunich to create difference within the site (Yaeger 2000). During the Late Classic II, when Xunantunich rose to prominence in the UBRV, changes in settlement organization at San Lorenzo occurred, specifically an increase in household differentiation. At San Lorenzo, wealth differences increased during the Late Classic II and wealthier households increased visible ties to Xunantunich through architectural and ceramic referents (Yaeger 2000). At Chaa Creek, both residents of minor centers and hinterland regions showed increased ties to Xunantunich in the Late Classic II through increased percentages of black, rather than red, slipped vessels (Connell 2000, 2010). Previously members of the Chaa Creek community had shown ties to sites to the east. The switch in the ceramic affiliations to Xunantunich were accompanied by architectural changes which re-oriented structures toward Xunantunich (Connell 2010). Both sites illustrate the ways in which leaders at small sites used visual markers of affiliation with large political powers to increase their own power and prestige.

The Callar Creek, San Lorenzo, and Chaa Creek cases illustrate instances of rural elites increasing affiliations and ties with major centers to increase their own power. Site leaders made conscious efforts to visibly affiliate themselves with the current political dynasty in the region. The site of Chan, a small farming community occupied continually from 800 B.C. – A.D. 1200, provides an example of ways in which these sites also
maintained a certain level of independence from this highly dynamic political climate (Robin 2012a,b, 2013; Robin et al 2014, 2015). Many of the trends from Chan probably hold true for these other hinterland communities, although this has not been the emphasis of study at these other sites. Investigations at Chan indicate continuity and independence on the part of residents in terrace farming and other subsistence practices (Robin et al. 2015; Wyatt 2012). The evidence from Chan provides an example of aspects of continuity in settlement in UBRV.

These varying ways in which minor sites interacted with major political centers emphasizes the variability present in the interactions between individuals of different socio-economic classes in the UBRV. The nature of these interactions affected the economic activity in the valley and will be further explored in a discussion of the economic organization of the region.

5.3 UBRV Economic Organization

The ways in which residence of the UBRV interacted can be seen perhaps most clearly in the ways in which economic activity was organized in the region. Evidence from previous investigations suggests that a variety of economic activities occurred in the region: marketplace exchange, the non-market distribution of certain goods, non-elite household production, and elite production activities, both within elite households and in other spaces. This section will address the evidence for each of these activities in turn, and then discuss the importance of the variability in economic activates seen in the UBRV.
5.3.1 Marketplaces

Evidence for market exchange in the UBRV is some of the strongest in any region of Mesoamerica, and marketplaces are proposed at the sites of Xunantunich and Buenavista. Both Xunantunich (Cap 2016; Keller 2006) and Buenavista (Cap 2007, 2015a,b) illustrate evidence for marketplaces, include architectural evidence, microartifact analysis, and soil chemistry (Cap 2007, 2015a,b, 2016; Keller 2006; see also Dahlin et al. 2007, 2009 for additional information on marketplace identification). The Buenavista marketplace, located in the East Plaza, was identified through the presence of activity areas for late stage finishing of chert and limestone bifaces and the production of obsidian blades (Cap 2015a,b; Heindel 2010; but see Kelsay 1985; Reith 2003). The multiple activity areas point to marketplaces as locations of multicrafting (see Hirth 2009a, Shimada 2007). The presence of multiple activity areas resembles evidence for marketplaces at Chunchucmil and ethnoarchaeological studies of modern Maya marketplaces (Dahlin 2003; Dahlin et al. 2007, 2009). Furthermore, the accessibility of the plaza, soil chemistry tests, and architectural features which may represent temporary stall features, support the identification of the area as a marketplace (Cap 2015a,b).

The Xunantunich marketplace, located in the Lost Plaza, is positioned near major access points to the Xunantunich site core (Jamison 1996; Keller 2006). Evidence for marketplace activity includes the plaza location, near major access points into the city, the form of the plaza, similar to areas at Caracol identified as marketplaces, and the presence of spatially discrete activity areas for spinning and textile sales, shell bead production, final stage finishing of chert bifaces, and the removal of obsidian blades from pre-prepared prismatic blade cores (Cap 2016; Keller 2006).
A similarity between these two marketplaces is the presence of late stage production activities in the marketplaces (Cap 2015a; Keller 2006). Since the recovered debitage at these marketplaces indicates only late stages of production, finishing, and reworking were performed on site, earlier stages of production must have occurred elsewhere. This evidence led Yaeger (2010) to suggest that producers and consumers in the UBRV had a close relationship. That is, that producers and consumers probably interacted frequently, whether that was through a marketplace setting or some other venue for exchange.

The presence of marketplaces at two of the main political centers in the UBRV indicates the importance of marketplaces in economic activity in the region. Other sites in the area might have marketplaces, but investigations of possible marketplace areas have not been performed at any other sites in the region. The number of marketplaces and their locations impacts the role of marketplace interactions on the economy. If each major site had its own marketplace, it would suggest that elites within the sites managed the marketplaces and benefited from their presence. If they were less common, the relationship between marketplaces and elite individuals becomes more complicated. Further investigation of the number and location of additional marketplaces in the UBRV would help elucidate their role in economic activity and the involvement of elite individuals in marketplace activity (see LeCount 2016).

5.3.2 Non-market Goods Distribution

In addition to the evidence for marketplace exchange within the UBRV, evidence indicates the concurrent operation of other exchange mechanism such as gift giving and taxation or tribute. Items which were probably exchanged through gifting include certain
types of polychrome ceramics (see Ball and Tascheck 2004; Reents-Bundet 2000; Reents-Bundet et al. 1994, 2000). Polychromes, often produced by elites, were distributed between elites during feasting and other ceremonies as a way of creating and maintaining elite social networks (see Reents-Bundet 1998, 2000; Neff 2010).

Obsidian is another good generally thought to be distributed through elite networks, as seen in the Copan region (see Aoyama 1999, 2001). Evidence for elite involvement in obsidian production comes from Laton, an area of elite obsidian blade production near El Pilar (Ford 1987, 2004b; Ford and Olson 1989; Hintzman 2000). However, the marketplaces at Buenavista and Xunantunich both illustrate production and exchange of obsidian in marketplace settings (Cap 2015, 2016; Keller 2006) indicating obsidian blade distribution in marketplace settings. Thus, there is no clear evidence of the non-market distribution of obsidian, but some obsidian materials were distributed through market exchanges. The evidence for non-market distribution of goods in the UBRV indicates that multiple exchange mechanisms, market exchange and gift giving, operated concurrently in the region.

5.3.3 Non-elite household production

Non-elite household production is common throughout the UBRV (Ashmore 2010). Household production is not indicative of any particular type of exchange mechanism but, as Sheets (2000) suggested at Ceren, household specialization, the household production of specific goods in quantities exceeding that necessary for household consumption, illustrates exchange occurred between households. Items produced in non-elite households in the UBRV included a variety of items, sometimes through multicrafting, such as chert bifaces and drills, manos and metates, cloth, shell
materials, and agricultural items (Chapman et al. 2015; Devio 2016; Hearth 2012; Kestle 2012; Robin 2013; VandenBosch 1999; VandenBosch et al. 2010; Yaeger 2000; see also Ford and Olson 1989).

The best studied cases of non-elite household production in the UBRV are lithic production particularly of formal tools such as bifaces. Households at Chan (Hearth 2012), Chaa Creek (Connell 2000), and Succotz (VandenBosch 1999) produced chert bifaces in amounts which indicate exchange within the community. In each case, only one household in each community produced bifaces, indicating that that household produced bifaces for exchange with other households. Informal lithic production occurred at most households within the UBRV, although at San Lorenzo, one household did perform more chert reduction activities than others, probably due to that household’s close proximity to the San Lorenzo chert source (Yaeger 2000).

In Late Classic occupations at non-elite households in Groups D and E at Xunantunich, unifacial tools, referred to variously as drills or unifacially backed bladelets, were produced in large quantities by elite individuals. These unifacial tools were produced for grating manioc and other tubers (Chapman 2013; Chapman et al. 2015; Devio 2016; see also J. Braswell 1998, 2010).

Evidence from Chan illustrates the widest variety of household production activities in the UBRV. In addition to biface production (Hearth 2012), studies indicated that various households specialized in the production of limestone blocks (Kestle 2012), agricultural materials (Lentz et al. 2012; Wyatt 2012), and ritual services (Robin et al. 2012). As at Ceren, the presence of multiple households specializing in a variety of

---

4 Technologically, these bladelets consist of two types: burinated bladelets and unifacially retouched bladelets.
activities indicates households produced one, or several, items in larger quantities than necessary for their own consumption to exchange within, and possibly outside, the community.

Further evidence for non-elite household production comes from Pacbitun (Ward 2013) where a mano and metate workshop was identified. The workshop contained mano and metate preforms, flakes, and tools broken during production. The placement of this workshop on the periphery of the site and in an area with little or no formal architecture suggests the inhabitants of surrounding household groups produced materials at this workshop.

Investigations throughout the UBRV point to multicrafting in non-elite households (see Hirth 2009a,b; Shimada 2007 for a discussion of multicrafting; see also Yaeger 2010a). Evidence for multicrafting comes from the low densities of craft production remains in households, which indicates part-time production, and thus the ability to produce multiple types of items. For example, at Chan, limestone quarries for limestone block and lime plaster production are found adjacent to households (Kestle 2012). These households quarried the limestone, as well as participating in agricultural activities, and in some cases, other types of crafting such as lithic (Hearth 2012) or shell production (Keller 2012). Furthermore, the presence of some chertdebitage in most households in the UBRV (see Chapter 9) suggests households produced some of their own tools which then would have been used for subsistence activities including farming and food preparation. Many probable instances of multicrafting in the UBRV are not fully discussed, as they probably involved use of perishable materials which no longer
preserve archaeologically. Thus, instances of multicrafting were probably more common than those for which we have evidence of archaeologically.

The presence of a variety of non-elite production activities in the UBRV illustrates the independence of such production activities. From studies of small communities, it appears likely that households within those communities produced one, or multiple goods, usually utilitarian, and then exchanged them with other individuals in the community. These types of production and exchange can occur without formalized mechanisms monitored by other individuals, and thus probably resulted in integration of household groups through the economic networks created by exchanges of items produced in households.

5.3.4 Elite Production

Elites throughout the UBRV produced goods, or supervised the production of goods, both in households and in non-household contexts. Many items produced by the elites are those for specialized rituals and ceremonies, such as polychrome ceramics, although utilitarian items were also produced. This section discusses elite household production of utilitarian items and prestige objects.

Elites in the UBRV produced obsidian materials, as illustrated from Laton, a rural elite residential complex in the hinterlands of El Pilar. Laton, an obsidian prismatic blade production site, is believed to be the only such site discovered in the central Maya lowlands (Ford 1987, 2004b; Ford and Olson 1989; Hintzman 2000). The site contains evidence of obsidian production and caches of prepared prismatic blade cores. Production at Laton occurred within the residences of the rural elites who utilized obsidian as a visible marker of wealth to increase their prestige among other elites (Ford
Obsidian, as a non-local resource, had to be imported, mostly from the Guatemalan highlands. Ford (2004a) suggests that residents procured obsidian as prepared prismatic blade cores and produced blades on site. Knappers at Laton utilized conservative production strategies, including maximizing blade production and caching used cores for future use (Hintzman 2000), indicating that despite their elite status, obsidian was relatively difficult to obtain. The production of obsidian blades by elites at Laton supports evidence elsewhere for the elite management of parts of the obsidian production process during the Late Classic (Aoyama 1996, 2001, 2008; G. Braswell 2002; Clark 1997; Clark and Bryant 1997; Spence 1981, 1984).

In terms of non-lithic materials, the best evidence for elite household production in the UBRV is for polychrome vases; Buenavista contains an area of specialized polychrome vase production in the area adjoining the palace (Reents-Bundet 2000; Reents-Bundet et al. 1994, 2000). Evidence of vase production comes from the large concentration of polychrome sherds and wasters. The polychromes produced there are Buenavista-style, defined by Ball and Taschek (2004) as cream slipped polychromes with orange slipped interiors. The production of these items probably served to maintain connections with elites at other sites through exchange of these vessels, perhaps during ritual events, as evidenced by the widespread distribution of polychromes outside their production locations.

The investigations of the economic organization in the UBRV draw on the long history of investigation in the region and indicate great variability in economic forms, including marketplaces, household production, and production within site centers. Evidence from the UBRV supports the operation of multiple economic modes, which
served to integrate residents, operating among the ancient Maya economy, and provides a well-studied area within which to situate the current research.

5.4 Conclusions

Previous and ongoing research in the UBRV provides a framework with which to investigate political and economic dynamics among the Maya, particularly in the Late to Terminal Classic. The current state of research in the region suggests a complex system of economic organization with household production and extra-household production co-occurring, alongside evidence for both marketplaces (and market exchange) and gift giving.

The complexity of economic systems provides the background to address management and access to chert resources in the UBRV, which will provide an additional avenue to study these complex economic dynamics. As economic and political dynamics are tightly intertwined, in ways which we as yet do not completely understand, the dynamic economic organization of the valley can be used to evaluate the political dynamics and the degree of centralization and control of political forces over economic activities within the region. This discussion sets the stage for the introduction of Callar Creek Quarry and the research performed at the site.
Chapter 6: Callar Creek Quarry

6.1 Introduction

Callar Creek Quarry is a chert quarry located in western Belize near the Belize-Guatemala border. The quarry was discovered during survey of the Callar Creek North settlement zone in 2009 by the Mopan Valley Archaeological Project (MVAP) (Kurnick 2013; Kurnick and Salgado-Flores 2009) and was investigated by MVAP from 2011-2014 (Horowitz 2012, 2013, 2014).

The survey of the Callar Creek North settlement area consisted of an opportunistic survey of 161 ha of land cleared for agriculture. The survey area is north of the area surveyed by the Xunantunich Settlement Survey (XSS), a transect running from Xunantunich to the site core of Callar Creek (Yaeger and LeCount 2010), and begins on the opposite side of the Mopan valley, west of the region surveyed around Buenavista (Peuramaki-Brown 2012) (Figure 6.1). The settlement consists mostly of plaza groups, although the overall settlement density in the area is fairly low, 45 structures per kilometer, a lower density than other parts of the region, particularly those surveyed by the XSS (Kurnick 2013). Callar Creek Quarry is in the western-most extent of the survey area, which abuts the Belize-Guatemala border.
Figure 6.1: Maps showing the location of Callar Creek Quarry in the upper Belize River valley (UBRV); Top - broad view of Belize Valley; Bottom - location of CCQ in relation to other regional settlement, map by Bernadette Cap, used with permission of the Mopan Valley Archaeological Project.
Callar Creek Quarry lies on a hillside overlooking the Mopan River due west of Buenavista and north of Callar Creek (Figure 6.1). Currently, the site is in a cow pasture and features low vegetation. The quarry covers an area which extends approximately 100 meters north-south and 70 meters east-west (Figure 6.2). To the northeast of the quarry is a habitation group, Callar Creek Quarry 1 and a second group, Callar Creek Quarry 2, located to the southwest. The habitation groups and investigations in these areas are discussed in Chapter 7.

Figure 6.2: Map of Callar Creek Quarry (Used with permission of the Mopan Valley Archaeological Project).

Features indicative of raw material extraction and production exist across the site. These features include: 1) the ubiquity of chert debitage and unmodified raw materials across the site; 2) a scalloped hillside indicative of quarrying into a hillside; and 3) the
presence of a debitage mound adjacent to the quarry curt. This chapter discusses these features, the temporal use of the quarry, and the activities which occurred within the quarry.

6.2 Investigations of Chert Extraction and Production

To understand the activities performed at Callar Creek Quarry, investigations involved both surface collections and excavations (see Appendix IV for a complete description of surface collection and excavation methodology). Surface collections served to obtain a representative sample of lithic materials from across the quarry. They then served as guides for the location of excavation units, based on the amount of lithic debitage collected from any one area. These two methods of investigation provided a sample of the types and qualities of the lithic raw material utilized at Callar Creek Quarry and illustrated the reduction of lithic materials at the quarry.

Seventy-one total surface collections were performed, Ops 370A/1 – 370BT/1 (Figure 6.3), using the dog and leash method (see Appendix IV for more information). Each surface collection unit consisted of a one meter diameter circle, collected using a nail placed in the center of the unit and a .5 m string, to measure the collection area. Surface collection Ops 370A/1 – 370K/1 were placed arbitrarily across the quarry as part of a feasibility study in 2011. Op 370L/1 was an opportunistic find of a biface during excavation to place a survey monument during the 2011 season. Collection areas Ops 370M/1 – 370BT/1 were placed at 10 m intervals across the quarry as part of a systematic surface collection of the area in 2012 (see Figure 6.3). An arbitrary point was set up in the southeastern edge of the quarry and surface collections were laid out every 10 m from this point, 100 m to the north and 60 m to the west using a tape and compass. A total of
4,119 lithics, 105 ceramics, 2 pieces of knapped glass, and 1 shell were collected from the surface collections, all of which were analyzed according to the conventions described in Appendices I (lithics) and II (all other material culture).

Quarry excavations were conducted to investigate the temporal span of extraction, chert extraction techniques, differential chert extraction across the quarry, and obtain samples of quarry debitage to investigate lithic reduction sequences. Six suboperations were placed throughout the quarry to attain these goals (see Figure 6.3).

Op 374A/1-7 (A in Figure 6.3), a 1 x 1 m unit, was placed in an area of the quarry with dense surface deposits, to obtain a sample of the lithic debitage in the area and examine the subsurface lithic deposits. The suboperation was excavated to bedrock, a depth of 70 cm from the modern ground surface, in arbitrary 10 cm levels as there was no apparent natural stratigraphy.
Ops 374B/1-8, 374C/1-7, and 374D/1-10 (BCD in Figure 6.3) were adjacent units which, when combined, form a 1 x 5 m trench. They were separated into 1 x 1 (Op 374B/1-8) and 1 x 2 m units (374C/1-7 and 374D/1-10) to provide more control in terms of the stratigraphic placement of lithic materials. All subops were excavated in arbitrary 10 cm levels to bedrock, or in situ chert cobbles, a depth of 70, 60, and 90 cm, respectively, from the modern ground surface.

The excavation of this trench (Ops 374B/1-8, 374C/1-7, and 374D/1-10) provided important information concerning the extraction of lithic raw material. In situ chert cobbles were present in the east end of the trench but not toward the west. The excavations revealed tabular chert beds, generally of a brownish color, with fossil inclusions, which fractures in a planar manner (see section 6.3.1 for a description of chert properties and images). The density of lithic materials throughout the trench varied greatly with greater densities at the eastern end of the trench and closer to the surface. Upon reaching the extant chert beds or bedrock the density of lithic materials decreased drastically. These differences are logical as more lithic debitage was found in areas with extracted chert, demonstrating the reduction of those materials; in situ chert beds would not produce lithic debitage.

Op 374F/1-9 (F in Figure 6.3), the final quarry excavation unit, spanned the distance between a visible chert cobble and the quarry cut, a 3 m distance. The placement of the 1 x 3 m unit allowed an examination of the variation in use of the area from a location of known extraction to one lacking extraction. Excavations reached bedrock, a depth of 90 cm below the modern groups surface, using arbitrary 10 cm levels. Interestingly, Op 374F/1-9 did not provide evidence for in situ chert beds such as those
found in Ops 374B/1-8, 374C/1-7, and 374D/1-10; rather these chert beds had been extracted. In fact, relatively few large chert pieces, either planar, cobbles, or boulders were identified within the matrix (Figure 6.4). Further confirmation of the extraction of materials from Op 374F/1-9 comes from the fact that the beds of chert in Ops 374B/1-8, 374C/1-7, and 374D/1-10 were brown and planar in quality and much of the lithicdebitage from Op 374F/1-9 resembled these materials, indicating extraction and reduction of chert resources.

Figure 6.4: East profile of Op 374F/1-9 showing the relative lack of large cobbles and bedded chert within the matrix.

The materials recovered from quarry excavations were predominately lithic, with 27,709 lithics, 2,129 ceramics, five pieces of obsidian, and six shells recovered. Excavations in the quarry allowed a determination of the methods of raw material extraction, discussed below, provided samples of lithic materials for examination of the reduction sequence, and provided information on the differential extraction of lithic materials across the quarry area.
The debitage mound, located near the quarry cut, was subject to investigation to ensure that it was a debitage mound and obtain a cross-section of lithic materials from the debitage mound. Op 374E/1-8 (E in Figure 6.3) was a 1 x 2 m unit excavated to bedrock, 70 cm below the modern ground surface, in arbitrary 10 cm levels. The debitage mound is a pile of debitage placed on a natural bedrock rise, resulting in its round shape.

The debitage mound excavations recovered a large quantity of lithic debitage as well as the only hammerstone recovered from the quarry. The lack of hammerstones and other tools used to quarry and produce tools is probably a result of the lack of raw materials to produce these items in the surrounding area. High quality hammerstones had to be imported, as the local geology is chert and limestone, which are not useful for hard hammer percussion. This theory is supported by the presence of re-used manos which show evidence of lithic production found at the households adjacent to the quarry, (see Chapter 8 for a more detailed description; see Clark 1988 for an example of this phenomenon elsewhere in the Maya area). A total of 4,454 lithics and 338 ceramics were recovered from the debitage mound.

6.3 Chert Descriptions and Use

Investigations at Callar Creek Quarry, as described above, laid the foundation for a discussion of the types of chert materials extracted from Callar Creek Quarry, as well as a discussion of the mechanisms through which they were extracted. This section describes the chert from the quarry, how it was extracted, the use of the quarry, and possible evidence for heat treatment.
6.3.1 Chert Description

Callar Creek Quarry chert is extremely variable in quality, color, and form. Callar Creek Quarry is in an area with limestone bedrock, as it is located just outside the area of the alluvial terraces of the Mopan River Valley (Dixon 1956; Furley and Crosbie 1974; Furley 1989; Romney 1959). Early geologic studies reported that the limestones from the Cayo District of Belize, the location of Callar Creek Quarry, date from the Late Cretaceous to the Eocene, 100 – 34 MYA (Dixon 1956; Romney 1959), while more recent studies date these formations to the Paleogene, 66-23 MYA (Cornec 2003; see also G. Flores 1952). The limestones in the area are from the El Cayo Group and Doubloon Bank formation. The Doubloon Bank formation is associated with large chert nodules, greater than 3 feet in diameter while the El Cayo Group is associated with smaller chert nodules and is made up of lagunal limestones and dolemite (Cornec 2003). The limestone includes both hard limestone and white powdery marl (Dixon 1956). The chert from Callar Creek Quarry is that which forms in limestone deposits, as evidenced from Cornec’s (2003) description of the geologic formations (see Luedtke 1992 for more information on chert formation processes). Despite the presence of fossils within some chert deposits (Figure 6.5), a more exact dating than to the Paleogene is unknown.
Perhaps unsurprisingly, given the shared geologic formations, chert is common throughout the Belize Valley. The Doubloon Bank and Cayo Group formations are made up of chert bearing limestones, and these formations extend through much of the Belize Valley and into northern Belize (Cornec 2003). In addition to Callar Creek Quarry, chert is known from the sites of San Lorenzo, Succotz, and Xunantunich (VandenBosch 1999; Yaeger 2000). The Succutz deposit is a primary chert deposit, like that at Callar Creek. The San Lorenzo deposit is a secondary deposit from the Mopan River. Secondary deposits along the Mopan River are found both along the modern course of the river and along previous courses and flooding stages of the river. Chert at Xunantunich is found discontinuously in cobbles within the bedrock underlying the site. The relatively ubiquitous presence of chert in the Mopan Valley should not undermine the importance of Callar Creek Quarry or studies of the source. Although chert can be found in many other areas, not all of these areas have such dense concentrations of chert nor production debris as found at Callar Creek Quarry.
As stated above, chert beds at Callar Creek Quarry in two distinct manners: linear beds buried beneath the surface and in large boulders on the surface. The color variation within and between the deposits is great. The bedded chert tends to be brown to tan and of poorer quality, with more inclusions (including fossils) and a less uniform interior consistency. The materials found on the surface have a large range of colors including clear, blue, brown, tan, white, and grey and tend to be rather large, over 1 meter in size (Figure 6.6). The quality varies greatly, ranging from fine-grained to course-grained, often within a single nodule of raw material (Figure 6.7). In general, higher quality raw materials include the clear, white, and blue materials while the tan, brown, and grey materials are more variable. The most common raw material colors (clear, white, tan, brown, and red) were characterized by hue, value, and chroma using a Munsell book; presence, frequency, and consistency of inclusions; grain size; color and grain size of cortex when known; and most common manner of bedding within the quarry. Grain size was determined using a Sand-gauge by W. F. McCoullough (1984).

Figure 6.6: Picture of large chert cobble on the surface at Callar Creek quarry.
Common Chert Colors and their Qualities:

Although specific characteristics of different colors of chert are described here, for the most part these colors grade into each other; clear, white, brown, tan, and gray chert may all be found in the same nodule thus rendering some of the differences between them irrelevant. The brown chert found in linear beds does not co-occur with the other types, however. Furthermore, there are differences in quality associated with the different colors.

Clear

Generally, of very high quality. No visible inclusions nor grains in the majority of samples. Clear chert is sometimes found with a white or blue tinge or, very rarely,
with an area of black. One sample has inclusions: 7-40 mm sized voids with coarse sand sized grains of a dark gray color (10 YR 4/1). The color ranges from 5 Y 2/5/1 (black), 5 Y 6/1 (gray), 5 Y 8/1 (white), Gley 2 7/10 B (light bluish gray), Gley 2 5/10 B (bluish gray), 7.5 YR 8.5/1 (white), Gley 2 8/10 B (light bluish gray), Gley 2 6/10 B (bluish gray), and clear. Can be found with white (10 YR 9.5/1, 9.5 N), very dark gray (10 YR 3/1, 10 YR 6/1), dark gray (10 YR 4/1) or gray (10 YR 5/1) cortex of silt-to coarse sand sized grains. Clear chert beds in round nodules/cobbles. These cobbles/nodules are found both on the surface and buried near the surface in sub-surface deposits. Commonly co-occurs with white chert (Figure 6.8).

Figure 6.8: Images showing examples of clear chert.

**White**

Variable quality. Some examples have no inclusions and no visible grain size while other examples have inclusions throughout. Inclusions include voids (similar to those found in geodes). Some contain medium sand-sized grains within the voids and are gray in color (2.5 Y 6/1). The inclusions are up to 2.5 mm in size. Some samples have
no visible grain size while others have grains of silt or fine sand-sized throughout. The color ranges from 2.5 Y 8.5/1 (white), 2/5 Y 8/1 (white), 9.5/N (white), 8.5/N (white), 2.5 Y 7/N (light gray), 5Y 7/2 (light gray), 2.5 Y 8.5/1 (white), 2/5 Y 9.5/1 (white), Gley 1 7/N (light gray), 7.5 YR 8/1 (white), 10 YR 9.5/1 (white), 10 YR 9/1 (white), 7.5 YR 9.5/1 (white). Some examples grade into other colors. One sample has both white (10 YR 9.5/1, 10 YR 9/1) and gray (7.5 YR 9.5/1, 10 YR 3/1) areas. In those examples inclusions are also found in parts of the chert but not the entirety; this leads to variation in quality throughout a single nodule. Can be found with cortex of medium sand sized grains and ranging from white (9.5/N) to dark gray (2.5 Y 4/1, 10 YR 4/1). White chert beds in cobbles and boulders both on the surface and close to the surface in sub-surface deposits. This chert has probably eroded out of the limestone bedrock. It commonly co-occurs with clear, tan, and brown cherts, sometimes in the same nodule, as discussed above (Figure 6.9).

Figure 6.9: Images showing examples of white chert.
Brown

Variable quality. Some samples have no visible grain size and lack inclusions and are of high quality while others have frequent inclusions. On samples with inclusions they occur throughout the material and are small (less than 1 mm in size) pockmarks. Fossil inclusions are also present in some samples. The fossils are up to 3 mm in size and are found throughout the nodules. Grain size can range from not visible up to silt sized grains. The color ranges include 10 YR 5/8 (yellowish brown), 10 YR 5/6 (yellowish brown), 10 YR 7/6 (yellow), 10 YR 4/2 (dark grayish brown), 10 YR 4/1 (dark gray), 10 YR 5/2 (grayish brown), 10 YR 2/2 (very dark brown), 10 YR 6/2 (light brownish gray), 10 YR 5/1 (gray), 10 YR 4/2 (dark grayish brown), 10 YR 8/2 (very pale brown). Some brown chert is stripped, usually with white chert. Stripped chert has similar colors to other brown (10 YR 6/1 (gray), 10 YR 6/3 (pale brown)) chert but also contains white strips (10 YR 9.5/1). Strips serve as inclusions in this case; the chert fractures along these lines. Cortex has sand sized grains and the color range includes 10 YR 2/1 (black) and 10 YR 7/1 (light gray). Brown chert beds in two different manners. The higher quality chert without inclusions frequently co-occurs with white and tan chert and is found on the surface in cobbles/boulders and buried in some sub-surface deposits. Brown chert is also found in more deeply buried sub-surface deposits. The chert with the fossil inclusions is found exclusively in these beds. This chert is found in linear beds and tends to fracture along planar lines as this is how the chert beds. The bedded chert tends to be of lower quality than other brown cherts within the quarry (Figure 6.10).
Gray

Most examples are of medium to high quality for knapping. Inclusions are uncommon and no grains are visible in these examples. Examples with inclusions have voids with course sand sized formations within them which are gray (10 YR 6/1). The color of the chert ranges from 7.5 YR 6/1 (gray); 7.5 YR 6/2 (pinkish gray); 7.5 YR 5/2 (brown); Gley 1 7/1 (light gray); Gley 1 3/N (very dark gray), 10 YR 7/1 (light gray), 10 YR 7/2 (light gray), to clear. Gray chert is found with silt, medium sand, or coarse sand sized cortex which is white (10 YR 9/5, 10 YR 8/1) or gray (5 Y 5/1). Gray chert tends to co-occur with white, clear, and brown examples in cobbles/boulders found on the surface and in some sub-surface deposits. Gray chert co-occurs within nodules with other colored chert (Figure 6.11).
Figure 6.11: Images showing examples of gray chert.

Tan
Tan chert is of variable quality. Some lacks inclusions and has no visible grain size while others have inclusions throughout. Color ranges include 10 YR 5/2 (grayish brown), 10 YR 6/4 (light yellowish brown), and 10 YR 6/2 (light brownish gray). Can be found with white (10 YR 9.5/1) cortex, sometimes with sports of dark grayish brown (10 YR 4/2). The cortex grain size ranges from very fine sand to silt sized grains. Tan chert is found both in buried bedded deposits, such as that described for some of the brown chert, and in cobbles/boulders found on/near the surface, similar to the white chert. Tan chert can also co-occur in the same nodule with all the other types of chert described here (Figure 6.12).
Pinkish White

White chert with areas of pink. Originally separated out as a possible sign of heat treatment; experimental heat treatment has shown that that is not the case. Quality of the chert is variable. Some cobbles contain inclusions, particularly voids of up to 1mm in size. Some voids contain coarse sand sized grains of reddish black color (7.5 R 2.5/1). Others lack inclusions. Grain size is generally not visible. Colors include 5 R 4/2 (weak red), 10 YR 7/6 (light red), 10 YR 8/2 (light pink), 7.5 R 7/2 (pale red), 7.5 R 8/1 (white), 7.5 R 8/1 (dusky red), and 10 YR 6/6 (light red). Cortex is generally a weak red color (7.5 R 4/3). Pinkish white chert is found in association with white chert. Such chert has not been found in situ beds, only as flakes and cores throughout the quarry (Figure 6.13).
Red

Chert is generally of high quality. Most show no evidence of inclusions while a few contain small areas of very fine sand sized inclusions throughout. Grain size ranges from not visible to silt sized grains throughout. The color ranges from 5 R 5/6 (red), 5 R 5/8 (red), 5 R 7/3 (pale red), 10 R 3/3 (dusky red), 7.5 R 4/4 (weak red), to 7.5 R 4/2 (weak red). Cortex has very fine or fine sand sized grains and ranges from 10R 7/4 (pale red), 10R 2.5/2 (very dusky red), 5 R 5/6 (red) 10 YR 7/1 (light grey), 10 YR 8/1 (white) to 5 R 2.5/1 (reddish black). Red chert is found only in small flakes and nodules at the quarry; no areas of in situ red chert have been identified (Figure 6.14).
The properties described above are those which are important for evaluating the quality of raw materials for knapping. High quality raw materials are those which have properties to encourage conchoidal fracture including small (or no) visible grain size, uniformity throughout the nodule in terms of grain size, and a lack of inclusions (Andrefsky 2004; Whittaker 1996). Thus the raw materials from Callar Creek Quarry show varying qualities for knapping. Some of the raw materials, usually clear or white, have many advantageous properties and are of a high quality for knapping. Others suffer from flaws such as inclusions, faults, or large grain size, which reduce the quality of the raw material for knapping. Overall, the quality of the raw materials from Callar Creek Quarry is highly variable.
6.3.2 Features Indicative of Chert Extraction

The quarry contains several features indicative of the manner and methods of chert extraction. A quarry cut is in the eastern part of the quarry with an adjacentdebitage mound. Other evidence of extraction and reduction of lithic materials was found in subsurface deposits.

Excavations of the subsurface deposits demonstrate that extraction occurred in three manners: 1) utilization of visible chert cobbles; 2) extraction of materials by digging into the hillside at the quarry cut; 3) extraction of linear beds of chert in other areas of the quarry. No direct evidence for the utilization of visible chert cobbles was uncovered but due to the ease of extraction of these cobbles they were probably extracted and reduced. Each of these methods of extraction is discussed in turn.

The quarry cut resulted from digging into the hillside to extract raw materials and resulted in the scalloped appearance of the hillside (Figure 6.15). Uneven extraction of materials along different points in the hillside creates the scalloped pattern. No evidence of the types of tools used in chert extraction was identified, although chert or limestone bifaces found elsewhere would suffice for chert extraction, and material to produce tools for chert extraction is ubiquitously available across the landscape. Some limestone quarrying may have also occurred in this area as exposed limestone cobbles are present near one end of the quarry cut (Figure 6.16). The limestone was probably expediently quarried for building materials after the chert was removed and exposed the limestone bedrock.
Figure 6.15: Quarry cut showing scalloped appearance.

Figure 6.16: Limestone blocks showing potential limestone quarrying.
Evidence for the extraction of linear beds of chert in other areas of the quarry comes from the differential distribution of these materials identified through excavation. In excavation of Ops 374B/1-8, 374C/1-7, 374D/1-10, linear beds of brown chert were identified prior to reaching bedrock (Figure 6.17). The excavation of Ops 374A/1-7 and 374F/1-9, however, did not reveal any in situ chert beds. Op 374F/1-9 was located adjacent to the quarry cut, and thus was in an area exploited for chert resources. The lithic debitage recovered from Op 374F/1-9 were of the same brown linear lithic materials that were located in situ in Ops 374B/1-8, 374C/1-7, 374D/1-10, thus indicating the extraction of those linear beds in Op 374F/1-9. In all excavations, lithic materials were identified down to bedrock (Figure 6.18), as in Ops 374A/1-7 and 374F/1-9 or down to the level of the in situ chert cobbles (Figure 6.19), as in Ops 374B/1-8, 374C/1-7, 374D/1-10. The presence of lithic debitage to bedrock in areas without in situ chert beds supports the extraction of these beds, and reduction of materials within the area.
Figure 6.18: Chart showing quantity of debitage is Ops 374A/1-7 and 374F/1-9 to bedrock

Figure 6.19: Chart showing quantity of debitage in Ops 374B/1-8, 374C/1-7, 374D/1-10 above in situ chert beds

Only one concentrated area of debitage disposal was identified at the quarry; a debitage mound which had large amounts of debitage dumped on a natural rise in the hill (Figure 6.20). Excavations at the debitage mound, further discussed above, revealed
large quantities of lithic material (a total of 4,454 lithics from a 1 x 2 m unit). The debitage is indicative of early stage reduction and testing of cobbles. Early stage reduction was indicated by high quantities of cortex, few dorsal flake scars, and little evidence of platform preparation or facets. Testing of cobbles and early stage reduction would be expected at the debitage mound due to its proximity to a definitive area of chert extraction. Further discussion of the results of the debitage analyses are presented in Chapter 8.

Figure 6.20: Debitage mound profile showing large quantity of debitage.

Although only the single concentrated area of debitage was located, debitage from chert reduction is ubiquitous across the landscape. Lithic debitage was present in all subsurface excavations as well as in surface collections. The dispersal of lithic debitage across the landscape is indicative of informal knapping of materials adjacent to areas of extraction rather than a more formalized system of extraction and production with a mechanism for debitage disposal concentrated in a single area.
6.3.3 Temporal Use of the Quarry

In terms of the temporal use of the quarry, ceramic evidence indicates use of the quarry from the Archaic though the Historic period. This section addresses the evidence for use of the quarry in different periods beginning with the Historic and Archaic periods, the most difficult to identify, and then continuing to evidence for Preclassic to Terminal Classic period use and occupation. Evidence for Preclassic to Terminal Classic quarry use comes from ceramic evidence (Table 6.1) while evidence for historic and archaic use comes from knapped glass (Figure 6.21) and organizational changes to lithic production, respectively.

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle Preclassic</td>
<td>74</td>
</tr>
<tr>
<td>Late Preclassic</td>
<td>1</td>
</tr>
<tr>
<td>Early Classic</td>
<td>0</td>
</tr>
<tr>
<td>Late/Terminal Classic</td>
<td>54</td>
</tr>
<tr>
<td>Total</td>
<td>129</td>
</tr>
</tbody>
</table>

Figure 6.21: Drawing and photograph of knapped glass from quarry surface collection.
Evidence for Historic period use of the quarry comes from the presence of knapped glass, part of a tradition of lithic material utilization in Historic contexts and in the ethnographic literature on lithic production and use among modern peoples (see McCall 2012 for an overview of ethnographic references). The use of glass for knapping is best known from Ethiopia and the Maya area. Ethnographic accounts of knapped glass utilization by Highland Maya peoples and the Lacandon Maya are found throughout the literature (Clark 1989a, 1991; Deal and Hayden 1987; Hayden and Deal 1989; Maler 1902; Tozzer 1907; see also Weigand 1989). In these ethnographic descriptions, glass was used in the manufacture of bone, horn, and leather tools and in ritual practices. These materials were utilized in conjunction with metal tools and other more traditional technologies. Knapped glass is an example of the continuation of the utilization of traditional tool production techniques utilizing new materials, such as glass, introduced by Europeans.

Most interesting in the present case is that the knapped glass is found at the source of raw material suitable for knapping, so there was no evidence of a shortage of other material with which to produce such tools. The glass tools probably played a similar role as obsidian tools prior to European contact; obsidian blades were also found at Callar Creek Quarry. Some raw materials are simply better for performing certain tasks, such as duller raw materials including lithics used for hide scraping (Johnson 1997; Raczek 2010; Shott and Weedman 2007; Weedman 2000, 2002, 2006; see also McCall 2012), or in this case, more vitreous lithic raw materials, presumably for cutting tasks.

Knapped glass has been identified archaeologically as a fairly common phenomenon in Colonial Maya sites (Lopez Olivares 1997; Palka 2005a,b, 2009; Yaeger
et al. 2004). Such technological continuity is also seen in other world areas, with the advent of the use of metal in Europe and the Near East, lithic and metal technologies overlapped due to both ritual and functional reasons (Bronowick and Masojc 2010; Flexner and Morgan 2013; Frieman 2010; Karimali 2010; Raczek 2010; van Gisn 2010). Unfortunately, the pieces of glass from Callar Creek Quarry are quite small so no identification or temporal information about the type of glass is possible. Despite the limited quantity of these materials, their presence suggests that the area continued to be an important resource and location of tool production through the Historic period.

Excavations at the residential group, Callar Creek Quarry 1, provide the suggestion of an Archaic, or Preceramic, utilization of the quarry. Paleoindian and Archaic settlement in Belize is rare and represented mostly by occasional surface finds of diagnostic projectile points or other lithic forms, such as strangulated unifaces (Hester et al. 1980; Lohse 2010; Lohse et al. 2006; Shafer et al. 1980; Rosenswig 2004, 2015; Stemp et al. 2016a,b; Stemp and Awe 2013). Unfortunately, excavations failed to recover diagnostic lithic tools like strangulated unifaces (Hester and Schafer 1984; Rosenswig et al. 2014; Rosenswig 2004) or Lowe and Sawmill points which have been identified in western Belize (Lohse et al. 2006; Lohse 2010; Stemp and Awe 2013), including a Sawmill Point surface find from the west bank of the Mopan River in the modern-day hamlet of Calla(r) Creek (Lohse et al. 2006; Stemp and Awe 2013; Stemp et al. 2016b), which is less than a kilometer from Callar Creek Quarry.

Variability in technological attributes between the potential Archaic deposit and the known Maya lithics suggest an Archaic presence at Callar Creek Quarry. Preceramic deposits from southern Belize also consist predominately of non-diagnostic artifacts (T.
Dennehy, personal communication 2015), indicating variation in pre-ceramic technologies throughout Belize. A paleosol was identified in a plaza area; the paleosol contains only lithic materials and no ceramics. Paleosols are typical locations for the identification of Archaic occupations, particularly in Belize (M. Kathryn Brown, personal communication 2013; Rosenswig et al. 2014; Rosenswig 2004). Unfortunately, the paleosol contained no materials for directly dating the context, instead, I compare technological attributes for lithics from the Paleosol and from the same area in later time periods. As mobility and settlement patterns differed in Mesoamerica from the Preceramic to later time periods the utilization of lithic materials, and the types of materials chosen for utilization, may have changed over time.

The paleosol and preceding stratigraphic levels contained 818 lithics. The paleosol, located in Ops 381G/1-4, 381I/1-3, and 381GI/1-6, was approximately 45 cm in depth (see Section 7.1 and Appendix IV for more information on these contexts). The materials from this level were compared with three other stratigraphic levels – the humus, the off-structure deposits, and an intermediate layer (Figure 6.22). Technological, raw material, and scalar variables were compared.
Figure 6.22: North profile of Ops 381G/1-4, 381I/1-3, and 381GI/1-6 showing the Paleosol.
Technological characteristics examined included the number of dorsal flake scars, presence/absence of platform preparation, number of platform facets, and the amount of cortex, by percentage category. Flake scars, platform facets, and cortex among the stratigraphic levels were all statistically insignificant in t-test and chi square analyses, respectively (Tables 6.2 and 6.3; Figure 6.23 and 6.24). The presence of platform preparation did vary significantly across stratigraphic levels however; relatively more preparation was present in lower stratigraphic levels.

Figure 6.23: Paleosol and Non-paleosol dorsal flake scars.
Figure 6.24: Paleosol and non-paleosol platform facets.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>DF</th>
<th>T</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flake Scars</td>
<td>703</td>
<td>.305</td>
<td>.822</td>
</tr>
<tr>
<td>Platform Facets</td>
<td>348</td>
<td>1.081</td>
<td>.357</td>
</tr>
</tbody>
</table>

Table 6.3: Chi-square statistic for technological characteristics from paleosol and non-paleosol contexts.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>DF</th>
<th>N</th>
<th>Chi-square statistic</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform Preparation</td>
<td>6</td>
<td>815</td>
<td>21.060</td>
<td>.002</td>
</tr>
<tr>
<td>Amount Cortex</td>
<td>15</td>
<td>817</td>
<td>14.829</td>
<td>.464</td>
</tr>
</tbody>
</table>

As technological variables did not show significant differences between the stratigraphic levels examined here, issues of material choice – material color and quality, were examined. Material color and quality, which are generally related, differed in a statistically significant manner across stratigraphic levels (Table 6.4). Material color shows that in the paleosol the use of brown chert, which is generally planar and found in
large beds, and is of lower quality, was more frequently used than the white chert, found in rounder nodules and is of higher quality, which was more commonly utilized in the non-paleosol levels. This may suggest selection for specific qualities of the raw material – such as the planar shape and large available size – or might suggest utilization of specific areas of the quarry – as the brown linear bands of chert are found in different areas of the quarry than the white chert. Choice of raw material for specific physical properties would imply a difference in the intended end product of the lithic reduction and as there are no real technological differences, as discussed earlier, it seems more probable that different areas of the quarry were being exploited at different times.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>DF</th>
<th>N</th>
<th>Chi-square statistic</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Material Quality</td>
<td>21</td>
<td>817</td>
<td>44.148</td>
<td>.002</td>
</tr>
<tr>
<td>Raw Material Color</td>
<td>9</td>
<td>817</td>
<td>31.061</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

The last technological attributes examined were scalar variables. By far these show the greatest difference between the paleosol and other levels. The paleosol contains statistically significantly larger materials (Table 6.5; Figure 6.25). This difference is significant for all scalar variables – length, width, thickness, weight, and platform width, and is seen easily in graphic form as well as in the statistical analyses. In general, materials from these levels are on average, larger than those found in other levels.
The comparison of traits between the paleosol and other levels demonstrates some subtle differences indicative of an Archaic presence at Callar Creek Quarry, and thus an Archaic use of the quarry itself. Organizational differences in reduction techniques would result in scalar and raw material choice variability, suggesting subtle technological organizational differences. These differences probably relate to issues of mobility. Archaic populations were presumably mobile, although the exact type of mobility (i.e. seasonal vs. residential) is unknown, but greater residential mobility would affect the design constraints on lithic reduction by Archaic peoples who would have aimed to

Table 6.5: T-test of scalar variables from paleosol and non-paleosol contexts.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>DF</th>
<th>t</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>347</td>
<td>14.292</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Width</td>
<td>347</td>
<td>11.729</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Thickness</td>
<td>347</td>
<td>6.461</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Weight</td>
<td>816</td>
<td>19.114</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Platform Width</td>
<td>347</td>
<td>14.824</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>
reduce lithic materials prior to their removal from the quarry area, thus the focus of lithic reduction would be testing of cobbles for quality and removal of cortical materials prior to transportation. The testing of cobbles and cortex removal might explain the larger size of the Archaic materials. The weight of lithic materials is a concern for mobile populations, so reducing that weight is always an important consideration (Beck et al. 2002). The establishment of permanent residences in the area negated the importance of reducing weight for transport. During later times, it seems that initial testing occurred adjacent to the quarried areas and the reduction near the habitation group produced items for local use and consumption. The change between mobile and sedentary societies can be used to explain the organizational differences found between paleosol and non-paleosol contexts at Callar Creek Quarry.

In combination with the stratigraphic evidence and lack of ceramic materials, these data suggest use of Callar Creek Quarry in the Archaic. If this is indeed an Archaic occupation, it would present differences from known Archaic contexts in northern Belize, which tend to be heavily patinated and have distinctive lithic types (Rosenswig et al. 2014; Rosenswig 2004). The presence of the possible Archaic use of Callar Creek Quarry suggests that such occupations might be more widespread than previously thought but that they are not recognized due to the lack of diagnostic lithic materials.

The examination of the temporal use of the quarry during other time periods focused on ceramic analysis. Although ceramic materials were found throughout the quarry, which is unusual for quarry areas, many of the contexts were mixed, making it difficult to attribute specific evidence of lithic reduction to temporal contexts (Table 6.6).
Furthermore, all quarry areas did not contain temporally diagnostic materials; among those which did, the majority were Preclassic or Late/Terminal Classic.

<table>
<thead>
<tr>
<th>Table 6.6: Surface collection and excavation contexts attributed to specific time periods.</th>
<th>Surface collection</th>
<th>Excavations</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>66</td>
<td>22</td>
<td>88</td>
</tr>
<tr>
<td>Middle Preclassic</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Late Preclassic</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>M/L Preclassic</td>
<td>0</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Late/Terminal Classic</td>
<td>5</td>
<td>16</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>50</td>
<td>122</td>
</tr>
</tbody>
</table>

As noted in Table 6.6, most of the surface collection contexts could not be associated with a specific time period due to the highly eroded nature of many sherds collected. The majority of the identifiable sherds were Late/Terminal Classic period ashwares, which are easily identifiable by their distinctive temper, even when heavily eroded (Gifford 1976; LeCount 1996). Sherds from excavation contexts were more easily identified, although the majority were undiagnostic body sherds. In fact, of the 2,619 sherds from excavations in the quarry only 138 (5.3%) were temporally diagnostic. Of the 28 temporally identifiable contexts (Table 6.6) almost all date to either the Preclassic or the Late to Terminal Classic period. Preclassic period diagnostics were dominated by the ubiquitous Mars Orange Ware (Gifford 1976). Mars Orange is easily identifiable even in small body sherds due to its distinctive orange paste, which have a chalky appearance when the slip erodes. The ubiquity and easily identifiable nature of Mars Orange probably skewed the identification of sherds in this direction. Seventy-Nine Mars Orange Ware sherds were collected during quarry excavations representing 57.2% of the diagnostic sherds from these excavations.
The Late to Terminal Classic period diagnostics consist predominately of Belize Valley Ash Tempered Wares with a few Mount Maloney Black: Mount Maloney Variety and Uaxactun Unslipped Wares (Gifford 1976; LeCount 1996, 2010; LeCount et al. 2002). Mt. Maloney jars and bowls can be dated to precise time periods (see Appendix II for more information); the two diagnostic Mt. Maloney rims from the quarry both date to the Late Classic I (A.D. 600-670) (LeCount et al. 2002; LeCount and Yaeger 2010) (Figure 6.26). The Uaxactun Unslipped Wares, of which there were four, are probably Cayo Unslipped: Cayo Variety jars, from the Cayo Ceramic Group, which date to the Late/Terminal Classic (Gifford 1976). The remaining diagnostic sherds, 54, from the Late/Terminal Classic were British Honduras Ash Tempered Wares, both body and rim sherds. Late/Terminal Classic diagnostics make up 43.5% of the diagnostic sherds from quarry excavations.

Figure 6.26: Rim Profile of Mt. Maloney Late Classic I sherd from quarry excavations.
Although the quantity of temporal diagnostics from the quarry excavations at Callar Creek Quarry is not large, the combination of the temporal diagnostics, historic glass, and comparisons between different lithic contexts allows a determination that the area was utilized from the Archaic through the Historic Period. The use of the area does not indicate extensive extraction of materials during any particular period, rather, only that the area was utilized during those periods. As quarry contexts are notoriously difficult to date, and rarely contain ceramics (Healan 1997), even this small quantity of temporally diagnostic sherds is extremely useful in determining temporal use of the quarry area.

The extensive use of the quarry, with evidence of probable quarry utilization from the Archaic through the Historic period, points to the importance of Callar Creek Quarry as a resource. As is discussed further in Chapter 7, occupation of sedentary groups at Callar Creek Quarry begins in the Early Classic period, although the plethora of Middle Preclassic period sherds and the Archaic lithics point to an earlier use of the quarry. In the Middle Preclassic, the landscape was fairly open for settlement, so if a residence was established at this early date, it suggests that the chert source was a draw for people to settle around the source. The continued use of the source also points to its importance as a resource through time.

6.3.4 Evidence for Possible Heat Treatment

When performing initial analyses at Callar Creek Quarry, the appearance of some items suggested heat treatment occurred at the quarry. Heat treatment refers to the purposeful heating of chert, or other lithic materials, in a fire or kiln, to improve the quality of the raw materials for knapping. Generally, heat treatment improves knapping
quality due to changes to the microcrystalline structure of the raw materials caused by heating. Over-heating of raw materials can lead to excessive fracturing and the development of flaws in the raw material (Ahler 1983; Byers et al. 2014; Griffiths et al. 1987; Mandeville 1973; Mandeville and Flenniken 1974). Qualities which indicate heat treatment include color changes, generally to reds and pinks, glossy surfaces, and a waxy feel, among others (Ahler 1983; Collins and Fenwick 1974; Melcher and Zimmerman 1971; Whittaker 1996). Different raw materials react differently to heat treatment, resulting in changes in color, sheen, and visible grain size, so experiments must be performed to evaluate the reaction of different raw materials to heat treatment (Ahler 1983; Crabtree and Butler 1964; Erikson 1995; Flenniken and Garrison 1975; Griffiths et al. 1987; Mandeville and Flenniken 1974; Melcher and Zimmerman 1971; Purdy 1971, 1974; Purdy and Brooks 1971; Rick 1978).

Heat treatment experiments have been carried out in a variety of times and places (Brooks and Donigan 1995; Crabtree and Butler 1964; Erikson 1995; Flenniken and Garrison 1975; Griffiths et al. 1987; Mandeville 1973; Mandeville and Flenniken 1974; Purdy 1971, 1974; Purdy and Brooks 1971; Rick 1978; Solberger and Hester 1973; Towner 1985). While ethnographic evidence from North America first illustrated the presence of heat treatment in past societies (i.e. Hester 1972), it is experimental archaeology which solidified our knowledge and understanding of how heat treatment works and the changes that result. In general, heat treatment experiments involve subjecting a sample of raw materials to heat in a controlled setting where the temperature and duration of the exposure can be controlled, or at least recorded. Heat treatment today is conducted in industrial kilns or in controlled fires, a better approximation for how heat
treatment would have been performed in the past (Byers et al. 2014; Crabtree and Butler 1964; Griffiths et al. 1987; Purdy 1971, 1974; Purdy and Brooks 1971). The recording and control of temperatures allows the evaluation of when specific changes occurred both in terms of the temperatures and the physical properties of the raw materials.

To evaluate the possibility that heat treatment occurred at Callar Creek Quarry, I conducted an experimental heat treatment of a selection of raw materials from the quarry and surrounding areas. As the goal of this experiment was to evaluate the changes to the visible physical properties of the chert which result from heat treatment rather than to evaluate the effects of heat treatment in general, the experiment utilized an open fire rather than a kiln. The use of an open fire allowed the experiment to take place in Belize, where access to an industrial kiln would be difficult, and limited the necessity of removing large quantities of chert from the country. As the temperature was also recorded, the use of a fire to heat treat the materials was a valid option. The experiment utilized a selection of chert nodules and flakes from previous experimental knapping from a variety of contexts at Callar Creek Quarry and a sample of materials from nearby chert sources. Prior to any exposure to heat, I characterized each sample, recording the Munsell color, the presence, type, and frequency of any (visible) inclusions, and the grain size of the material. Each item was also photographed.

I experimentally heat treated 22 samples. Of these items seven were cobbles collected from Callar Creek Quarry for this purpose. Four were unutilized chert cobbles from construction fill which presumably came from the quarry, although their origin cannot be confirmed. Five samples were from previous experimental knapping – four flakes and a biface. These items were knapped in 2012 during experimental knapping of
quarry materials to test material quality. Heat treatment of preforms took place in other locations (Byers et al. 2014; Griffiths et al. 1987), so heat treatment of knapped items sheds light on the possibility of heat treatment of already knapped items at Callar Creek Quarry. The remaining six samples come from the site of San Lorenzo. The San Lorenzo items serve as a control group for the materials from Callar Creek. They are river cobbles discovered during excavations on the Flood Plain North (FPN) area of San Lorenzo. San Lorenzo is the location of one of the other chert quarries in the Mopan Valley, discussed in Chapters 4 and 5. Table 6.7 shows the description of the characteristics and qualities of each sample.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Origin</th>
<th>Color</th>
<th>Inclusions</th>
<th>Grain Size</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CCQ</td>
<td>Gley 3/N (very dark gray) with spots of Gley 4/5 PB (Dark bluish gray)</td>
<td>None</td>
<td>None Visible</td>
<td>Fair, beds are linear so would have planar fracture</td>
</tr>
<tr>
<td>2</td>
<td>CCQ</td>
<td>5 Y 8/1 (white) 5 Y 5/1 (gray) 2.5 Y 6/2 (light brownish gray)</td>
<td>Present over roughly ½ of surface; very coarse sand sized, Gley 2 2.5/10G (greenish black)</td>
<td>None visible</td>
<td>Poor to fair, large areas of inclusions</td>
</tr>
<tr>
<td>3</td>
<td>CCQ</td>
<td>Gley 7/5 B (light bluish gray) to Gley 5/5 B (Bluish gray)</td>
<td>One area (8mm) of coarse sand sized grains. 5 YR 8/1 (white) in color</td>
<td>None visible</td>
<td>High, except for area of inclusions</td>
</tr>
<tr>
<td>4</td>
<td>CCQ</td>
<td>Gley 8/10 B (light bluish gray), Gley 8/N (white), clear</td>
<td>None visible</td>
<td>None visible</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>CCQ Construction Fill</td>
<td>Gley 8/10 Y (light greenish grey) 5 YR 6/1 (gray)</td>
<td>Lots – over more than ½ sample; coarse sand size, 5 YR 8/1 (white)</td>
<td>Range from not visible to medium sand sized grains</td>
<td>Overall poor; some areas of high quality while others have inclusions and large grain size</td>
</tr>
<tr>
<td>----</td>
<td>----------------------</td>
<td>-----------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6</td>
<td>CCQ Construction Fill</td>
<td>5 YR 8/1 (white)</td>
<td>Inclusions of up to 5 mm, white sand sized grains</td>
<td>Fine sand</td>
<td>Medium</td>
</tr>
<tr>
<td>7</td>
<td>CCQ Construction Fill</td>
<td>5 YR 4/1 (Dark reddish gray)</td>
<td>None visible</td>
<td>None visible</td>
<td>Medium to high</td>
</tr>
<tr>
<td>8</td>
<td>CCQ Construction Fill</td>
<td>5 YR 8/1 (white) 5 YR 6/1 (gray) 5 YR 5/1 (gray)</td>
<td>Inclusions of up to 15 mm across, voids with medium sand sized grains within. 5 YR 8/1 (white)</td>
<td>None visible</td>
<td>Medium to poor. Planar beds which it would fracture on and the presence of inclusions</td>
</tr>
<tr>
<td>9</td>
<td>CCQ Construction Fill</td>
<td>5 YR 2.5/2 (dark reddish brown)</td>
<td>Throughout; voids up to 2 mm in size, found every 1-2 cm</td>
<td>None visible</td>
<td>Medium, presence of inclusions throughout</td>
</tr>
<tr>
<td>10</td>
<td>SL</td>
<td>2.5 Y 6/8 (olive yellow) 2.5 Y 5/6 (light olive brown)</td>
<td>A few voids about 8 mm in size</td>
<td>None visible</td>
<td>Medium</td>
</tr>
<tr>
<td>11</td>
<td>SL</td>
<td>7.5 YR 8/1 (white) 7.5 R 4/8 (red) 7.5 R 4/1 (dark gray) Stripped</td>
<td>None visible</td>
<td>Silt sized grains</td>
<td>Poor – visible grain size</td>
</tr>
<tr>
<td>12</td>
<td>SL</td>
<td>7.5 YR 6/6 (reddish yellow)</td>
<td>2 inclusions; 12 mm in size. 5 YR 5/1 (gray). Fine sand sized grains</td>
<td>None visible</td>
<td>Medium – presence of inclusions reduces quality</td>
</tr>
<tr>
<td>13</td>
<td>SL</td>
<td>7.5 R 5/6 (red) 7.5 R 6/4 (pale)</td>
<td>None visible</td>
<td>None visible</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>SL</td>
<td>7.5 R 4/8 (red) 7.5 R 5/6 (red) 7.5 R 6/2 (pale red)</td>
<td>None Visible</td>
<td>Ranges from not visible to silt sized throughout</td>
<td>Medium – presence of visible grains reduces quality</td>
</tr>
<tr>
<td>15</td>
<td>SL</td>
<td>7.5 R 6/3 (pale red) 7.5 R 6/4 (pale red) 7.5 R 4/6 (red)</td>
<td>None Visible</td>
<td>None Visible</td>
<td>High</td>
</tr>
<tr>
<td>16</td>
<td>CCQ</td>
<td>2.5 YR 8/1 (white) with a strip of Gley 6/5 PB (bluish gray) and Gley 2.5/10G (greenish black)</td>
<td>None visible</td>
<td>None in darker areas; white areas have silt sized grains</td>
<td>Medium – visible grain size and the presence of different areas of different quality/grain size reduce overall quality</td>
</tr>
<tr>
<td>17</td>
<td>CCQ (biface produced 2012)</td>
<td>Gley 8/5 B (light bluish grey) Gley 5/10 B (bluish grey)</td>
<td>Voids of 5-7 mm; limited to a 2 cm area, contain coarse sand sized crystals</td>
<td>None visible</td>
<td>Medium to high</td>
</tr>
<tr>
<td>18</td>
<td>CCQ (Flake produced 2012)</td>
<td>Gley 8/5 B (light bluish gray) Gley 5/10 B (bluish gray)</td>
<td>None visible</td>
<td>None visible</td>
<td>Medium to high</td>
</tr>
<tr>
<td>19</td>
<td>CCQ (Flake produced 2012)</td>
<td>Gley 8/5 B (light bluish gray) Gley 5/10 B (bluish gray)</td>
<td>None visible</td>
<td>None visible</td>
<td>Medium to high</td>
</tr>
<tr>
<td>20</td>
<td>CCQ (Flake produced 2012)</td>
<td>Gley 8/5 B (light bluish gray) Gley 5/10 B (bluish gray)</td>
<td>None visible</td>
<td>None visible</td>
<td>Medium to high</td>
</tr>
<tr>
<td>21</td>
<td>CCQ (Flake produced 2012)</td>
<td>Gley 8/5 B (light bluish gray)</td>
<td>None visible</td>
<td>None visible</td>
<td>Medium to high</td>
</tr>
</tbody>
</table>
The experiment commenced with the placement of all 22 samples in the hearth area for heating. Each sample was numbered (1-22) for ease of identification. As these numbers were unlikely to preserve a map was also drawn of the area, with each sample labelled, so the samples could be identified for later comparisons (Figure 6.27). Two thermocouple probes (type K-probes for thermocouple Simple Logger II Model L642) were also placed in the area. Unfortunately, one of the probes malfunctioned so only one probe collected temperature data. The location of the probes was also noted on the map of the area. A fire was then lit and kept burning for approximately five hours. The thermocouple probes continued to record for an additional three hours and took temperature readings every 30 seconds, so temperature data are available for this range of time. After the fire died out the samples were left in the coals to cool as they were too hot to touch and removal from the area may have caused additional spalling.

Heat spalling occurred while the fire burned. The spalling was audible in the vicinity of the fire and some of the pieces moved considerable distances, some visible both during and after the experiment. The spalling occurred due to internal flaws in the raw material, as observations after the experiment noted that many of the spalls occurred along lines of internal flaws. The temperature of the fire reached over 1,000° F (Figure 6.28).
Figure 6.27: Map showing the location of samples prior to heat treatment.

Figure 6.28: Chart showing the temperature of fire during heat treatment. Red represents probe 2; Black probe 1 (failed probe).
The items were removed from the fire after waiting overnight for them to cool sufficiently. The map marking the original placement of materials pre-firing aided in the identification of the materials post-firing treatment. One sample (Sample 13 from San Lorenzo) was not recovered as it could not be located. The materials moved around substantially (Figure 6.29). This movement was in part due to spalling; large cobbles spalled off smaller pieces which were then not in the same exact place. Movement also occurred in the natural processes of tending to the fire. As many of the pieces were more fragmentary than they had been prior to heat treatment, after each sample was noted on the map the samples were placed in plastic bags labelled with the sample number. The materials were then taken back to the laboratory, the ash was removed from their surfaces, and they were then subject to the same analyses as prior to the heat treatment experiment. Each sample was photographed, its Munsell color taken, and a description of the grain size and presence, frequency, and size of inclusions was noted (Table 6.8).

Figure 6.29: Map showing the locations of samples post heat treatment
Table 6.8: Characterization of samples post heat treatment.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Origin</th>
<th>Color</th>
<th>Inclusions</th>
<th>Grain Size</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CCQ</td>
<td>5 Y 8/1 (white)</td>
<td>None</td>
<td>None visible</td>
<td>Increase in uniformity and decrease in grain size of materials; brittle from overheating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some spots of 5 Y 5/1 (gray) and 5 Y 6/2 (light olive gray)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CCQ</td>
<td>Gley 1 8/N (white) with areas of Gley 1 6/N (gray)</td>
<td>Common; 10 YR 6/8 (brownish yellow), medium sand sized; fractured along the inclusions during heat treatment</td>
<td>None visible</td>
<td>Fractured along lines of inclusions; otherwise would be high quality</td>
</tr>
<tr>
<td>3</td>
<td>CCQ</td>
<td>2.5 Y 8/1 (white) with spots of 2.5 Y 7/6 (yellow)</td>
<td>Throughout 2.5 YR 6/1 (gray) medium sand sized</td>
<td>None visible</td>
<td>Fractured along inclusions during heat treatment; some parts have waxy feel and glossy quality found in high quality heat treated material</td>
</tr>
<tr>
<td>4</td>
<td>CCQ</td>
<td>2.5 Y 8/1 (White) 2.5 Y 7/6 (ellos) 2.5 Y 6/1 (gray)</td>
<td>None visible</td>
<td>None visible</td>
<td>Parts overheated; dull rather than shiny; closely resembles Burlington chert; otherwise fairly high</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>quality</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>
| 5 | CCQ | 2.5 Y 8/1 (white) With areas of 2.5 Y 8/2 (pale yellow) and 2.5 Y 5/1 (gray) | Coarse sand sized grains 2.5 Y 7/2 (light gray) to 2.5 Y 6/1 (gray) | None visible
|   |   |   |   | Fractured along lines of inclusions; glossy texture associated with high quality heat treated material |
| 6 | CCQ Construction Fill | 2.5 Y 8/1 (white) With areas of 10 R 6/6 (light red) and 10 R 7/4 (pale red) areas | Few visible; voids with coarse sand sized crystals | None Visible
|   |   |   |   | Medium, presence of inclusions |
| 7 | CCQ Construction Fill | 2.5 Y 8/1 (white) With areas of 2.5 Y 8/2 (pale yellow) | Coarse sand sized inclusions, 2.5 Y 7/2 (light gray) | None visible
|   |   |   |   | Medium; waxy feel typical of heat treatment present |
| 8 | CCQ Construction Fill | 2.5 Y 8/1 (white) 2.5 Y 7/1 (light gray) 2.5 Y 6/1 (gray) | Few inclusions; coarse sand sized, 2.5 Y 7.4 (pale yellow) | None visible
|   |   |   |   | High quality; waxy feel and shiny luster present |
| 9 | CCQ Construction Fill | 7.5 R 6/1 (reddish gray) With spots of 7.5 R 4/2 (weak red) and 7.5 R 3/2 (dusky red) | Present throughout, medium sand sized 7.5 YR 8/3 (pink) | None visible
|   |   |   |   | Fair; inclusions present; very fire cracked; mostly along lines of inclusions |
| 10 | SL | 7.5 YR 7/1 (light gray) With areas of 7.5 YR 8/2 (pinkish white) | Small numbers visible; fine sand sized inclusions, 7.5 YR 7/4 (pink) | None visible
|   |   |   |   | Medium; chalky texture and presence of inclusions |
| 11 | SL | 7.5 R 7/2 (pale red) | None visible | None visible
<p>|   |   |   |   | Poor – medium; |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>SL</td>
<td>7.5 R 4/6 (red)</td>
<td>A few voids with coarse sand sized inclusions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.5 R 4/4 (weak red)</td>
<td>2.5 YR 7/6 (light red)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.5 R 6/4 (pale red)</td>
<td>None visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5 YR 6/8 (light red)</td>
<td>Medium; presence of inclusions limits quality/utility</td>
</tr>
<tr>
<td>13</td>
<td>SL</td>
<td>Missing</td>
<td>Missing</td>
</tr>
<tr>
<td>14</td>
<td>SL</td>
<td>2.5 YR 6/1 (reddish gray)</td>
<td>A few voids with medium sand sized inclusions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5 YR 4/2 (weak red)</td>
<td>2.5 YR 8/1 (white)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5 YR 8/1 (white)</td>
<td>None visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2/5 YR 7/1 (light reddish gray)</td>
<td>Medium to fair; slight waxy feel and glossy sheen; presence of inclusions limits quality</td>
</tr>
<tr>
<td>15</td>
<td>SL</td>
<td>5 Y 8/6 (yellow)</td>
<td>None visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Y 8/3 (pale yellow)</td>
<td>None visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Y 6/1 (gray)</td>
<td>Medium – some areas glossy with distinctive sheen from heat treatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With spots of 7.5 R 7/3 (pale red)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>CCQ</td>
<td>Gley 1 8/N (white)</td>
<td>None visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With spots of Gley 1 7/N (light gray)</td>
<td>None visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Heat spalling reduced size, but has glossy feel and luster</td>
</tr>
<tr>
<td>17</td>
<td>CCQ (biface produced 2012)</td>
<td>7.5 YR 8/1 (white)</td>
<td>Voids with coarse sand sized inclusions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7.5 YR 7/1 (light gray)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>None visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Medium to high; some areas of waxy feel with sheen from heat treatment</td>
</tr>
<tr>
<td>18</td>
<td>CCQ (Flake produced)</td>
<td>7.5 YR 8/1 (white) with</td>
<td>None visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>None visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High – waxy with glossy</td>
</tr>
</tbody>
</table>
The results of the heat treatment experiment demonstrated that all the Callar Creek Quarry chert turn white when heat treated (Figure 6.30). This is rather unusual as many cherts turn red or pink when exposed to heat. The Callar Creek materials, on the other hand, became white almost uniformly. Unfortunately, the fire reached high temperatures too quickly, which lead to fracturing of some of the raw materials, depending on their placement in the fire, due to excessive heating; this may have also contributed to the white color of the chert. The materials from San Lorenzo became pinker or gray in some cases, demonstrating the variability of responses to heat treatment among different raw materials.
Despite the overheating and excessive spalling of some materials, several of the samples demonstrated the positive changes which can be brought about by heat treatment experiments (Figure 6.31). These include the typical glossy surface which is found on many heat-treated materials. The materials from Callar Creek Quarry would improve if heat treatment had been performed at the quarry. Furthermore, even the spalled edges of the raw material were extremely sharp further demonstrating the quality of raw materials after heat treatment.
Knapping experiments were also performed on the raw materials after heat treatment. As discussed above, some of the materials had suffered extensive heat spalling so only samples 2, 3, 4, 5, 6, 7, 8, and 22 were knapped. In general, they tended to fracture on lines of inclusions which were present prior to the heat treatment or along fault lines cause by the overheating of the samples. Several samples did knap well, however, showing that heat treatment did improve their quality. Figure 6.31 illustrates the high-quality items produced from the experimental knapping.

The overall evaluation of the heat treatment materials demonstrated that the CCQ materials did improve in quality with heat-treatment but characteristics of these samples were not identified in the lithics collected from the quarry. All the different colors of chert at Callar Creek Quarry turned white although some had areas of red, yellow, and grey inclusions/spots. The San Lorenzo materials, river cobbles that tended tend to be red pre-firing, turned a pinkish-gray. Heat treatment also permitted the observation of pre-existing internal flaws. The materials fractured along lines of inclusions and internal
flaws in the fire thereby revealing inclusions which were not visible in previous analyses of the materials.

The results of the experiment illustrated that the possibly heat treated materials from the quarry, some of the red and pink materials, were not heat treated. As the Callar Creek Quarry materials turn white, there is no these materials probably did not result from heat treatment. A few of the white chert examples from Callar Creek Quarry exhibit possible evidence of heat treatment based on the experiment, but there is not much evidence for heat-treatment from the archaeological materials collected. In general, the experiment served to illustrate that the materials from Callar Creek Quarry were not subject to systematic heat treatment, at least not at the quarry. In many ways this is not surprising, as the majority of the knapping which occurred at the quarry was for informal tools, and it is rare to put forth such a large effort to improve the quality of raw materials for the production of informal tools.

6.4 Conclusions

Callar Creek Quarry is a chert quarry utilized from the Archaic through the Historic period. Investigations at Callar Creek Quarry demonstrate that throughout the use-life of the quarry, chert was extracted in a variety of manners. The method of chert extraction varied depending on the form of the chert cobbles being extracted. This discussion of chert extraction and information concerning the chert from Callar Creek will be combined with information from Chapter 7, concerning the adjacent habitation groups, to discuss the reduction sequence and economic role of Callar Creek Quarry chert in the regional economy.
Chapter 7: Household Investigations

7.1 Introduction

Around Callar Creek Quarry, adjacent to the area of raw material extraction, are two household groups, Callar Creek Quarry 1 and 2. Investigations at these groups focused on determining their relationship with the quarry, particularly the involvement of household residents in the extraction and production of raw materials. Investigations demonstrated that the two household groups were occupied at different times and constructed in different manners. This chapter presents a description of each of the two household groups, their excavation, and a discussion of their construction and occupation sequences and the materials recovered from both on and off-structure excavations.

7.2 Callar Creek Quarry 1

Callar Creek Quarry 1 (CCQ-1) is a plaza group located to the northeast of the quarry area (see Figure 7.1). The group consists of six structures. The most northerly, Structure 1, is a range structure located across a modern smuggling road from the rest of the group in a forested area. The remainder of the group is located in an area cleared for a cow pasture. Structure 2 is a pyramidal structure which possibly served as the ancestor shrine for this group (Figure 7.2). Structures 3 and 4 are located on top of Platform 1 and are both range structures (Figure 7.3). Structure 5 is a low platform structure which
seems to have been subject to some destruction, possibly due to farming practices in the region (Figure 7.4), the area is currently an active farm and has been farmed for some time.

The focus of the investigations at CCQ-1 were on Str. 4 and Platform 1, as they are the largest structures, except for the pyramidal structure, and so were most likely to provide in-depth information about the occupation and chronological sequence of CCQ-1. Structure 5 was also briefly investigated to provide additional data and determine the nature of its construction.

Figure 7.1: Map showing structures and excavations from CCQ-1
Figure 7.2: Photograph of Structure 2, the possible ancestral shrine, facing north.

Figure 7.3: Photograph of Structures 3 and 4, on Platform 1, facing east.
7.2.1 Dating the Construction of CCQ-1

Excavations at CCQ-1 demonstrated that the first construction occurred in the Early Classic period with subsequent construction phases in the Late/Terminal Classic period. Ceramic evidence illustrates abundant Middle Preclassic occupation, although there is no evidence of construction at the time. Ceramic evidence also points to a robust Late/Terminal Classic period occupation, with fewer ceramics, and little evidence for occupation, from intervening time periods; Late Preclassic, Protoclassic, and Early Classic period diagnostics are present in small quantities. As shown in Table 7.1, the majority of the excavated lots can be dated to the Preclassic, Early Classic, or Late to Terminal Classic periods.

It should be noted that Preclassic and Late/Terminal Classic diagnostics are among the best known and best defined in the Belize Valley (Gifford 1976; LeCount 1996; LeCount et al. 2002; see Appendix II for more information on the ceramic analysis.
methodology). Thus, the definability and distinctiveness of these sherds may lend itself to the over-identification of such sherds, as compared with those from other periods.

Table 7.1: Table showing the attribution of excavation units to time periods from CCQ-1.

<table>
<thead>
<tr>
<th>Context</th>
<th>Preclassic</th>
<th>Early Classic</th>
<th>Late/Terminal Classic</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>381A/1-15</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>381B/1-14</td>
<td>2</td>
<td>3</td>
<td>7</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>381C/1-10</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>381D/1-19</td>
<td>7</td>
<td>0</td>
<td>9</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>381F/1-9</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>381J/1-5</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>381K/1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Excavations in CCQ construction fill recovered 9,938. Of these, 924 (9.3 %) are temporally diagnostic (Table 7.2). As stated above, these are dominated by Middle Preclassic diagnostics, predominately Mars Orange Wares, and Late/Terminal Classic sherds, predominately British Honduras Ash Tempered Wares and Mount Maloney bowls and jars.

Table 7.2: Table showing counts of diagnostic sherds by Subop for CCQ-1 construction fill contexts.

<table>
<thead>
<tr>
<th>Context</th>
<th>Number of diagnostic sherds</th>
</tr>
</thead>
<tbody>
<tr>
<td>381A/1-15</td>
<td>61</td>
</tr>
<tr>
<td>381B/1-14</td>
<td>107</td>
</tr>
<tr>
<td>381C/1-10</td>
<td>234</td>
</tr>
<tr>
<td>381D/1-19</td>
<td>320</td>
</tr>
<tr>
<td>381F/1-9</td>
<td>111</td>
</tr>
<tr>
<td>381J/1-5</td>
<td>41</td>
</tr>
<tr>
<td>381K/1</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>924</td>
</tr>
</tbody>
</table>

Excavations in Structure 5 uncovered only the Late to Terminal Classic Period construction phase of the structure; as CCQ Burial 1 was uncovered within the structure; the units (Ops 381F/1-9, 381J/1-5, 381K/1) in Structure 5 were not dug to bedrock.
Burial 1 was placed in a cut into the construction fill of the structure and the single individual was placed in a laid-out position oriented roughly north-south with the feet toward the north. The burial was accompanied by a vessel, a Dolphin Head Red bowl diagnostic of the Late Classic I, placed upside down on top of the head of the individual (Gifford 1976) (Figure 7.5). Within the construction fill, 95 (47% of the diagnostic sherds) sherds are British Honduras Ash Tempered Wares, diagnostic of the Late/Terminal Classic period. While 75 (37% of the diagnostics) are Mars Orange Wares, diagnostic of the Middle Preclassic period, the exposed part of the structure was constructed in the Late/Terminal Classic period, probably in the Late Classic II, or Hats’ Chaak phase (A.D. 670 – 780) given the dating of other diagnostics. Three diagnostic sherds (1.5% of the diagnostics) were Mt. Maloney bowls or jars, two dated to the Late Classic II (LCII), a bowl and a jar, and one bowl dated to the Late Classic I (LCI) (LeCount 1996; LeCount et al 2002) (Figure 7.6). The Uaxactun Unslipped Wares show a similar pattern (n = 5; 2.5%) with a LCII Alexander Unslipped: Beaverdam Variety and an LCII Alexander Unslipped: Alexander Variety as well as two Alexander Unslipped: Croja Variety sherds (Figure 7.7). The combination of the ceramics from the fill contexts and the burial vessel indicate a Late Classic II (A.D. 670-780) construction for the final construction phase of Structure 5.
Figure 7.5: Drawing and photograph of burial vessel (All ceramic drawings follow color conventions in Gifford 1976).
Figure 7.6: Sherd profile of a Late Classic I Mt. Maloney bowl from Op 381 J/3

Figure 7.7: Sherd profile of an Alexander Unslipped, Croja Variety jar from Op 381 J/2

The construction of Structure 4 and Platform 1 were slightly more complex as multiple construction phases were identified. As demonstrated in Figure 7.8, there are two construction phases separated by a possible episode of abandonment, as there is a buried A horizon between the two phases. The first construction phase appears to have been constructed directly on bedrock in the Early Classic period (A.D. 300 – 600) despite the
presence of Middle Preclassic and Protoclassic sherds in the construction fill. A second
construction phase was built in the Late/Terminal Classic period (A.D. 600 – 890).
Obvious Middle Preclassic period (1,000 – 400 B.C.) occupation existed at CCQ-1, due
to the overabundance of Middle Preclassic sherds, specifically Mars Orange Wares,
within the group. However, it does not seem to be the case that Structure 4 was
constructed during this time. Instead, it is possible that Str. 2, the probable ancestor
shrine, was first built during this period, as these are typical constructions found at
Middle Preclassic sites.

Of the 720 diagnostic sherds identified from Platform 1 and Structure 4, 330 are
diagnostic Late/Terminal Classic sherds (45.8 %) the overwhelming majority (n = 240;
72.7 %) of which are British Honduras Ash Tempered Wares. An additional 13 Belize
Red sherds were also identified. Other Late to Terminal Classic period diagnostics
included 25 (7.5 %) Mount Maloney Black sherds. The Mt. Maloney’s included a Late
Classic I bowl, 19 Late Classic II bowls, two Terminal Classic Mt. Maloney bowls, and
three Late Classic II jars (Gifford 1976; LeCount et al. 2002; LeCount 1996) (Figure 7.9).
25 jars from the Cayo Ceramic Group (7.5 %) were also identified including ten Late
Classic II Alexander Unslipped: Alexander Variety, two Late Classic II Alexander
Unslipped: Beaverdam Variety, and six Late Classic II Alexander Unslipped: Croja
Variety (Gifford 1976; LeCount et al 2002; LeCount 1996) (Figure 7.10). Additional
Late to Terminal Classic period diagnostics included a single Garbett Creek Red: Variety
Unspecified sherd, and a single Vaca Falls Red: Vaca Falls Variety sherd (Gifford 1976).
Figure 7.8: North profile of Ops 381A 1/15 and 381B/1-14.
Figure 7.9: Sherd profile of a Late Classic II Mt. Maloney bowl from Op 381 A/2

Figure 7.10: Sherd profile of a Cayo Unslipped Cayo Variety jar, diagnostic Late Classic from Op 381 B/1.
Early Classic period diagnostics are represented in these structures by only 44 sherds (6.1% of temporally diagnostic sherds from these structures). As discussed above, Early Classic period diagnostics are much less defined and more difficult to identify than either Late to Terminal Classic or Preclassic period diagnostics, which probably contributed to the discrepancy in Early Classic period diagnostics. Several ring bases were identified, which began to be used in the Early Classic period and continued later in time (LeCount 1996; Peuramaki-Brown 2012; Yaeger 2000). The number of ring bases found in these contexts is suggestive, although not definitive, evidence of an Early Classic period occupation. Other Early Classic period diagnostics include eight Balanza Black: Variety Unspecified sherds, an Uaxactun Unslipped Ware and several Peten Gloss Wares. As mentioned elsewhere, Peten Gloss Wares can be difficult to date definitively and many of these may have been produced in the Early to Late Classic periods. These sherds include a Lucha Incised: Variety Unspecified (Figure 7.11), a Batalleros Black on Orange: Variety Unspecified, a Caldero Buff Polychrome: Variety Unspecified, and a Yaloche Cream Polychrome: Variety Unspecified. These sherds are not indicative of a large or widespread Early Classic occupation. However, as discussed above, Early Classic diagnostics are less well understood than other time periods, and this probably contributes to the lack of visibility of Early Classic contexts.
The best evidence for Protoclassic period (A.D. 1 – 300) occupation comes from three diagnostic sherds (0.4 % of the total diagnostic sherds) from the Aguacate Ceramic Group. One is an Aguacate Orange: Ramonal Variety, one Guacamallo Black on Red: Guacamallo Variety, and the other simply an Aguacate Orange. The Aguacate Orange: Ramonal Variety is a fragment of a mammiform foot, also diagnostic of the Protoclassic period (Figure 7.12).

The evidence for a Preclassic, predominately a Middle Preclassic, component at CCQ-1 is much greater than that of an Early Classic or Protoclassic component. Just under half, 343 sherds, or 47.6 %, of the diagnostic sherds found in Platform 1 and Structure 4, date to the Preclassic. The majority of these sherds are Mars Orange Wares (n = 302; 86 % of Preclassic diagnostics in these contexts). Excavations recovered nine additions sherds which are in the Savana Orange Group within Mars Orange Wares, 26 Paso Carballo Waxy Ware sherds, including Sierra Red sherds (Figure 7.13), and three Jocote Orange-Brown: Variety Unspecified jars.
Figure 7.12: Photograph and drawing of the Aguacate Orange, Ramonal Variety Mammiform foot.

Figure 7.13: Sherd profile of a Savana Orange sherd, Op 381A/10.
This overview illustrates the different types of ceramics, and their chronological attributions, which were found in the construction fill of Platform 1 and Structure 4. We will now turn to a discussion of how these temporally diagnostic sherds articulate with the structures’ stratigraphy to reveal evidence of their construction phases and the dating of those phases. As mentioned above, the excavations on Structure 4 (which is on top of Platform 1) and Platform 1 consist of four operations: Ops 381A/1-15, 381B/1-14, 381C/1-10, and 381D/1-19. Ops 381A/1-15, 381B/1-14, and 381D/1-19 focused on Structure 4 while Op 381C/1-10 was located on Platform 1. Evidence from the stratigraphic profiles of Ops 381A/1-15, 381B/1-14, and 381D/1-19 show two construction episodes of Structure 4 (Figure 7.8, 7.14), one of which dated to the Early Classic period and the other to the Late/Terminal Classic period (Probably Late Classic II (A.D. 670-780) based on the prevalence of Late Classic II sherds in the construction fill). Although Preclassic period, particularly Middle Preclassic sherds, are more common in the construction fill, several of the levels of construction fill with predominantly Middle Preclassic period sherds also contained Polychrome sherds, which cannot date any earlier than the Early Classic. As such, it is probable that the earliest construction phase of Structure 4 is in the Early Classic.

The dating of the construction of Platform 1 is less secure. The first 50 cm of excavation produced large number of diagnostic Late/Terminal Classic sherds (see Appendix IV). Given the location of the excavation unit, downslope of the rest of the platform, these sherds could be due in part to post-depositional processes. No earlier temporal diagnostics were identified, although a large part of the excavation unit did not contain any temporally diagnostic ceramics. Given that Structure 4 was built on top of
the platform, it must have been built in the Early Classic period, or earlier, to permit the construction of a structure on its summit.

Radiocarbon samples from Str. 4 provide confirmation of the dating of the construction phases for the structure. Six radiocarbon samples from various areas provide evidence of multiple construction phases (see Appendix V for a detailed...
description of the location of radiocarbon samples, their testing, and the calibration method) including a Late to Terminal Classic period construction stage, dating to cal A.D. 770-900 or cal A.D. 925-945, and an Early Classic terminus post quem for the earlier construction phase, dating to cal A.D. 405-550. These samples support the data obtained from the ceramic materials from construction fill; that the structures at CCQ-1, particularly Str. 4, were construction in two construction episodes, the first in the Early Classic, or slightly earlier, and the second in the Late to Terminal Classic. The samples from the lowest excavation levels of these structures point to much earlier periods which might be a result of the reuse of materials from earlier periods in the construction fill of the structures.

7.2.2 Household Occupation at CCQ-1

Excavations in the area around CCQ-1 demonstrated that the area was used for habitation. Many household objects were recovered including a spindle whorl, groundstone pieces, utilitarian ceramics, and formal and informal lithic tools, including 12 bifaces (Table 7.3).

| Table 7.3: Counts of objects typically found in households from CCQ-1. |
|------------------------|--------|
| Material Type          | Count  |
| Biface                 | 12     |
| Uniface                | 4      |
| Spindle Whorl          | 1      |
| Shell beads/pendants   | 3      |
| Metates (and fragments)| 5      |
| Mano (and fragment)    | 5      |
| Daub                   | 11     |
| Obsidian               | 11     |
To demonstrate the household nature of the CCQ-1 assemblage, a comparison was made with household materials from the site of San Lorenzo, Belize, discussed briefly in Chapter 5. It is a small settlement cluster in the Belize Valley occupied from the Middle Preclassic to the Terminal Classic periods (1,000 B.C. – A.D. 890), with possible evidence for Postclassic period use or occupation (Yaeger 2000; Yaeger et al. 2014). Yaeger (2000) provides counts of materials from various habitation areas, this discussion focuses on SL-22 and SL-28. SL-22 is one of the largest residences at the site, and one which Yaeger (2000) extensively excavated. It consists of five structures arranged around a patio. Yaeger (2000) argues that the residents at SL-22 managed the SL-82 quarry, while the SL-28 residents were the producers. SL-28 is one of the smaller residences at San Lorenzo, but was associated with the quarry cut, identified as SL-82 and discussed in Chapter 3. SL-28 consists of three structures arranged around a patio; the structures themselves are relatively small, which allowed for more extensive excavation. As CCQ-1 is associated with a quarry, SL-28 seemed the best household from San Lorenzo with which to compare to CCQ-1. To obtain the data necessary for comparisons with Callar Creek Quarry, the counts from the excavation lots from the two household groups were combined, mixing patio and structure-excavation data. These data were compared with the total counts of excavated materials from CCQ-1.

Comparisons focused on ceramics, obsidian, groundstone, daub, and slate. For ceramics, the percentages of open and closed forms were compared. Open forms refer to items including plates, dishes, bowls, and vases while closed forms refer to jars. All form designations are based on Sabloff’s (1975) definitions. Yaeger (2000) also records ritual and ‘other’ forms; as these categories were not utilized in the analysis of the CCQ
materials, only open and closed form designations were considered. For CCQ materials, the number of open and closed forms only includes those pieces for which the form could be determined, so the number of ceramics does not represent the total number of sherds collected from CCQ-1.

Comparisons between CCQ-1 and the two San Lorenzo groups reveal similarities between CCQ-1 and SL-22 including similar percentages of open and closed forms. The percentages vary rather significantly from SL-28, which contained significantly higher proportions of open forms than at CCQ-1 or SL-22 (Table 7.4). A chi-square test performed between SL-22 and CCQ-1 for the number of open and closed forms demonstrates they are statistically similar ($X^2 = 15.5; df = 1; p < .001$).

**Table 7.4: Counts of ceramics by form from CCQ and SL.**

<table>
<thead>
<tr>
<th>Context</th>
<th>Open Forms</th>
<th>Closed Forms</th>
<th>Total$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL – 22</td>
<td>675 (59.5 %)</td>
<td>358 (31.5 %)</td>
<td>1,136</td>
</tr>
<tr>
<td>SL-28</td>
<td>137 (86.7 %)</td>
<td>15 (9.5 %)</td>
<td>158</td>
</tr>
<tr>
<td>CCQ – 1</td>
<td>311 (54.7 %)</td>
<td>258 (45.3 %)</td>
<td>569</td>
</tr>
<tr>
<td>CCQ - 2</td>
<td>135 (60.8 %)</td>
<td>87 (39.2 %)</td>
<td>222</td>
</tr>
</tbody>
</table>

a. The numbers of the open and closed forms for SL-22 and 28 do not add up to the total as Yaeger (2000) included ritual and other ceramics, which are not considered here.

Comparisons between other household materials reveal further similarities and some differences between contexts. Counts of groundstone, obsidian, slate, and daub revealed large disparities between the San Lorenzo and Callar Creek Quarry contexts due to the differences in the excavation area between these locations (see Table 7.5). Material counts from San Lorenzo were much greater than Callar Creek Quarry, the San Lorenzo
structures were more intensively excavated. To account for this difference the counts were normalized by excavation area. Although excavation volume has been used for comparisons elsewhere in this dissertation, area was more easily calculated from the information presented in Yaeger (2000) so area, rather than volume, is used for comparisons. Comparisons between these items, again, show similarities between SL-22 and CCQ-1 including in the proportions of groundstone and slate. SL-22 contained much higher quantities of obsidian and daub than present at Callar Creek Quarry 1 (Table 7.2.5). This is perhaps explained due to the ease of access to chert for the residents at CCQ-1, which would decrease their need for obsidian. Conversely, it could be a result of access to obsidian, with residents at San Lorenzo having easier access to obsidian materials than those at Callar Creek Quarry.

Table 7.5: Table showing counts of materials, and the material amounts normalized by excavation area, from San Lorenzo and Callar Creek Quarry.

<table>
<thead>
<tr>
<th>Context</th>
<th>Groundstone</th>
<th>Obsidian</th>
<th>Slate</th>
<th>Daub</th>
<th>Excavation area</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL-22</td>
<td>90 (0.62/m²)</td>
<td>149 (1/m²)</td>
<td>44 (.30/m²)</td>
<td>1572 (10.9/m²)</td>
<td>144.6 m²</td>
</tr>
<tr>
<td>SL-28</td>
<td>25 (.21/m²)</td>
<td>114 (.98/m²)</td>
<td>26 (.22/m²)</td>
<td>214 (1.8/m²)</td>
<td>116.7 m²</td>
</tr>
<tr>
<td>CCQ-1</td>
<td>12 (.67/m²)</td>
<td>12 (.67/m²)</td>
<td>10 (.56/m²)</td>
<td>22 (.61/m²)</td>
<td>18 m²</td>
</tr>
<tr>
<td>CCQ-2</td>
<td>8 (.62/m²)</td>
<td>2 (.15/m²)</td>
<td>1 (.07/m²)</td>
<td>0 (0/m²)</td>
<td>13 m²</td>
</tr>
</tbody>
</table>

The comparisons with residences from San Lorenzo, particularly with SL-22, suggest that CCQ-1 is in fact a household group. Although many, but not all, of the household materials from CCQ-1 were found in construction fill, the lack of other surrounding settlement areas suggests that these household goods were from occupation at CCQ-1. Surprisingly, SL-22 and CCQ-1 shared more similarities than between CCQ-1
and SL-28, a lithic producing household. Perhaps the similarities between CCQ-1 and SL-22 are a result of wealth and status differences; SL-22 is one of the largest, and wealthiest, households excavated at San Lorenzo, and one which was occupied for a long time. CCQ-1 also demonstrates evidence of wealth and status items, as discussed below. A further discussion of the differences in wealth between these two lithic producing areas will be presented in Chapter 9, although the difference probably relates to ownership and control of lithic raw material sources rather than simply chert production.

Status and wealth items from CCQ-1 reveal interaction between residents and the broader region. Wealth and status items include a sherd with a glyphic inscription (CR-145) (Figure 7.15), several sherds with pseudo glyphs (CR – 148, CR- 154) (Figure 7.16), and a sherd with a possible Buenavista Device (CR – 143) (Figure 7.17). The glyphic inscription is part of the Primary Standard Sequence (PSS) including a fragment of God N (Christophe Helmke, personal communication 2013). The PSS is normally found around the edges of vases or bowls and identified the owner of these items. The Buenavista Device (Figure 7.18) is a symbol identified by Ball and Tascheck (2004) as indicative of the site of Buenavista del Cayo, since it does not have an emblem glyph. The symbol has been found on several items at the site of Buenavista, including those which were thought to be produced at the workshop located in the palace complex (Ball and Tascheck 2004; Reents-Budet et al. 2000). A fragment similar to that at CCQ-1 was also found at Callar Creek (Kurnick 2013, 2016). The sherd containing the Buenavista Device and one additional sherd are also Buenavista style sherds which Ball and Tascheck (2004) indicate are red on cream with orange slipped interiors and are thought to have been produced at a ceramic workshop in Buenavista (Figure 7.19). Although this
symbol is prevalent at the site of Buenavista, its attribution as a ‘device’ or symbol of Buenavista has been criticized (Awe 2014). The symbol itself appears to be a flower with scent scrolls (Stone and Zender 2011). Even if the figure does not represent Buenavista, and interaction with the site, the polychrome sherds are indicative of some ability to obtain vessels with writing, imitation writing, and polychrome decorations, all indicative of wealth and status.

Figure 7.15: Photograph of the sherd with glyphs (CR – 145).

Figure 7.16: Photograph of two sherds with pseudoglyphs (CR – 148 and 154).
Figure 7.17: Photograph of the potential Buenavista Device sherd (CR – 143).

Figure 7.18: Buenavista Device, redrawn after Ball and Tascheck 2004.

Figure 7.19: Photograph showing Buenavista style sherds from CCQ.
In addition to ceramic materials indicating wealth, a few shell beads were also obtained from CCQ-1. Two shell pendants, or tinklers, and a single round shell bead were recovered from excavations (Figure 7.20). A large fragment of marine shell (Figure 7.21) was also identified. These items are indicative of interaction within and outside of the region. The shell beads are all made on non-local materials, as they are marine shell. These items would have had to be obtained through interaction with other individuals.

Figure 7.20: Photograph of the shell pendants and beads from CCQ-1 (SP-71, SP-72, SP-79; Op 381A/10; Op 381J/4).

Figure 7.21: Photograph of marine shell from CCQ-1 (LT-707; Op 381D/8).
Lithic materials from off-structure excavations at CCQ-1 indicate utilization of materials from the quarry. No large deposits of lithics, indicative of production dumps, were identified, but debitage indicates utilization of these resources. A total of 1,522 lithics were recovered from off-structure excavations at CCQ-1 (see Appendix IV for additional information). Given a total excavation volume of 3.8 m³, across four excavation units, the density of lithics is 400.5 lithics/m³. Such a volume does not indicate the presence of intensive lithic production or dumping of lithic material. For instance, in comparison with the density of excavated material from the debitage mound at the quarry (see Chapter 6 for additional information), where 3,181.4 lithics/m³ were recovered, a density of 400 lithics/m³ is not great. However, this density is much greater than densities at households elsewhere in the Belize Valley, indicating that residents of this household group were participating in lithic production activities around CCQ-1. For instance, excavations at SL-22 at San Lorenzo recovered only 84 lithics, and excavations at SL-28 recovered 559 lithics (Yaeger 2000). As noted above, the excavation areas (and hence volume) for these two household groups were greater than that from CCQ-1, but the number of lithics is less, or just slightly more, than the density per m³ recovered from off-structure deposits at CCQ-1. These comparisons support the involvement in lithic production of the household groups at CCQ-1. The vast difference in lithic quantity, as compared with other households, is probably due to the lithic production which occurred at the household, despite the lack of in situ reduction areas or dumps.

Analysis of the lithics from fill contexts also supports the attribution of these structures as households as household waste was used for construction fill. The density of lithics from construction fill on Structure 4 and Platform 1, was, on average, 340.8
lithics/m$^3$ while that from Str. 5 was 725.3 lithics/m$^3$. In fact, the density of lithic materials is less than the ceramic densities for these contexts (Table 7.6). The higher relative densities of ceramics to lithics in these construction fill contexts indicate reliance on household waste rather than on quarry waste, in the construction of the structures at Callar Creek Quarry 1.

### Table 7.6: Ceramic and lithic densities by excavation volume for Strs. 4 and 5 and Platform 1 in CCQ-1.

<table>
<thead>
<tr>
<th>Op</th>
<th>Lithics/m$^3$</th>
<th>Ceramics/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>381A/I-15</td>
<td>266.2</td>
<td>311.7</td>
</tr>
<tr>
<td>381B/I-14</td>
<td>91.3</td>
<td>565.8</td>
</tr>
<tr>
<td>381D/I-19</td>
<td>531.2</td>
<td>646.9</td>
</tr>
<tr>
<td>381C/I-10</td>
<td>232.5</td>
<td>913.8</td>
</tr>
<tr>
<td>381F/I-9</td>
<td>562.7</td>
<td>676.7</td>
</tr>
<tr>
<td>381J/I-5</td>
<td>1,510</td>
<td>2,106.7</td>
</tr>
<tr>
<td>381K/I</td>
<td>103.3</td>
<td>1,000.7</td>
</tr>
</tbody>
</table>

Furthermore, only 58 cores and formal tools were identified (3.7 cores and formal tools/m$^3$), while in CCQ-2 construction fill (see below for details on CCQ-2), which had a much smaller volume, 92 cores were identified (20.5 cores/m$^3$). CCQ-2 has over five times as many cores and tools per cubic meter than CCQ-1 in the construction fill. The significantly higher proportion of cores in CCQ-2 construction fill than in CCQ-1 supports the idea that CCQ-1 was using household, rather than quarry, waste as fill construction. The high density of cores is much more easily associated with quarrydebitage than with household waste, particularly given the limited evidence for intensive lithic production at CCQ-1.

### 7.2.3 Summary

Investigations at CCQ-1 indicate that use of the area began in the Archaic period (see Chapter 6) and extended into the Late to Terminal Classic period. Although
significant evidence for a Middle Preclassic period (1,000 – 300 B.C.) occupation, or at least visits to the area, is evident at CCQ-1, from the excavations currently conducted, it appears that the first construction of Structure 4 and Platform 1 occurred in the Early Classic period (A.D. 300-600) with a second construction episode in the Late Classic II or Hats’ Chaak phase (A.D. 670-780). Only one construction phase of Structure 5 was uncovered, which dated to the Late Classic II or Hats’ Chaak phase (A.D. 670 – 780).

Materials from construction fill and off-structure excavations indicate that CCQ-1 contained a household group comparable with households at other sites in the Belize Valley, particularly SL-22 at San Lorenzo. The off-structure excavations revealed that residents performed lithic reduction activities at the site, although no in situ production areas or debitage dumps were discovered.

7.3 Callar Creek Quarry 2

Callar Creek Quarry 2 (CCQ-2) is an L-shaped group located to the southwest of the quarry area (see Figure 7.22). The group consists of two structures, a range structure (Str. 1) (Figure 7.23) and a smaller pyramidal structure (Str. 2) (Figure 7.24). Str. 1 has an outset staircase which faces toward Str. 2. The structure also has two levels; the more northerly part is raised slightly above the southerly. This type of structure is found in other parts of the Belize Valley, such as Xunantunich (J. Yaeger, personal communication 2012). Str. 2 is a small structure which had a large looters trench through the top (Figure 7.25). The fill used for the construction of both structures consisted mostly of lithic cobbles, cores, and other debitage from the quarry. The area between the two structures was artificially leveled and defined to create a level plaza space.
Figure 7.22: Map showing excavations and locations of CCQ-2.

Figure 7.23: Photograph of the range structure, Structure 1, facing west.
7.3.1 Dating the Construction

Excavations of both structures in CCQ-2 demonstrated they were constructed in single construction episodes in the Late to Terminal Classic period (A.D. 600 – 890); no evidence of multiple construction phases exists (see Appendix IV for a detailed
description of excavation methods) (Figure 7.26). A total of 63 diagnostic sherds, all Late/Terminal Classic diagnostics, were identified from Str. 2, (17% of the total 369 sherds recovered from Str. 2 excavations). British Honduras Volcanic Ash Tempered Wares were the most common (n = 27; 43% of total diagnostics) with an additional 11 Belize Red: Belize Variety sherds (17% of total diagnostics). Four Mount Maloney Black: Mount Maloney Variety sherds (6 % of total diagnostics), three Late Classic II bowls and one Late Classic I bowl (LeCount et al 2002; LeCount 1996), and three Uaxactun Unslipped Wares (5 % of total diagnostics) (including two Cayo Unslipped: Cayo Variety jars) provide additional support to the Late/Terminal Classic period attribution of the structure (Figure 7.27). Three typeable polychromes were also present including a Saxche/Palmar Orange polychrome, a Zacatel Cream polychrome, and a Xunantunich Black on Orange. These ceramics all date to the Late Classic period (Figure 7.28; see Gifford 1976). Further refinement of the dating of the construction of Structure 2 comes as one of the Uaxactun Unslipped Wares, a Terminal Classic piecrust rim on a Cayo Unslipped: Cayo Variety Jar, indicates that the structure was probably constructed in the Terminal Classic, or Tsak’ phase (A.D. 780 – 890) (Figure 7.29). The rim was recovered from Op 373A/2, the first lot excavated into the construction fill at the bottom of the looters trench. The location of the rim is such that it was part of the construction fill rather than a sherd which was discarded on top of the structure in a later period. As such, CCQ-2 Structure 2 was probably constructed in the Terminal Classic.
Figure 7.26: Figure of the profile of Op 373A/1-12, showing the single construction episode
Figure 7.27: Drawing of a Mount Maloney LC II bowl from Op 373A/3

Figure 7.28: Drawing of the Saxche Orange Polychrome from Op 373A/2.
The ceramics from Structure 1 mirror patterns seen in Structure 2. A total of 130 diagnostic sherds were recovered, 3% of the total sherds (n = 4,395) recovered from Structure 1 construction fill. Of those 130 diagnostic sherds, 115, or 88.5% are Late to Terminal Classic period diagnostics. The most common diagnostics were British Honduras Volcanic Ash Tempered Wares, which made up 69.3% of the Late Classic diagnostics (n = 79). Ten additional sherds were Belize Red: Belize Variety, also diagnostic of the Late to Terminal Classic (Figure 7.30). An additional seven Mt. Maloney Black: Mt. Maloney Variety sherds were identified, six Late Classic II Mt. Maloney bowls and one Late Classic I jar. Other Late Classic period diagnostics included one Dolphin Head Red: Dolphin Head Variety sherd and five fragments of Cayo Unslipped Ware jars, including a diagnostic Late Classic II Alexander Unslipped: Alexander Variety jar and one Cayo Unslipped: Cayo Variety jar. Four Peten Gloss Wares, which date from the Early to Late Classic periods, due to the difficulties in chronological attribution of Peten Gloss Wares, a Palmar Orange sherd, one from the Meditation Black group, an Achote Black sherd, and a Yuhactal Black on Red. Structure
1 contained one Early Classic diagnostic (0.77% of all diagnostic sherds excavated from this suboperation). The single sherd was a Mountain Pine Red: Mountain Pine Variety, which is a Pine Ridge Carbonate Ware from the Tiger Run Ceramic Complex (Gifford 1976). Twelve sherds dated to the Middle Preclassic period (9.2% of all diagnostic sherds). All of these sherds were Mars Orange Wares, which are distinctive and ubiquitous throughout the Belize Valley.

Figure 7.30: Drawing of the profile of a Late Classic Belize Red vessel from Op 373B/9.

The approximately 70% of diagnostics which date to the Late to Terminal Classic period point to a Late to Terminal Classic period construction for Structure 1. Similarly to Structure 2, Mount Maloney and Cayo jars provide the *terminus anti quem* for the construction of the structure in the Late Classic II (A.D. 670-780). This overview of the ceramic materials in Structures 1 and 2 indicate that both structures were constructed in
single construction episodes in the Late to Terminal Classic period, probably in the Late Classic II or Terminal Classic periods (A.D. 670-890).

Radiocarbon samples from Str. 1 construction fill provide a terminus post quem for the structure construction in the Early Classic, cal A.D. 420 – 575 and A.D. 90-100 or 125-250 (see Appendix V for a full description of radiocarbon dates, their context, and calibration). The terminus ante quem for the structures still results from the Late Classic II to Terminal Classic ceramics recovered from construction fill, pointing to a LCII or TC construction of Str. 1.

7.3.2 Household Occupation at CCQ-2

Excavations around the structures determined that the group functioned as a household. While few artifacts which are usually definitively indicative of household use (i.e. groundstone, spindle whorls) were discovered, the materials uncovered were more similar to those found at other households than to areas of administration or specialized production (Table 7.7). The materials consisted mostly of utilitarian ceramics and flake tools. Additional objects indicate regional connections and possible access to wealth and status items. At least one sherd from CCQ-2 is in the Buenavista style, red on cream with an orange interior (Ball and Tascheck 2004) and thus indicative of possible connections with the site of Buenavista.

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifaces</td>
<td>3</td>
</tr>
<tr>
<td>Uniface</td>
<td>10</td>
</tr>
<tr>
<td>Mano fragment</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 7.7: Objects associated with households from off-structure deposits at CCQ-2.
The ceramics, groundstone, obsidian, daub, and slate counts from CCQ-2 were also compared with those from CCQ-1 and San Lorenzo’s SL-22 and SL-28 (See Tables 7.4 and 7.5). As with CCQ-1, CCQ-2 demonstrates similar proportions of ceramic forms and groundstone but differed in proportions of obsidian, daub, and slate, as compared with SL-22 (see Table 7.5). The similarities between SL-22, CCQ-1, and CCQ-2 support the attribution of CCQ-2 as a household group. It is interesting to note the differences between CCQ-2 and SL-28, a lithic producing household at San Lorenzo. The prevalence of high-status items at CCQ-2 is suggestive of wealth differences, which may be related to the control of lithic raw material sources. The similarity between CCQ-2 and SL-22, which Yaeger (2000) suggest managed access to the quarry, although the SL-28 residents were the producers, may relate to the economic benefits of management of raw materials rather than lithic production.

The amount of lithic debitage recovered from CCQ-2 was not indicative of large scale knapping activities occurring on or at the structures. A total of 2,777 lithics were recovered from these off-structure deposits, for a density of 470.7 lithics/m$^3$, which is comparable with that from CCQ-1 (400.5 lithics/m$^3$). In comparison with the debitage discard area in the quarry, the debitage mound, which had a density of 3,181.4 lithics/m$^3$, the concentration of lithics suggests large-scale production activities did not occur within the residential group. The debitage indicates, however, utilization of resources from Callar Creek Quarry.

An additional aspect of the use of Callar Creek Quarry resources by CCQ-2 residents was the use of quarry debitage for construction fill. The fill contained large numbers and high densities of lithics. Structure 1 had a density of 2,863 lithics/m$^3$ while
Structure 2 had a density of 1,257 lithics/m³. For comparison, Structure 1 had a density of 1,291 ceramics/m³ and Structure 2 a density of 866 ceramics/m³. The density of lithic materials from both contexts is extremely high, particularly in comparison with the ceramic densities.

Further evidence for the use of quarry debitage for the construction of these structures is the large size of the lithic materials from the construction fill. The average weight of all debitage from Structure 1 is 26 g while that from Structure 2 is 21 g. The large size probably relates to the high proportion of cores, mostly tested and discarded cobbles, found in the material, in addition to the presence of some extremely large flakes. For both structures, a total of 92 cores were identified. This is a much higher number and proportion of cores than found in quarry deposits; only 77 cores were collected from excavations with an additional 75 from surface deposits. These 152 cores are 0.4 % of the total lithic material collected from the quarry while the 92 cores are 1.7 % of the total lithic materials from construction fill. The higher proportion of cores in fill suggests a preference for large quarry debitage for construction. The construction of the CCQ-2 structures in the LCII to TC (A.D. 670-890) would allow for sufficient debitage piles in the quarry as utilization began in the Archaic.

Further evidence of the use of quarry debitage for the construction of the CCQ-2 structures can be found in similarities between the reduction sequences from the quarry and the construction fill. As described in more detail in Appendix I, the lithic materials from quarry deposits were subject to a detailed attribute analysis, while those from the construction fill were analyzed through an aggregate analysis. The comparability of these types of analyses is detailed in Appendix I. As discussed elsewhere (Chapter 6 and
8), the evidence from the lithic reduction in the quarry is indicative of early stage reduction and the production of flake tools through informal core reduction. CCQ-2 construction fill lithics show evidence of similar trends. The proportions of types of cores between the construction fill and quarry contexts are also fairly similar (Table 7.8). Both show a prevalence of multidirectional cores, with some unidirectional cores. Many of these unidirectional cores are tested cobbles, those with only a few flakes removed to test the quality of the raw material for making tools. As such, the patterns from the cores support the attribution of construction fill as coming from quarrying deposits, and as representational of these deposits.

<table>
<thead>
<tr>
<th>Context</th>
<th>Unidirectional</th>
<th>Multidirectional</th>
<th>Discoidal</th>
<th>Fragment</th>
<th>Other</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCQ-2 Fill</td>
<td>22</td>
<td>66</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>92</td>
</tr>
<tr>
<td>Quarry Deposits</td>
<td>25</td>
<td>114</td>
<td>1</td>
<td>8</td>
<td>4</td>
<td>152</td>
</tr>
</tbody>
</table>

Comparisons between the counts of formal tools from these contexts also illustrate some similarities. Bifaces were the predominant tool type in both contexts (Table 7.9). The quarry contexts, however, show more variety in the types and numbers of tools present. This is perhaps unsurprising as the tools most common in the construction fill would be expected to be larger items discarded with quarry waste, which would predominately be bifaces and possibly unifaces. The remaining items which are more commonly represented in the quarry deposit are smaller items, as it appears a preference was made for large quarrying debitage, these items may be underrepresented in construction fill due to their small size.
Table 7.9: Table showing counts of formal tools from CCQ-2 construction fill and quarry deposits.

<table>
<thead>
<tr>
<th>Context</th>
<th>Bifaces</th>
<th>Unifaces</th>
<th>Burin</th>
<th>Notch</th>
<th>Blade</th>
<th>Drill</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>(75 %)</td>
<td>(6.3 %)</td>
<td>(6.3 %)</td>
<td>(6.3 %)</td>
<td>(6.3%)</td>
<td>(0 %)</td>
<td></td>
</tr>
<tr>
<td>Quarry Deposit</td>
<td>28</td>
<td>36</td>
<td>0</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>(35 %)</td>
<td>(45.6 %)</td>
<td>(0 %)</td>
<td>(13.9 %)</td>
<td>(2.5%)</td>
<td>(2.5%)</td>
<td></td>
</tr>
</tbody>
</table>

Comparisons between the debitage from the two contexts also reveal similarities.

The majority of debitage in both contexts had little or no cortex (Table 7.10). This phenomenon, in a quarry context, is further discussed and explained in Appendix I. While the percentages of cortex in the two contexts are not identical, they follow the same broad trends, suggestive of core reduction and removal of cortex in both areas. The majority, 96.4 % of fill lithics (n = 10,495), were probably produced through hard hammer percussion while the same was true for 68 % of quarry lithics (n = 21,354). Hard hammer percussion is generally associated with generalized core reduction.

Table 7.10: Table showing frequency of percentages of cortex from the CCQ-2 construction fill and quarry deposits.

<table>
<thead>
<tr>
<th>Cortex Percent</th>
<th>Construction</th>
<th>Quarry</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>5,908</td>
<td>21,756</td>
</tr>
<tr>
<td></td>
<td>(54.3 %)</td>
<td>(69.3 %)</td>
</tr>
<tr>
<td>1 – 25</td>
<td>148</td>
<td>3,496</td>
</tr>
<tr>
<td></td>
<td>(1.4 %)</td>
<td>(11.1 %)</td>
</tr>
<tr>
<td>26 – 50</td>
<td>2,866</td>
<td>2,522</td>
</tr>
<tr>
<td></td>
<td>(26.3 %)</td>
<td>(8%)</td>
</tr>
<tr>
<td>51 - 75</td>
<td>46</td>
<td>826</td>
</tr>
<tr>
<td></td>
<td>(.4 %)</td>
<td>(2.6 %)</td>
</tr>
<tr>
<td>76 – 100</td>
<td>1,922</td>
<td>2,784</td>
</tr>
<tr>
<td></td>
<td>(17.7 %)</td>
<td>(8.9 %)</td>
</tr>
<tr>
<td>Total</td>
<td>10,882</td>
<td>31,384</td>
</tr>
</tbody>
</table>

The combination of analysis of the debitage, cores, and tools from the quarry and construction fill suggest some similarities between the two areas. As discussed elsewhere, quarry production focused on early stage reduction and the production of
generalized cores and flake tools. Similarities between the fill contexts and the quarry materials support the idea that the fill lithics could be quarry debitage used as construction material, presumably as it was the most expedient construction method. Like the quarry, the fill from CCQ-2 contains predominately multidirectional cores, with some unidirectional, tested cobbles, while the debitage shows a predominance of hard hammer production and similar amounts of cortex to the quarry contexts. These similarities bolster the argument that quarry waste was used in construction at CCQ-2. Both have predominately multidirectional cores, with some unidirectional cores, mostly tested cobbles.

7.3.3 Summary

CCQ-2 construction occurred in the Late Classic II or Terminal Classic and utilized quarry debitage for construction fill. The materials from the two structures, and off-structure excavations, illustrate that the area was used residentially and that, although knapping occurred around the structures, not on a large scale. No evidence of in situ production areas or production dumps existed in the excavated areas around CCQ-2.

7.4 Relations between the Households

Off-structure excavation at CCQ-1 and 2 demonstrated that lithic production occurred in these areas, although not at the high volumes as within the quarry area (see Chapter 6). Comparisons between the lithic reduction at the two household groups and from the quarry indicate that the reduction occurred in similar manners, and hence presumably by similar individuals.

The one difficulty in these comparisons is the problem with the large discrepancy between the size of the lithic assemblage from the quarry and the households. This is
particularly problematic as the comparisons must be performed between contexts that can be attributed to specific time periods to avoid conflating changes which occurred over time, thus reducing the sample sizes, particularly from household contexts, significantly.

Before comparing the household with the quarry, the households must first be compared with each other, to validate the combination of these groups in comparisons with the quarry. Comparisons between the households are discussed here, with further comparisons between the households and the quarry discussed in Chapter 8. The combination of the two households alleviates some of the issues of sample size. Only materials from off-structure excavations were included in these analyses as they are clearly associated with the households rather than with quarry waste or construction. While the overall discussion includes multiple time periods, the lithic materials from CCQ-2 only include materials dating to the Late/Terminal Classic, so comparisons between the two household groups will only consider materials from that time period. A total of 2,908 lithics from CCQ-2 and 662 from CCQ-1 were compared in this section.

Comparisons between materials focused on the makeup of the assemblage and technological properties of the lithic materials. The numbers of dorsal flake scars, platform facets, flake termination frequencies, cortex percentages, and the general size of items can be compared between assemblages to evaluate if the same, or similar, types occur in the two structure areas. For information on how these data were collected, consult Appendix I.

Both contexts consisted predominately of debitage with 99 % (n = 2,879) of the materials from CCQ-2 and 99.4 % (n = 658) of the lithics from CCQ-1 in this category. Cores made up relatively little of the assemblage with 10 cores found at CCQ-2 (0.34 %)
and only one at CCQ-1 (0.15 %). Due to the small number of cores in these assemblages, no comparisons between the cores were made.

Comparisons between technological aspects of the lithics from the two households included comparisons of the number of dorsal flake scars, number of platform facets, flake terminations, and cortex amounts. These characteristics are indicative of reduction stage, technique, and skill, and similarities in the technological attributes indicates similarities in the reduction sequence and skill between the households. Comparison of the types of terminations on whole flakes and flake fragments indicate that the percentages of types of terminations are relatively consistent between the two contexts. Feather terminations are most common, followed by other/unknown, step, and hinge (Table 7.11). This consistency in flake terminations indicates similarities in knapper skill between the two areas.

<table>
<thead>
<tr>
<th></th>
<th>Feather</th>
<th>Step</th>
<th>Hinge</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCQ-1</td>
<td>493</td>
<td>47</td>
<td>6</td>
<td>109</td>
<td>655</td>
</tr>
<tr>
<td></td>
<td>(75.3 %)</td>
<td>(7.2 %)</td>
<td>(0.9 %)</td>
<td>(16.6 %)</td>
<td></td>
</tr>
<tr>
<td>CCQ-2</td>
<td>2,013</td>
<td>298</td>
<td>20</td>
<td>549</td>
<td>2,880</td>
</tr>
<tr>
<td></td>
<td>(69.9 %)</td>
<td>(10.3 %)</td>
<td>(0.7 %)</td>
<td>(19.1 %)</td>
<td></td>
</tr>
</tbody>
</table>

Further similarities between the materials in CCQ-1 and 2 are seen in the number of platform facets. Small numbers of platform facets are indicative of earlier stages of production and informal core production while higher number of facets tends to be associated with later stage production or formalized core production. Both CCQ-1 and 2 had low numbers of platform facets (mean = 1.04: Figure 7.31). Dorsal flake scar counts are also associated with reduction stage, as smaller numbers of dorsal flake scars are
normally associated with earlier stages of reduction while more dorsal flake scars are found later in the reduction sequence. Both contexts had relatively similar average numbers of dorsal flake scars; 1.88 and 1.67, respectively (Figure 7.32). This difference between the two areas is not great, as the number of dorsal flake scars can be altered by many reduction issues including the size of flakes, the number of large vs. small flakes removed, and other issues which affect dorsal flake scar counts (Baumler 1988; see Horowitz 2010; Horowitz and McCall 2013 for a discussion of this process in biface flake scar counts).

The similarities between the two contexts also include the cortex percentages. This argument is bolstered by similarities in the amount of cortex in the debitage from the two contexts. A chi-square test indicates that the two are similar ($X^2 = 9.127, df = 5, p = .104$). Similarities in cortex amounts are also related to the stage of reduction, as earlier stages of reduction tend to produce more cortical flakes than later stages. Overall, the comparisons of technological aspects of the materials, the cortex, platform facets, and flake terminations indicate similarities between the two areas, despite small differences in the dorsal flake scar counts. These similarities between the two contexts in terms of technological attributes indicate that the two come from the same populations, and thus can be combined for purposes of comparison with contexts from the quarry. The demonstration of the relationship between CCQ-1 and 2 allows the combination of the materials from the off-structure excavations for comparison with the quarry. These data will be used to discuss the relationship between the quarry and the household groups in Chapter 8.
Figure 7.31: Platform facet counts from off-structure deposits at the CCQ households.

Figure 7.32: Dorsal flake scar counts from off-structure deposits at CCQ households.
7.5 Conclusions

This chapter described habitation areas around Callar Creek Quarry. Evidence of occupation of the area exists from the Preclassic through the Terminal Classic periods with construction in the Early Classic (CCQ-1) and Late/Terminal Classic periods (CCQ-1 and 2). Both CCQ-1 and 2 were household groups involved in the production of lithic materials at Callar Creek Quarry.

The occupation of Callar Creek Quarry 1 and 2 fits well within known chronology of other sites in the Belize Valley. For instance, Callar Creek, a nearby minor center, has large occupations in the Preclassic and Late to Terminal Classic periods with little evidence for Early Classic period occupation (Kurnick 2013). Similar trends also exist at Buenavista (Peuramaki-Brown 2012) although more recent investigations in the site core have revealed the possibility of a large Protoclassic/Early Classic period occupation at Buenavista (Yaeger et al. 2015). As more investigations in this region are performed, it seems likely that more evidence of Protoclassic and Early Classic period occupation will come to light. We are still gaining a better understanding of the ceramics of this period, so it is possible that occupations of this time are just underrepresented in diagnostic ceramics and are thus more difficult to identify. The information from Callar Creek Quarry provides some evidence for Protoclassic and Early Classic period occupation, although not as large an occupation as in the Preclassic and Late/Terminal Classic periods.

Although the Callar Creek Quarry households fit well within the temporal dynamics of the region, the residents’ place in larger socio-political dynamics in the region bears additional examination. Callar Creek Quarry residents show mixed signs of
wealth and some evidence of contact with regional political entities, perhaps a result of their economic roles in lithic extraction and production. Object illustrating wealth, or buying power, include the of high numbers of polychrome ceramic sherds, some which feature glyphs and pseudo-glyphs, while evidence of the political connections to the Buenavista political community include Buenavista-style sherds and the fragment of the Buenavista device. The Buenavista-style sherds and device indicate CCQ residents had contact with the Buenavista political community, possibly indirectly through the residents of Callar Creek, the closest minor center to CCQ.

In contrast with the material wealth of CCQ residents, the investment in architectural and burial furniture is rather low. Structures were not built using stone masonry and there is no evidence of corbeled vaults; presumably perishable structures were built on top of the structures, as seen from the limited amount of daub collected during excavations. CCQ Burial 1 contained only a utilitarian bowl. The limited investment in architecture and burial furniture by residents of CCQ suggests they were not that wealthy and were not invested in emulating elite architecture, a deliberate choice at other settlements in the region (see Yaeger 2000).

CCQ residents had the buying power and political capital to acquire polychrome vessels and symbols of regional political identity, but did not invest in architecture and burial goods. These data suggest that CCQ residents had some degree of wealth, but that they were not too wealthy, and that they were connected to the political community centered at Buenavista. The connection between the lithic extraction and production and relative wealth of CCQ residents will be discussed further in Chapter 9.
The relationship between the two household groups at CCQ also bears further discussion. As CCQ-1 is obviously the earlier of the two groups, why was CCQ-2 constructed? Although we can only speculate on the reasoning, it seems that CCQ-1 was still occupied when CCQ-2 was constructed. CCQ-2 was constructed in the Late Classic II to Terminal Classic period while evidence from CCQ-1 indicates occupation in the Late Classic II period with some evidence of a Terminal Classic period occupation. The three possibilities are 1) that people moved from CCQ-1 to CCQ-2 in the Terminal Classic period, 2) the household group expanded from CCQ-1 to CCQ-2 in the LC II/TC and both were occupied at the same time, or 3) a new group of people built and occupied CCQ-2. Of the three possibilities, the third, the occupation by a new group of people, is the most unlikely. The similarities between the two groups, particularly in ceramic traditions and lithic reduction practices, indicate that they were probably the same group of people, which supports the first two explanations. Explanation two has the most logical support. If the size of the group increased, placing an additional group of structures on the opposite side of the quarry might provide advantages of securing the resource from that side, and securing the group claim on the resource. Further discussion of the role of the residents of the household groups in quarrying practices is found in Chapter 9, following the discussion of production in the quarry and the reduction sequences of quarry materials in Chapter 8.
Chapter 8: Technological Organization at the Quarry and Households

The preceding chapters introduced the quarry and households surrounding Callar Creek Quarry and began comparisons between the lithics from the two areas. To fully elucidate and understand production at the quarry, how it changed through time, and the relationship with household production, the sequence of extraction and production of raw materials must be determined. This chapter addresses the technological organization of lithic materials from Callar Creek Quarry, beginning with lithic extraction and production; the discussion of quarry production will be separated chronologically, followed by a comparison of the household and quarry reduction sequences. These analyses provide a clear picture of lithic reduction which occurred at the quarry and the methods and techniques utilized.

8.1 Lithic Reduction within the Quarry

Within Callar Creek Quarry, extensive lithic reduction occurred, both testing of lithic cobbles and further core reduction, with an emphasis on generalized core reduction and the production of flake tools, as detailed below.
8.1.1 Description of the overall assemblage

The quarry assemblage, 35,652 lithics, consists predominately of flakes, followed by cores and tools, with debitage composing 99% of the quarry materials. Cores, the second most common lithic type, represent only 0.5% of lithic materials. The remaining lithics consist of bifaces, unifaces, scrapers, drills, awls, notches, and blades (Table 8.1). Cores provide important information about the reduction sequence of lithic materials, but they must be combined with information from the debitage, as cores only demonstrate the last reduction sequences that occurred, rather than the entire sequence of reduction utilized (Bietti and Grimaldi 1995; Grimaldi and Lemorini 1995; Marks and Monigal 1995).

Table 8.1: Table showing the frequency of debitage and tools from the quarry.

<table>
<thead>
<tr>
<th>Tool type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debitage*</td>
<td>31,165</td>
</tr>
<tr>
<td></td>
<td>(99.2 %)</td>
</tr>
<tr>
<td>Biface</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>(.0 %)</td>
</tr>
<tr>
<td>Uniface</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>(.1 %)</td>
</tr>
<tr>
<td>Core</td>
<td>152</td>
</tr>
<tr>
<td></td>
<td>(.5 %)</td>
</tr>
<tr>
<td>Scraper</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(0 %)</td>
</tr>
<tr>
<td>Drill</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(0 %)</td>
</tr>
<tr>
<td>Awl</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(0 %)</td>
</tr>
<tr>
<td>Notched</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>(0 %)</td>
</tr>
<tr>
<td>Blade</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(0 %)</td>
</tr>
</tbody>
</table>

* Includes retouched flakes
Debitage represents the most commonly collected material from Callar Creek Quarry, with over 99% of the assemblage. The majority of the debitage indicates that early stage, generalized core reduction occurred at the quarry. Analysis of debitage characteristics elucidates the methods and mechanisms of core reduction (Baumler 1988). The debitage consists of whole flakes, flake fragments, and shatter (Table 8.2) (Figure 8.1). Small numbers of bipolar flakes, split flakes, and broken flakes round out the remaining debitage. Perhaps the most surprising aspect of the assemblage is that shatter consists of only 22.1% of the assemblage, indicating large amounts of shatter did not result from the quarrying process. This may also have resulted from the collection process, as all materials were screened through ¼” mesh, and the shatter may not have been collected due to its small size.

<table>
<thead>
<tr>
<th>Debitage type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Flakes</td>
<td>11,523</td>
</tr>
<tr>
<td></td>
<td>(37 %)</td>
</tr>
<tr>
<td>Broken Flakes</td>
<td>163</td>
</tr>
<tr>
<td></td>
<td>(0.5 %)</td>
</tr>
<tr>
<td>Flake Fragments</td>
<td>12,500</td>
</tr>
<tr>
<td></td>
<td>(40.1 %)</td>
</tr>
<tr>
<td>Shatter</td>
<td>6,881</td>
</tr>
<tr>
<td></td>
<td>(22.1 %)</td>
</tr>
<tr>
<td>Bipolar</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(0.0 %)</td>
</tr>
<tr>
<td>Split Flakes</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>(0.0 %)</td>
</tr>
</tbody>
</table>
Hard hammer percussion predominates among flakes produced at Callar Creek Quarry, emphasizing the prevalence of large flake removals (Table 8.3) (see Figure 8.1). Large flake removals facilitate raw material testing and the reduction of cobbles for ease of transport and removal of additional lithic materials. Additional materials include small numbers of bifacial thinning and soft hammer flakes (Table 8.3; Figure 8.2) indicating the possibility of some biface production within the quarry or, more probably, biface resharpening.
Table 8.3: Technological designation of flakes from Callar Creek Quarry.

<table>
<thead>
<tr>
<th>Flake Technology</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decortication Flake</td>
<td>239 (0.8 %)</td>
</tr>
<tr>
<td>Bipolar</td>
<td>8  (0.0 %)</td>
</tr>
<tr>
<td>Bifacial thinning flake</td>
<td>148 (0.5 %)</td>
</tr>
<tr>
<td>Hard Hammer Flake</td>
<td>21,877 (70.3 %)</td>
</tr>
<tr>
<td>Other</td>
<td>8,651 (27.8 %)</td>
</tr>
<tr>
<td>Soft Hammer Flake</td>
<td>206 (0.7 %)</td>
</tr>
</tbody>
</table>

Another important technological characteristic of flakes, flake terminations, supports the presence of a relatively low rate of production errors. The majority of flakes possessed feather terminations (Table 8.4), or the termination type could not be determined. A relatively small proportion of the assemblage (10 %) showed evidence of production errors, indicating that although testing for material quality constituted much of the production at Callar Creek Quarry, such activities did not inhibit the knapping quality or increase the presence of production errors. The lack of such errors also indicates that knappers at Callar Creek Quarry were relatively skilled.

The overall size of materials from the quarry varies greatly with large and small materials present (Table 8.5). Importantly, all attributes (length, width, thickness, and weight) were measured only on whole flakes; the remainder of the debitage was only weighed due to issues with the measurement of other attributes (see Appendix I for a description of the lithic analysis procedures), which explains the greater variation in weight relative to the other metric attributes.
Table 8.4: Flake terminations from quarry contexts

<table>
<thead>
<tr>
<th>Flake Terminations</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feather</td>
<td>20,984</td>
</tr>
<tr>
<td></td>
<td>(67.4 %)</td>
</tr>
<tr>
<td>Step</td>
<td>2,836</td>
</tr>
<tr>
<td></td>
<td>(9.1 %)</td>
</tr>
<tr>
<td>Hinge</td>
<td>246</td>
</tr>
<tr>
<td></td>
<td>(0.8 %)</td>
</tr>
<tr>
<td>Overshot</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>(0.1 %)</td>
</tr>
<tr>
<td>Other/Not Applicable(^a)</td>
<td>7,027</td>
</tr>
<tr>
<td></td>
<td>(22.5 %)</td>
</tr>
</tbody>
</table>

\(^a\): Other/Not Applicable refers to items for which the termination did not fit into one of the above categories or to items for which terminations were not present (i.e. broken flakes, shatter, etc.).

Table 8.5: Size characteristics of debitage from Callar Creek Quarry (mm)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>20.1</td>
<td>.1</td>
<td>321</td>
<td>18.4</td>
</tr>
<tr>
<td>Width</td>
<td>18.6</td>
<td>.1</td>
<td>120</td>
<td>16.5</td>
</tr>
<tr>
<td>Thickness</td>
<td>8.3</td>
<td>.1</td>
<td>95</td>
<td>8.6</td>
</tr>
<tr>
<td>Weight</td>
<td>11.9</td>
<td>.1</td>
<td>531.6</td>
<td>25.1</td>
</tr>
</tbody>
</table>

The larger materials indicate early stage reduction and cobble testing, while some of the smaller material may be indicative of other sorts of production, including retouching, as discussed above (Figure 8.3). Size of lithic products is, perhaps obviously, bounded by the size of the raw material; larger pieces of raw materials permit the production of larger flakes and cores (see Dibble 1991; Dobosi 1991), as is seen at Callar Creek Quarry. Size of lithic raw materials also relates to the scarcity or prevalence of raw materials in an area or region. In areas where lithic raw materials are scarce, difficult to obtain, or unreliablely present, lithic materials tend to be further reduced, resulting in smaller flakes and cores (Dibble 1991; Marks et al. 1991; McCall et al. 2015; Soffer 1991). For example, the chert materials from Chalcatzingo, Morelos, in central Mexico show evidence of extensive reduction, specifically the reduction of nodules (probably
river cobbles) into small cores, the presence of bipolar reduction, and the overall small size of the raw materials (McCall et al. 2015). Householders at Chalcatzingo had relatively little access to local cherts, providing one explanation for the intensive use and reduction of materials, and the overall small size of those materials. Callar Creek Quarry, as a source of raw material, does not suffer from issues of chert scarcity, one explanation for large size of many materials extracted from the quarry.

Figure 8.3: Large (374B/5) and small (374D/2) flakes from the quarry.

Several technological debitage characteristics support both the early stage and generalized nature of the assemblage including platform facets, platform preparation, and dorsal flake scars. On average, the number of platform facets in the assemblage was 1.04, indicating that most flakes had 1 - 2 platform facets. Low numbers of platform facets are associated both with early stage lithic reduction and the generalized sequence of reduction, as formalized reduction sequences frequently result in larger numbers of platform facets. The majority, 99.7 % of debitage (n = 31,045) either had no platform preparation or the category was inapplicable. Of the remainder, .3 % (n = 80) illustrate battering, while one flake (.0 %) suggested grinding prior to flake removal. The low level
of platform preparation reinforces the generalized nature of core reduction, as it
necessitates little to none platform preparation.

Other evidence supportive of early stage reduction includes the low number of
dorsal flake scars, on average 1.67 (see Baumler 1988 for a discussion of the relationship
between reduction and dorsal flake scars). The lack of flake scars indicates the removal
of most flakes during early stages of the lithic reduction process.

The cortex presents a more complex picture of the reduction at Callar Creek
Quarry. While lithics representative of early stage reduction, cobble testing, and
quarrying generally contain large amounts of cortex, this is not the case at CCQ as over
half of the materials from the quarry do not possess any cortex (Table 8.6). The
unexpected trend in the lack of cortex can, however, be explained due to the varying
presence of cortex in large cobbles. The size and shape of raw material results in changes
in the possible amount of cortex; the ratio of the surface area to volume varies according
to both of these factors, and hence the maximum possible amount of cortex present also
varies (Dibble et al. 2005; Douglass 2010; Douglass et al. 2008; Lin et al. 2010). For
spheres, the closest approximation to the shape of Callar Creek Quarry raw material,
volume and surface area do not increase at the same rate. Raw material sources with
large cobbles, like this one, have lower average cortex/volume of material than ones with
small nodules (Dibble et al. 2005; see Appendix 1 for more information). As such, the
high amount of debitage without cortex should not be taken as an indicator of a lack of
early stage reduction. Instead, the lack of cortex can be explained by the large size of the
raw materials, and their shape, which means that relatively little cortex per cobble
actually existed in the quarry. Cortex presents a problematic approach for the identification of reduction stages.

### Table 8.6: Cortex percentages for debitage from Callar Creek Quarry.

<table>
<thead>
<tr>
<th>Cortex Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>21,659</td>
</tr>
<tr>
<td>1-25 %</td>
<td>3,438</td>
</tr>
<tr>
<td>26-50 %</td>
<td>2,473</td>
</tr>
<tr>
<td>51-75 %</td>
<td>802</td>
</tr>
<tr>
<td>76-100 %</td>
<td>2,758</td>
</tr>
</tbody>
</table>

Flakes with possible retouch occurred throughout Callar Creek Quarry with 5.6 % (n = 1,724) of the debitage showing possible evidence of retouch (Figure 8.4; see Appendix I for a discussion of retouch identification). The majority of possibly retouched flakes were unifacially retouched (99 %; n = 1,708) and most showed retouch on over 50% percent of the flake (87.9 %; n = 1,515). Callar Creek Quarry contained a high number of probably retouched flakes, possibly for local use or transport elsewhere. The large number of retouched flakes supports production within the quarry of flake tools, such as retouched flakes.
The debitage indicates that production at Callar Creek Quarry focused on the removal, testing, and generalized reduction of materials. The production of some retouched tools also occurred, although little evidence exists for retouched flakes, so little information about the retouching process exists.

Cores represent the second most common lithic type from quarry materials, although they represent only 0.5% of the overall assemblage. Cores are important components of the assemblage as they provide information about the methods and mechanisms utilized to produce flakes and other materials. The majority of cores, 71.7%, are multidirectional (Table 8.7), cores with flake scars removed in multiple directions and which have no clear form (Figure 8.5). Production of multidirectional cores commonly occurs with generalized core reduction. Multidirectional core reduction wastes raw materials as it is not a conservative manner of reduction; formal tools, particularly bifaces, conserve raw materials by utilizing more of the available raw material for flake or tool production (Beck et al. 2002; Beck and Jones 1997; Kelly and...
Todd 1988; Kuhn 1994; but see Douglass 2010). The multidirectional cores recovered from CCQ vary in the number of removals from the core, from those with a few removals to exhausted cores. The cores generally show no organized sequence of removals, rather they illustrate opportunistic choice of removals dependent on core characteristics such as the shape of the cobbles, raw material quality, including the presence of any inclusions, and any production errors which impeded further reduction, such as hinge or step fractures. Discard of some multidirectional cores occurred due to production errors or raw material constraints, particularly the presence of inclusions, while others were used until exhausted.
Unidirectional cores represent the next most common core type, 15.7% of the core assemblage (Table 8.7). Many unidirectional cores resulted from tests of raw material quality, which tends to be poor in these discarded examples; concerns about the shape of the raw material; the difficulty of removing flakes from the core; or knapper errors which decreased the efficacy of the piece. Few of the unidirectional cores contained large numbers of flakes removed in a single direction, instead, they tend to be discards from the testing of raw materials (Figure 8.6).

The remaining cores consist of core fragments (5%) and cores which could not be classified in any of the utilized categories (6.9%). Core fragments are partial cores which were broken, and can provide little information about the reduction of materials due to the partial nature of these materials.
Excavations recovered one formal core, a discoidal core. The discoidal core seems to be an artifact of the manner of flake removal, possibly influenced by the raw material shape, rather than an intentional attempt to create such a core (Figure 8.7). The
flat nature of the raw material eased production of this type of core while the angular and globular nature of the majority of cobbles at Callar Creek Quarry discourages discoidal core production. While discoidal cores are purposefully constructed in other world areas, this example seems to be an artifact of the reduction sequence rather than a purposeful attempt to create such a core.

Table 8.7: Frequencies of core types from Callar Creek Quarry.

<table>
<thead>
<tr>
<th>Core Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discoidal</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(.6 %)</td>
</tr>
<tr>
<td>Multidirectional</td>
<td>114</td>
</tr>
<tr>
<td></td>
<td>(71.7 %)</td>
</tr>
<tr>
<td>Unidirectional</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>(15.7 %)</td>
</tr>
<tr>
<td>Core Fragments</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>(5 %)</td>
</tr>
<tr>
<td>Other</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>(6.9 %)</td>
</tr>
</tbody>
</table>

Figure 8.7: Drawing of discoidal core (this core was recovered from a fill context, but the discoidal core from the quarry had similar properties).
The cores recovered from Callar Creek Quarry illustrate the generalized nature of the core reduction sequence. As the assemblage consists of multidirectional cores, from generalized reduction sequences, or tested cobbles, which represent the earliest stages of the production process, the cores demonstrate a generalized core reduction sequence with a focus on early stage reduction.

After retouched flakes unifaces represent the next most common tool type with 36 (0.1 % of the total assemblage). Unifaces were defined as unifacially worked lithic materials where the unifacial working covers the entirety of the object; these are formal core tools rather than flake tools or unifacially retouched flakes). The unifaces varied in size with a mean weight of 10.8 g (min = .2 g; max = 49.5 g); their size is generally more similar to the bifaces than the flakes in the assemblage. The majority of the unifaces (n = 28; 77.8 %) possessed no cortex, while the remaining eight had variable amounts of cortex. The lack of cortex indicates that the unifaces were produced from flakes removed after the initial testing and decortication of cobbles in the quarry. The relatively small number of unifaces suggests limited production.

Bifaces, all General Utility Bifaces (GUBs), characterized less than 0.1 % of the total assemblage (n = 9) (Table 8.1; Figure 8.8). An example of utilitarian bifaces, GUBs, large, thick bifacial tools were utilized for a variety of tasks, such as agricultural activities, including chopping trees and other heavy duty tasks (Clark and Woods 2014; Johnson 1976; Kidder 1947, 1948; Rovner 1975; Rovner and Lewenstein 1997; Smith and Kidder 1951; Willey 1972). Unlike bifaces in many other areas, where the goal of biface production is to thin the biface without reducing the surface area (Johnson 1981) the goal of GUB production does not seem to follow this trend as they are, in general,
very thick implements (see Clark and Woods 2014 for a further discussion of this phenomenon). The average thickness of the materials from Callar Creek Quarry is 9.5 cm (Table 8.8). The bifaces have a low Width/Thickness (W/T) ratio (Table 8.8), a measure of the completeness of bifaces which relies upon the idea that bifaces are thinned while maintaining the large overall size of the biface (see Horowitz and McCall 2013 for a description of the utility of such indices).

![Figure 8.8: Image of a GUB from the quarry (Op 374E/3).](image)

The Johnson Thinning Index (JTI) (Johnson 1981), a similar measure of biface reduction, uses the goal of biface thinning, while maintaining the width, to examine biface completeness. The JTI decreases as bifaces become thinner as it is calculated from the weight divided by plan view area of a biface. Using both weight and plan view area accounts for size differences in bifaces, so bifaces of varying sizes could be compared. However, the average JTI for the Callar Creek Quarry bifaces is 3.3, an extremely high value for this index (see Horowitz and McCall 2013). The combination of the W/T and JTI measures indicate that thinness was a property which was not desirable in these
bifaces, as the biface reduction sequence did not encourage biface thinning. The thickness, and overall large size of the bifaces, may be due to their utility in quarrying tasks where thickness aids in the extraction of chert boulders and beds, as suggested by Clark and Woods (2014) from experimental data.

<table>
<thead>
<tr>
<th>Table 8.8: Descriptive statistics for metrics of the quarry bifaces</th>
<th>Avg</th>
<th>Min</th>
<th>Max</th>
<th>St. dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (mm)</td>
<td>45.8</td>
<td>7.5</td>
<td>145</td>
<td>57.64</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>24.5</td>
<td>4.3</td>
<td>75</td>
<td>29.4</td>
</tr>
<tr>
<td>Thickness (mm)</td>
<td>9.5</td>
<td>1.5</td>
<td>39</td>
<td>13.4</td>
</tr>
<tr>
<td>Weight (g)</td>
<td>208.9</td>
<td>39.6</td>
<td>467.2</td>
<td>148.7</td>
</tr>
<tr>
<td>W/T (mm)</td>
<td>3.3</td>
<td>1.4</td>
<td>13.1</td>
<td>3.7</td>
</tr>
<tr>
<td>JTI (g/mm)</td>
<td>3.3</td>
<td>.9</td>
<td>7.6</td>
<td>2.7</td>
</tr>
</tbody>
</table>

The varying characteristics of these bifaces reveal a problematic aspect of the measurement and analysis of bifaces. GUB production aimed to create tools for heavy-duty activities, not for use as projectiles nor for transport to other locations, both of which would encourage the more conservative use of raw material, particularly biface thinning. The bifaces from CCQ, although a small sample, suggest that the function of bifaces influences the form (see Andrefsky 2005; Beck and Jones 1990; Odell 2003; Whittaker 1994), while drawing attention to the use of measures of thickness, or other morphometric characteristics without first considering the possible function of materials. This issue presents a particular problem for the use of such measurements to determine the production stage of materials, particularly as biface thinning occurs near the end of the reduction sequence (see Horowitz 2010; Horowitz and McCall 2013 for a discussion of measures of biface production and reduction and their utility).
Little evidence supports *in situ* biface production in the quarry or households. While some bifacial thinning flakes exist, the small number of such flakes recovered does not support the production of bifaces within the quarry area. Most likely, the bifaces arrived at the quarry in finished form and the few bifacial thinning flakes identified arose through retouching and resharpening of finished tools. Evidence from the Mopan Valley indicates specialized areas for biface production, supporting the importation of bifaces to CCQ in their finished form (Cap 2012; VandenBosch 1999; VandenBosch et al. 2010).

Few additional tools were recovered from the quarry. These tools include scrapers, drills, awls, notches, and blades (Table 8.1; Figure 8.9). Scrapers were distinguished from unifaces, and other formal tools as they are flake tools as well as by the types of retouch and the form of the item (similarly to the ways in which scrapers are discussed in Paleolithic contexts (i.e. Dibble 1990)). The small numbers of these tools indicate only occasional production and use. The small number of tools, and the lack of debitage indicative of retouch, implies the production of small numbers of materials for local use.

The Callar Creek Quarry lithic assemblage consisting of debitage, cores, and some tools, indicate a generalized reduction sequence with a focus on testing and early stage reduction of lithic materials with the production of some flake tools. The next section provides a discussion of the specific steps and processes of the CCQ reduction sequence.
8.1.2 Reduction sequences

The reduction sequence from Callar Creek Quarry consists of the extraction of raw materials from the quarry, initial testing for raw material quality, further core reduction, and the production of flake tools. Each of these steps will be discussed in order, along with the possible outcomes for materials during each production stage.

Raw Material Extraction

Raw material extraction occurred in three ways: 1) utilization of chert cobbles visible on the ground surface; 2) extraction of materials by digging into the hillside at the quarry cut; 3) extraction of linear beds of chert in other areas of the quarry. The removal of materials from the quarry was low intensity, none of the materials removed were difficult to extract and \textit{in situ} chert cobbles are still present on the surface of the quarry, so the quarry materials were not exhausted or in danger of exhaustion.

Utilization of varied raw materials, extracted through different methods, occurred throughout the quarry. As discussed in Chapter 6, excavations revealed that the extraction near the quarry cut was more intensive with the removal of \textit{in situ} beds of chert. The chert bed removal can be seen from their absence, combined with the
presence of debitage reminiscent of that found in in situ chert beds, in some quarry areas. The bedded chert differs in appearance from the surface nodules, whose debitage is scattered across the quarry surface. Excavations in other areas of the quarry revealed in situ chert beds which had not been extracted, so the differences in intensity in extraction varied across the quarry. A discussion of the tools used to aid in raw material extraction follows at the end of this chapter.

*Initial Testing of Materials*

After materials were removed from the quarry, initial testing and reduction occurred. Initial testing served to identify poor quality raw materials, materials with high numbers of inclusions, shapes which inhibited reduction, or variable quality. Evidence of raw material testing is seen in the presence and number of unidirectional and tested cobbles. Tested cobbles, discarded after a few removals, often illustrate internal flaws which would have led to the discard of the material without further reduction (Figure 8.10). After testing of material quality, cores were discarded or further reduced.

![Figure 8.10: Poor quality raw material illustrating reasons for the discard of tested cobbles.](image-url)
Core Reduction

Further core reduction occurred for the cores not discarded due to the raw material quality. As discussed and outlined above, this reduction took the form of generalized core reduction. The majority of cores recovered from Callar Creek Quarry are multidirectional cores and the debitage shows little to no evidence of the presence of more uniform or organized manners of core reduction.

Cores were reduced to produce flakes for flake tool production or for transport elsewhere. Evidence of core transport comes from the generally low numbers of cores in the quarry, particularly considering the amount of debitage present. To examine core transport, an estimate of the number of cores necessary to produce the flakes present in the quarry must be determined. Production estimates frequently use the production of a quantifiable product, the quantity of debitage, or production rejects.

Production estimates of materials produced through standardized reduction sequences are simple to develop as they are frequently based on some waste product from the materials produced, such as the use of tranchet flakes to estimate the intensity of tranchet adze production at Colha workshops (Shafer and Hester 1991). To produce a tranchet adze one tranchet flake must be produced. Shafer and Hester (1991) calculated the number of tranchet adzes produced in a single workshop by counting the number of tranchet flakes (see also Nelson 2000). Similarly, estimates of the production of obsidian prismatic blade cores are based on experimental knapping, and an average number of blades, and the amount of cutting edge present on those blades which could be removed from a single blade core (Sheets and Muto 1972, 1978). Henry (1995) estimated the number of points produced per core, between 2 to 5.3, but these estimates were specific
to his site in the Levant and used only for point production, which is not useful for estimating products produced from generalized core reduction. Callar Creek Quarry, as an area of generalized lithic reduction, not the production of a specific product, cannot employ any of these attempts to calculate production output.

To illustrate the variability in numbers of debitage per core present in different assemblages, Bar-Yosef (1991) discussed assemblages in the southern Levant with between 100 pieces of debitage per core while other sites have only 20 to 50 pieces of debitage per core. The differences relate to the intensity of flake removals as well as the number of materials removed from the sites for use in other areas. The number of flakes produced per core depends on the intensity of lithic reduction, the presence or scarcity of raw materials, removal of lithic materials, and the intended productions of lithic reduction (Strauss 1991), thus leading to significant variability in the number of lithics produced per core, and the methods which can be used to predict such estimates.

Another approach to estimating the number of products from Callar Creek Quarry is to estimate the number of flakes produced by a single core, a complex issue. Perhaps most importantly, different types of core reduction produce varying quantities of flakes (Boeda 1995; Delagnes 1995; Kuhn 1995; Parry and Kelly 1987). Generalized core reduction results in different numbers of flakes from core reduction aimed at specific types of core reduction. For instance, Levallois core reduction is generally thought of as a wasteful use of raw material, as it emphasizes flake size rather than number of flakes produced (Boeda 1995; Van Peer 1995). The size, shape, and other core characteristics also vary depending on the raw material size and shape (Baumler 1995; Bietti and Grimaldi 1995; Delagnes 1995; Dibble 1991; Dobosi 1991; Kuhn 1995; Marks and
Monigal 1995; Marks et al. 1991; Montet-White 1988; Strauss 1991; but see Lin et al. 2016). The impact of the size of the raw material and the differences which result from various reduction sequences make it difficult to produce generalized estimates for the numbers of flakes which could be produced from a single core.

Some problems with estimates of the number of flakes produced per core are particular to Callar Creek Quarry. Firstly, different cores were reduced with varying intensity. Of the extant cores, some were tested cores, with only a few flakes removed, while others were heavily reduced to the point where it would have been difficult to remove more flakes. The reduction intensity and the impossibility of separating thedebitage from these reduction sequences complicates any estimate of the total number of cores in the quarry as some cores produced only a few flakes while others produced many more. Additionally, the raw materials used are highly variable in size from large to small cobbles. Different sized cobbles produce varying numbers of flakes, increasing the difficulty of estimating the total number of cores present in the quarry.

Several studies of core reduction attempt to examine the level of reduction of the core from its extant characteristics (see Clarkson 2013; Dibble et al. 2005; Holdaway et al. 2014; Lin et al. 2010, 2016; Marwick 2008). As discussed elsewhere, cortex as a measure of the amount of reduction of a core, or an assemblage, is not a reliable measure without exact knowledge of the form and shape of the raw material cobbles (Dibble et al. 2005; Douglass 2010; Holdaway et al. 2014; Lin et al. 2010; but see Marwick 2008). So, use of cortex amounts on flakes and cores is a poor estimate of the number of cores produced at Callar Creek Quarry. Other estimates necessitate an estimate of the size of the original cobbles (Douglass 2010; Holdaway et al. 2014), which although possible, the
variation in cobble size from Callar Creek Quarry would place such variation in estimates of the number of cores from the quarry that these estimates would prove worthless. Clarkson (2013) employs the Scar Density Index (SDI) which uses the ratio of the number of flake scars on a core to its surface area as a measure of the amount of reduction. As more flakes are removed, the remaining core weight decreases, resulting in a measure of the remaining usable mass of the core, and possibly, a way of estimating how much of the core was reduced. However, this estimate cannot be used here as the number of core removals was not recorded for all cores.

Some reduction estimates are based on experimental reduction. Ohnuma (1995) experimentally reduced cores using Levallois and discoidal core reduction and found that for five cores 235 and 259 pieces of debitage were produced, a total of 47 and 51.8, respectively, for a single core. Using those calculations, between 614 (31,804/51.8) and 677 (31,804/47) cores were produced at Callar Creek Quarry. These estimates should be used with caution at Callar Creek Quarry as Levallois cores are known for their wasteful reduction process.

Montet-White (1988) presents an alternative method of approximating the number of flakes based on the number of cortical flakes present in an assemblage. She provides an estimate of the ratio of cortical flakes to cores as 3:1; specifically, she uses complete flakes and the proximal fragments (broken flakes) in ratios with cores. Using this ratio, 1,804 cores (5,412/3) would be present at Callar Creek Quarry. However, Montet-White (1988) based her estimates on formalized core reduction, overestimating the number of cores necessary to produce that quantity of flakes through a generalized reduction sequence.
Although neither of these methods are particularly applicable to Callar Creek Quarry, the estimates they provide far outstrip the total number of cores from the quarry, 152. These estimates suggest between 614 and 1804 cores would have had to be present in the excavated area of the quarry. Even if these estimates were halved or thirded, to account for the less formalized nature of core reduction, the estimates of the number of cores necessary to produce the debitage at Callar Creek Quarry would imply that between 205 and 601 cores would have to be present in the excavation portion of the quarry to account for the large amount of debitage present. These estimates suggest that cores were removed from the quarry for transport elsewhere, presumably for further reduction. See Section 8.3 for a further discussion of the quantification of number of cores possibly produced at the quarry.

**Flake Tool Production**

The large number of potentially retouched flakes at Callar Creek Quarry indicates flake tool production occurred at Callar Creek Quarry. Little evidence for their production, in the small retouch flakes, was recovered, although some of those flakes were probably too small to be recovered through normal screening techniques. Flake tools occurred more frequently in some areas of the quarry than others. In Op 374A/1-7, a 1 x 1 meter excavation unit, which contained 647 pieces of debitage, 110 were retouched, or 17% of the debitage. Conversely, in Op 374E/1-8, a 1 x 3 m excavation unit, only 61 of 3,986 lithics were retouched, or 1.5% of the debitage. These discrepancies emphasize the variation in retouch throughout the quarry which may be related to temporal variation in quarry use. Although some retouched flakes remained in
the quarry, it is likely that some retouched flakes were transported away from the quarry for use or exchange with other locations.

*The Reduction Sequence*

The reduction sequence of lithic materials focuses on the production of generalized flake cores and flake tools. Figure 8.11 shows the sequence of reduction while Figure 8.12 shows the sequence of behaviors associated with those reductions, including the discard or transport of raw materials. At each step of the process, materials were either subject to continued reduction, discarded, or transported elsewhere.

![Diagram of lithic reduction sequence](image)

*Figure 8.11: Lithic reduction and associated behaviors for lithic materials from Callar Creek Quarry*
Figure 8.12: Schematic of the reduction sequence for lithic materials from Callar Creek Quarry.

**Temporal Variation**

As Callar Creek Quarry was utilized from the Archaic through the Historic period, variation in lithic technologies and assemblages must be considered while addressing the reduction sequences from the quarry. The palimpsest nature of the quarry limits definitive dating of contexts to the Preclassic and the Late to Terminal Classic
periods, so potential variation in quarrying practices are limited to a discussion of these two-time periods.

Among the differences between time periods is the number of materials recovered from each area. The Late Classic contexts contained 19,099 lithics while the Preclassic contexts contained 7,780 lithics. These differences are not necessarily indicative of differing scales of production, but rather a function of which quarry contexts can be definitively dated through associations with ceramic materials.

Temporal and spatial variation co-occurred throughout the quarry. Ops 374A/1-7, 374C/1-7, and 374E/1-8 had both Late Classic and Preclassic period materials while Ops 374B/1-8 and 374F/1-9 contained mostly Late Classic materials, and Op 374D/1-10 contained mostly Preclassic period materials (see Figure 6.4; Table 6.6). These differences are important as Op 374F/1-9 was an area where bedded cherts were extracted and reduced while Op 374D/1-10 is an area of the quarry which contained bedded cherts which were not extracted, suggesting extraction intensity may have varied through time. The use and reduction of varying materials throughout the quarry could lead to differences between the materials and the characteristics of lithic materials through time.

In terms of descriptive information about the lithic materials, the Late Classic and Preclassic period materials were similar in weight, the only size measure analyzed on all materials, as seen through an t-test ($t = -0.534; df = 10735; p = .594$; see Figure 8.13). The majority of materials from both time periods were produced through probable hard hammer percussion, although this was not statistically significantly similar (Late Classic 70.9 %, n = 13,573; Preclassic 65.9 %, n = 4,617). The types of debitage, dominated by
flake fragments and broken flakes (Table 8.9) also illustrate similarities between the two contexts. The similarities in size, production methods, and debitage types produced in both time periods indicate similarities between the periods in the methods of production, particularly the focus on hard hammer percussion.

Figure 8.13: Paneled histograms of quarry material weight by time period.

Table 8.9: Table showing types of debitage recovered in Late Classic and Preclassic period quarry contexts.

<table>
<thead>
<tr>
<th>Type</th>
<th>Late Classic</th>
<th>Preclassic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Flake</td>
<td>7,319</td>
<td>2,138</td>
</tr>
<tr>
<td></td>
<td>(38.2%)</td>
<td>(30.5%)</td>
</tr>
<tr>
<td>Broken Flake</td>
<td>140</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>(.7%)</td>
<td>(0.1%)</td>
</tr>
<tr>
<td>Flake Fragment</td>
<td>7,529</td>
<td>3,077</td>
</tr>
<tr>
<td></td>
<td>(39.3%)</td>
<td>(43.9%)</td>
</tr>
<tr>
<td>Shatter</td>
<td>4,026</td>
<td>1,730</td>
</tr>
<tr>
<td></td>
<td>(21%)</td>
<td>(24.7%)</td>
</tr>
</tbody>
</table>
More specifically, similarities exist in the materials produced at the quarry. The lack of platform preparation (Table 8.10) and the low average number of platform facets (Late Classic = 1.03; Preclassic = 1.03) indicates a focus on generalized core reduction in both periods. This focus is bolstered by the low frequency of dorsal flake scars (Late Classic = 1.71; Preclassic = 1.75). Both the Preclassic and Late Classic period contexts show similar percentages of retouched flakes (Late Classic 5.3 %, n = 1,007; Preclassic 5.1 %, n = 356), indicating retouched flake production occurred in both periods. These attributes, and their similarities across time, indicate a focus on generalized core reduction, and flake tool production, in both the Preclassic and Late Classic periods.

The percentages of cortex from the two time periods (Table 8.11) illustrate similar trends, although these similarities were not statistically significant. Both periods show higher numbers of lithics with no or little cortex, with fewer items with large amounts of cortex. As discussed elsewhere, this distribution of cortex is probably due to the shape and size of the raw material cobbles; that is, that large cobbles contain less cortex than they do interior flakes, so cortical flakes are underrepresented in the assemblage.

Table 8.10: Table showing frequencies of platform preparation in Late Classic and Preclassic periods quarry contexts.

<table>
<thead>
<tr>
<th>Platform Preparation</th>
<th>Late Classic</th>
<th>Preclassic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Applicable</td>
<td>11,796 (%)</td>
<td>4,856 (%)</td>
</tr>
<tr>
<td>None</td>
<td>7,267 (%)</td>
<td>2,138 (%)</td>
</tr>
<tr>
<td>Battering</td>
<td>60 (.3 %)</td>
<td>8 (.1 %)</td>
</tr>
<tr>
<td>Ground</td>
<td>1 (0 %)</td>
<td>0 (0 %)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (0 %)</td>
<td>0 (0 %)</td>
</tr>
</tbody>
</table>
Table 8.11: Cortex percentages in the Late Classic and Preclassic periods quarry contexts.

<table>
<thead>
<tr>
<th>Cortex</th>
<th>Late Classic</th>
<th>Preclassic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>13,235</td>
<td>4,774</td>
</tr>
<tr>
<td>(69.1 %)</td>
<td>(68.1 %)</td>
<td></td>
</tr>
<tr>
<td>0 – 25</td>
<td>1,917</td>
<td>970</td>
</tr>
<tr>
<td>(10%)</td>
<td>(13.9 %)</td>
<td></td>
</tr>
<tr>
<td>26 – 50</td>
<td>1,738</td>
<td>405</td>
</tr>
<tr>
<td>(9.1 %)</td>
<td>(5.8 %)</td>
<td></td>
</tr>
<tr>
<td>51 – 75</td>
<td>520</td>
<td>173</td>
</tr>
<tr>
<td>(2.7 %)</td>
<td>(2.5 %)</td>
<td></td>
</tr>
<tr>
<td>76 - 100</td>
<td>1,720</td>
<td>680</td>
</tr>
<tr>
<td>(9 %)</td>
<td>(9.7 %)</td>
<td></td>
</tr>
</tbody>
</table>

A final point of comparison is the frequency of flake terminations throughout the quarry (Table 8.12). Again, these patterns show similarities, although not at a level of statistical significance. Both time periods show a predominance of feather terminations, with relatively few production errors as seen from step and hinge terminations. The similarities in flake terminations supports relatively similar levels of skill across these periods as well as indicating that testing of raw materials, and particularly poor quality raw materials, did not drastically increase the number of production errors, as they are low for both time periods (Table 8.12).

Table 8.12: Flake terminations from Preclassic and Late Classic periods quarry contexts.

<table>
<thead>
<tr>
<th>Flake terminations</th>
<th>Late Classic</th>
<th>Preclassic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feather</td>
<td>12,937</td>
<td>4,664</td>
</tr>
<tr>
<td>(67.6 %)</td>
<td>(66.6 %)</td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>1,799</td>
<td>545</td>
</tr>
<tr>
<td>(9.4 %)</td>
<td>(7.8 %)</td>
<td></td>
</tr>
<tr>
<td>Hinge</td>
<td>137</td>
<td>20</td>
</tr>
<tr>
<td>(.7 %)</td>
<td>(.3 %)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>4,052</td>
<td>1,721</td>
</tr>
<tr>
<td>(21.1 %)</td>
<td>(24.5 %)</td>
<td></td>
</tr>
</tbody>
</table>
The comparisons between lithic materials from the Late Classic and Preclassic periods quarry contexts illustrate similarities in the reduction sequence and aims of reduction in the two periods. Both are dominated by generalized reduction sequences with a focus on the production of generalized cores and flake tools.

Cores from Late Classic and Preclassic period contexts also indicate generalized reduction. Only .4 % (n = 30) of Preclassic period quarry remains and .4 % (n = 68) of the Late Classic period quarry materials consisted of cores. In both cases, multidirectional, unidirectional tested cores, and core fragments were present, with multidirectional cores dominating (Table 8.13). The presence of unidirectional, tested cobbles indicates initial raw material testing for raw material quality while the multidirectional cores supports the presence of generalized core reduction at the quarry.

Table 8.13: Core types from Late Classic and Preclassic Quarry Contexts.

<table>
<thead>
<tr>
<th>Core Type</th>
<th>Late Classic</th>
<th>Preclassic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multidirectional</td>
<td>44 (64.7 %)</td>
<td>25 (83.3 %)</td>
</tr>
<tr>
<td>Unidirectional</td>
<td>12 (17.6 %)</td>
<td>3 (10 %)</td>
</tr>
<tr>
<td>Core Fragments</td>
<td>12 (17.6 %)</td>
<td>2 (6.7 %)</td>
</tr>
<tr>
<td>Total</td>
<td>68 (100 %)</td>
<td>30 (100 %)</td>
</tr>
</tbody>
</table>

Despite the similarities in reduction, and particularly the aim of reduction, between the Preclassic and the Late Classic periods, some differences exist between thedebitage from these two periods. The main difference is the use of raw materials as illustrated by differences in the color \( (x^2 = 333.53; df = 24; p < .001) \) and quality \( (x^2 = 325.8; df = 12; p < .001) \) of the raw material. These differences probably related to the different areas of the quarry from which these raw materials were extracted. Although
high, low, and medium quality raw materials were used in both time periods, a higher number of medium quality raw materials seem to be utilized in the Late Classic period than in the Preclassic period. Both time periods also show use of the full variety of raw material colors found in the quarry, although a slightly higher percentage of raw materials in the Late Classic period were made on brown chert than during the Preclassic period. The differences are due, at least in part, to the areas of the quarry from which the materials come, which have different types of raw materials. The differences between these materials could also lead to some minor differences in characteristics discussed above.

In general, the materials from the Late Classic and Preclassic period contexts from Callar Creek Quarry are similar, indicating that the reduction sequence in Figures 8.11 and 8.12 present a good generalized schematic for reduction through time at Callar Creek Quarry. The main differences in the materials stem from the extraction of raw materials from different areas of the quarry, and hence the use of different raw materials.

A note of caution should be mentioned; although the current evidence indicates the use of different areas of the quarry, and hence different materials, in different time periods it is impossible to state if this difference was widespread through time due to the large number of quarry areas which cannot be dated to a specific period. Hence, although the datable sample illustrates these differences, they should not be extrapolated to indicate that such trends were common throughout time.

**8.2 Quarry and Household Production Sequences**

Comparisons between the lithic assemblages illustrate that the same reduction processes, and hence similar peoples, produced materials in the quarry and surrounding
households. The expectations for comparisons include that if the reduction sequences and techniques utilized in the two areas are similar the types and techniques utilized to produce flakes, including similar proportions of errors in production and in types of cores and core reduction techniques should be present. Dissimilarities between the two areas would be expected in the cortex amounts as the quarry should also have a higher proportion of flakes with cortex as removal of cortex occurs during testing and initial lithic reduction.

Comparisons between the households and the quarry will be performed by time period. Unfortunately, due to the palimpsest nature of the quarry and the number of mixed contexts, quarry contexts could only be definitively dated to the Preclassic or the Late/Terminal Classic periods as discussed above, so comparisons will be restricted to these time periods. Materials from the Preclassic period indicate generalized core reduction occurred in both the households and in the quarry. The Preclassic period contexts in the quarry contained 6,999 with 793 from the households, the majority of which consist of debitage (quarry: 99.4 % (n = 6,957); households: 99.4% (n = 788)).

Both contexts also had similar proportions of cores, 0.4 % (n = 30) and 0.3 % (n = 2), respectively. Of these cores, 25 of those from the quarry and both of those from the household groups were multidirectional, which speaks to the generalized nature of core reduction in these contexts. The remaining five cores from the quarry were unidirectional, tested cobbles (n = 3) and core fragments (n = 2).

In terms of technological aspects of the flakes, the majority were produced through hard hammer percussion (quarry = 65.9 % (n = 4,617); households = 75 % (n = 595)) or an undetermined production method (quarry = 32.9 % (n = 2,304); households =
17.9% (n = 142)). The predominance of hard hammer percussion supports a generalized core reduction sequence. Other evidence which supports the generalized nature of the core reduction includes the low number of platform facets (quarry average = 1.03, household average = 1.06; Figure 8.14) and dorsal flake scars (quarry average = 1.75, household average 2.01; Figure 8.15). Both of these technological aspects indicate generalized core reduction.

Flake terminations illustrate similarities between the two areas. The majority of flakes in both contexts had feather terminations with relatively few step and hinge fractures (Table 8.14). The relatively uncommon nature of these errors speaks to the skill of producers and its similarities across contexts.

![Figure 8.14: Counts of Platform Facets from the Quarry and Households in the Preclassic.](image)
As expected, some differences were present between the quarry and the habitation groups. These include a higher frequency of dorsal flake scars at the habitation groups than at the quarry ($t = -6.154, df = 858.7, p < .000$; Figure 8.15). While the means between the groups show little separation (quarry mean = 1.75; household mean = 2.01) this difference can be explained by the dynamics between the quarry and household. As earlier stage production would have occurred at the quarry, items in the households might
be expected to show some evidence of later stages of production, as further reduction occurred. The slight increase in the number of dorsal flake scars in the habitation groups over the quarry areas supports this argument. The cortex percentages between groups are also statistically significantly different \( (x^2 = 576; df = 4; p < .001) \) and present a complex picture. The quarry materials tend to have no cortex or limited amounts of cortex, while materials from the households seem to have more debitage possessing middle ranges of cortex (Table 8.15). This may be due to the interplay between volume of cores and surface area, discussed further in Chapter 8. So cortical removals in the quarry could have been transported to the households for use or CCQ residents could have been reducing smaller nodules in the household areas, which would result in the higher amounts of cortex. The size of the materials between the two contexts was actually similar when considering weight, the only scalar variable measured on all materials. As only whole flakes are subject to other size measures, weight is the most accurate measure of size in the different groups. The weight of materials showed similarities between the two areas \( (t = -1.71, df = 1302, p = .864; \text{Figure 8.16}) \).

<table>
<thead>
<tr>
<th>Context</th>
<th>None</th>
<th>1-25%</th>
<th>26 – 50 %</th>
<th>51 – 75 %</th>
<th>76 -100 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry</td>
<td>4,774</td>
<td>970</td>
<td>405</td>
<td>173</td>
<td>680</td>
</tr>
<tr>
<td></td>
<td>(68.1 %)</td>
<td>(13.9 %)</td>
<td>(5.8 %)</td>
<td>(2.5 %)</td>
<td>(9.7 %)</td>
</tr>
<tr>
<td>Households</td>
<td>458</td>
<td>100</td>
<td>111</td>
<td>31</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>(57.7 %)</td>
<td>(12.6 %)</td>
<td>(14 %)</td>
<td>(3.9 %)</td>
<td>(11.8 %)</td>
</tr>
</tbody>
</table>
This analysis of the Preclassic period materials from the quarry and households shows a complex relationship. Both areas illustrate generalized core reduction through the predominance of flakes, generalized flake cores, and indicators of the generalized sequence of production including low dorsal flake scar and platform facet counts. Evidence for similarities in production between areas derives from similarities in the proportions of flake terminations, supporting similar skill levels. Differences between the groups, such as the varying frequencies of cortex percentages and the higher frequencies of dorsal flake scars in the households, indicates that materials in the households were further reduced from those in the quarry; that is, materials in the quarry were from testing cobbles while some additional reduction occurred in the household areas. This is logical as if materials were transported from the quarry, they would be
subject to additional reduction and use within the households. The further reduction at households in the Preclassic period does not indicate household occupants were not producing material in the quarry. In fact, it indicates they removed material for use and production for household consumption in addition to production in the quarry. Thus, the information from the analysis of the Preclassic period materials in the quarry and the households supports a shared production sequence between these two areas.

I will now discuss the materials from Late Classic period contexts in these two areas. The Late Classic period materials indicate generalized core reduction for the purpose of the production of generalized flake cores and some flake tools. As with the Preclassic period materials, the majority of lithics in both areas were debitage (quarry 99.3 % (n = 18,985); households 98.9 % (n = 2,701) with the remainder made up of cores (quarry 0.4 % (n = 69); households 0.5 % (n = 15), and other miscellaneous items. As in the Preclassic period component, the majority of cores in both contexts were multidirectional (quarry = 44; households = 12), with additional unidirectional, tested cobbles in the quarry (n = 12), and core fragments (quarry = 12; households = 3). The cores support the attribution of these materials to generalized core reduction. Other evidence supporting the presence of generalized core reduction includes the low average number of dorsal flake scars (quarry = 1.71; households = 1.73; Figure 8.17) and platform facets (quarry = 1.03; households = 1.04; Figure 8.18), both of which support the attribution of generalized core reductions. Both dorsal flake scars ($t = -.987$, $df=2999.8$, $p = .324$; Figure 8.17) and the number of platform facets ($t = .734$, $df=936.7$, $p = .463$; Figure 8.18) also show statistical similarities between the two areas, demonstrating they come from the same population.
Figure 8.17: Dorsal Flake Scar counts for Late/Terminal Classic quarry and household contexts.

Figure 8.18: Platform Facet Counts for Late/Terminal Classic quarry and household contexts.
Similarities between the two groups are also found in the proportions of types of flake terminations. The majority of terminations in both contexts are feather terminations followed by step and hinge terminations (Table 8.16). The similarities between the two types of terminations are indicative of similarities in reduction skill between the knappers in the two areas. Further similarities, and evidence of generalized core reduction comes from the predominance of hard hammer percussion, with 71 % and 75.2 % of debitage in the quarry and households, respectively. The size of materials, when examined from weight, the most all-inclusive size measure, as all materials are weighed and only some have additional size measures (see Appendix I for a discussion of the lithic analysis protocol), also demonstrates similarities between the materials from different areas ($t = .835; df = 3565; p = .404$; Figure 8.19).

<table>
<thead>
<tr>
<th>Context</th>
<th>Feather</th>
<th>Step</th>
<th>Hinge</th>
<th>Other/Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry</td>
<td>12,937</td>
<td>1,799</td>
<td>137</td>
<td>4,238</td>
<td>19,111</td>
</tr>
<tr>
<td></td>
<td>(67.7 %)</td>
<td>(9.4 %)</td>
<td>(0.7 %)</td>
<td>(22.1 %)</td>
<td>(100 %)</td>
</tr>
<tr>
<td>Households</td>
<td>1,907</td>
<td>276</td>
<td>22</td>
<td>527</td>
<td>2,732</td>
</tr>
<tr>
<td></td>
<td>(69.8 %)</td>
<td>(10.1 %)</td>
<td>(.8 %)</td>
<td>(19.3 %)</td>
<td>(100 %)</td>
</tr>
</tbody>
</table>
Figure 8.19: Weight of Late/Terminal Classic quarry and household materials.

Differences between the two areas are seen, as would be expected due to the differences in reduction stage between the areas. Cortex percentages follow the same patterns as in the Preclassic period data, with more evidence of items with middle ranges of cortex in the households, due to dynamics of cobble size – with smaller cobbles having more cortex in proportion to the overall volume than larger ones. The cortex from the quarry and the households is statistically significantly different ($\chi^2 = 106.38$, $df = 4$, $p < .001$). This indicates a similar pattern in the transport of materials from the quarry to the household as seen in the Preclassic period (Table 8.17).
Table 8.17: Counts showing the percentage of cortex in the Late/Terminal Classic period quarry and household deposits

<table>
<thead>
<tr>
<th>Context</th>
<th>None</th>
<th>1-25 %</th>
<th>26 – 50 %</th>
<th>51 – 75 %</th>
<th>76 – 100 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry</td>
<td>13,235</td>
<td>1,917</td>
<td>1,738</td>
<td>520</td>
<td>1,721</td>
</tr>
<tr>
<td></td>
<td>(69.2 %)</td>
<td>(10.5%)</td>
<td>(9.1 %)</td>
<td>(2.7 %)</td>
<td>(9 %)</td>
</tr>
<tr>
<td>Households</td>
<td>1,631</td>
<td>369</td>
<td>313</td>
<td>91</td>
<td>334</td>
</tr>
<tr>
<td></td>
<td>(59.6 %)</td>
<td>(13.5 %)</td>
<td>(11.4 %)</td>
<td>(3.3 %)</td>
<td>(12.2 %)</td>
</tr>
</tbody>
</table>

In summary, the patterns in the lithic materials from the Late Classic period indicate similarities between the household and quarry in the aim of reduction, generalized flake cores, reduction skill, as seen through flake termination patterns, and various technological attributes including dorsal flake scars, platform facets, and the type of percussion used in reduction. Differences in the two areas include the amounts of cortex, probably due to patterns of reduction from transport to a different area and the differing amounts of cortex on nodules of varying sizes, with smaller nodules having larger amounts of cortex per volume than larger ones. The patterns from the Late Classic period indicate similarities in reduction between the quarry and the households.

A further discussion of the exact steps of production which occurred at the households and the quarry, however, warrants further discussion. While, as shown here, there are many similarities, some differences between the exact reduction trajectories were noted.

Perhaps the greatest difference in the reduction sequence for the two areas is the absence of quarrying and the initial testing of cobbles in the households. As material extraction occurred in the quarry, the reduction sequence of materials in the households began with generalized core reduction, rather than with the extraction and initial testing of the raw material cobbles (Figures 8.20; 8.21). As such, we would expect slightly lower frequencies of tested cobbles in the households than the quarries, although the
small number of cores from the households prohibits such a comparison. Several technological characteristics, including the number of dorsal flake scars, support the slightly later stage reduction at the households. The average number of dorsal flake scars from the households is 1.77 while that from the quarry is 1.67, indicating that slightly more/later stage reduction occurred at the households as opposed to the quarry.

Figure 8.20: Lithic reduction and associated behaviors for the lithic materials from the households around Callar Creek Quarry.

Figure 8.21: Schematic of the reduction sequence for lithic materials from the households around CCQ.
Furthermore, as indicated in Figures 8.20 and 8.21, the emphasis on production in the households focused on materials for local utilization. No evidence, particularly given the density of lithic debitage at the households, indicates production occurred for uses other than household use. For comparison, off-structure deposits from CCQ-1 had a density of 400.5 lithics/m$^3$ (84.5 lithics/m$^2$) CCQ-2 a density of 470.7 lithics/m$^3$ (213.6 lithics/m$^2$), and the debitage mound a density of 3,181.4 lithics/m$^3$. The scale of production of lithic materials is much lower than at the quarry, a possible indicator of production for household use rather than for exchange in these areas. The materials from the households have similar proportions of probable retouched and utilized flakes to those from the quarry. Although this does not directly indicate household use of the lithic resources, the presence of the lithics near the households implies some use of these items. The large quantity of readily available lithic resources may have resulted in non-intensive use of lithic materials, which thus do not show indications of use.

In comparison with other households in the Mopan Valley, CCQ-1 and 2 demonstrate a greater density of lithic reduction. At San Lorenzo, SL-22 and SL-28, excavations recovered 84 (.58 lithics/m$^2$) and 559 (4.8 lithics/m$^2$) lithics respectively (see Chapter 7 for a more detailed comparison). The Callar Creek Quarry households had almost 17 times denser debitage deposits than those from SL-22 and SL-28. However, comparisons with the lithic producing areas at Succotz households had denser deposits than at CCQ-1 and 2. The lithic producing areas in Succotz produced bifaces for use and distribution beyond the household.

VandenBosch (1999) examined the density of lithic materials by using ceramic counts as opposed to excavation area or volume. He compared the count of rim sherds to
the count of lithic materials to determine the lithic density. He used only whole and proximal (referred to in this dissertation as broken fragments) flakes, cores, and formal tools to calculate the number of lithic materials. VandenBosch suggests the use of whole and proximal flakes creates a Minimum Number of Individuals (MNI) for the flakes, as it prevents possible over counting from the inclusion of the proximal and distal end of the same flake. However, VandenBosch’s comparison method is problematic as the number of ceramics and rim sherds themselves are not consistently present and can vary depending on a variety of circumstances. Thus, using a comparison based on the number of these items present does not take into account the variation represented by the number of sherds while evaluating lithic densities. However, as the Succotz densities are presented in this way, comparisons here will utilize these calculations.

The comparison with Succotz focuses on TA1-002 and TA1-003. TA1-002 is a household group with evidence of lithic production which is located adjacent to the quarry area, found in TA1-003. Additional descriptions of these areas occur in Chapters 3 and 5. The ratio of lithics/rims from Succotz TA1-002, the household group adjacent to the production area at Succotz, where lithic production occurred in a production area not the households, similar to that from Callar Creek Quarry 1 and 2 (Table 8.18). These similarities suggest that the CCQ-1 and 2 households were only producing materials for household use and the main production occurred within the boundary of the quarry.
Table 8.18: Table comparing rations of rims and debitage from Callar Creek Quarry and Succotz. All Succotz data comes from VandenBosch (1999). The number of utilized flakes is included in the Flake MNI for the Callar Creek Quarry data.

<table>
<thead>
<tr>
<th>Site</th>
<th>Rims</th>
<th>Flake MNI</th>
<th>Cores</th>
<th>Utilized flakes</th>
<th>Unifaces</th>
<th>Bifaces</th>
<th>Lithic total</th>
<th>Lithics/rim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Succotz TA1-002</td>
<td>97</td>
<td>523</td>
<td>5</td>
<td>12</td>
<td>11</td>
<td>29</td>
<td>580</td>
<td>5.4</td>
</tr>
<tr>
<td>Succotz TA1-003</td>
<td>2</td>
<td>42</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>43</td>
<td>21.5</td>
</tr>
<tr>
<td>CCQ-1</td>
<td>92</td>
<td>562</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>571</td>
<td>6.2</td>
</tr>
<tr>
<td>CCQ-2</td>
<td>69</td>
<td>804</td>
<td>10</td>
<td>0</td>
<td>10</td>
<td>2</td>
<td>826</td>
<td>12.0</td>
</tr>
</tbody>
</table>

The focus on production in the household for household use, with production in the quarry for other purposes is logical. To transport the lithic materials to the households for reduction would require extra energetic input; if the goal of the reduction of these materials was simply to exchange them or transport them elsewhere for exchange, then the transport of materials to the households for reduction is a repetitive step. It is also more efficient to perform all the reduction within the quarry area, hence eliminating the extra step of moving the lithic materials (which are rather heavy) more than necessary. The reduction in the quarry would not be inconvenient, as the households are rather close to the quarry, and depending on where within the quarry one was, arriving at the households would take between one and ten minutes.

The analysis of the household and quarry materials through time indicates that household occupants were involved in the production of lithic materials. The role the occupants played, and the importance of that involvement, will be examined in the discussion and conclusion of this dissertation. Furthermore, the reduction sequence at the households is a restricted version of that seen in the quarry. The steps of extraction and initial testing of raw material are present only in the quarry, and the focus in the
households was on reduction for personal use. A further discussion of the quantity of materials produced in the quarry is found in the next section.

8.3 Quantification of Quarried Materials

The amount of materials extracted from a quarry provides information on the intensity of reduction and the potential for distribution of materials elsewhere. Studies of extraction and production amounts can be rather difficult, particularly in cases of generalized reduction, such as that seen here (see Shott and Olsen 2015 for an overview of problems with quarry production estimates). Furthermore, the lack of clear temporal control problematizes extraction estimates. As discussed in Chapter 6, ceramics indicate the use of the quarry began as early as the Archaic period and continued into the Historic period, a span of over 2,000 years. The length of quarry utilization inhibits estimates of quarry extraction as few areas can be specifically and definitively dated to a single period.

Some studies of quarries estimated the amount of material extracted based on the size of the quarry pits or areas (Daras 1999; Gramly 1984; Tripcevich and Contreras 2013). This strategy works best for open pit or gallery mines when a clear idea of the size of the area from which materials were extracted is available and when the density of materials within the matrix is known. In other cases, the tailing piles, or discarded materials, can also help estimate the amount of materials extracted (Schultze 2013). The problem for Callar Creek Quarry is that as materials were extracted in different manners, and some areas which were used for extraction were refilled with debitage, neither the volume of excavated areas, nor the density of materials within the matrix is known for the
whole quarry, so this is not a good manner of estimating the volume of materials produced.

A possible manner of estimating the amount of materials reduced from the quarry is to use weight and excavated area to estimate a weight excavated per cubic meter. The total weight of lithic materials analyzed from Callar Creek Quarry is 401,972.3 g. A total of 8.2 m$^3$ were excavated from the quarry, for a total of 49,021 g/m$^3$ of lithic materials.

In an attempt to extrapolate the amount of lithic materials from excavated contexts to a total amount excavated from the quarry, I use the weight of materials collected as an average weight for materials throughout the quarry. The area of Callar Creek Quarry is approximately 80 x 100 m$^2$ and on average, excavation units excavated to bedrock were about 1 meter in depth (some were greater, thus this is a conservative estimate of the possible area of quarried materials), resulting in an area of 8,000 m$^3$ for the quarry. Using the amount of lithics (g/m$^3$) for the excavated area of the quarry results in an estimate of 392,168,000 g (392,168 kg) of quarried material for the entirety of the quarry (total quarry area m$^3$ x weight of excavated lithics per m$^3$).

To address the number of cores which could have been produced, introduced in Section 8.1.2, I used the weight of the cores and remaining lithic materials collected to create a proportion of the estimated weight of materials which would be cores. The total weight of excavated cores from the quarry is 35,675.3 g, thus non-core items collected weighed 366,297 g. The ratio of core to other lithic materials weight is .0974 (35,675.3/366,297). By multiplying this ratio by the estimated total weight of materials from the quarry, I estimate the total weight of cores from the quarry as 38,197,163 g (392,168,000 g * .0974). Excavated cores from the quarry weigh an average of 234 g
(range .7 - 679.5 g). Thus, I estimate a total production from the quarry of 163,235 cores (range from 56,213 - 38,197,163; estimated total weight of cores produced/average weight of excavated cores; 38,197,163 g/234 g).

This estimate of the number of cores produced at the quarry provides a wide range of possibilities (average 163,235; range 56,213 – 38,197,163 cores). The large number of cores estimated, combined with the estimates in Section 8.1.2 of the number of cores which would have been necessary to produce the number of flakes excavated from the quarry suggests that the amount of materials produced at the quarry far outstrips the amount of materials which would have been used by the residents of the CCQ households. Furthermore, the number of cores recovered from CCQ-2 as fill (92; see Section 7.3.2) would not account for the remaining cores from the quarry either. Thus, while not as intensive as production elsewhere in the Maya area (such as the Succotz workshop and Colha), I argue that at Callar Creek Quarry cores produced at the quarry were transported away for the quarry for reduction elsewhere. The estimate of the number of cores produced is low enough that a few part-time or periodic lithic producers could produce them, thus suggesting Callar Creek Quarry producers also participated in other economic activities (presumably farming but also possibly other craft production activities).

Although this estimate of materials produced at the quarry provides a useful metric with which to evaluate the intensity and amount of materials produced, it has some limitations. First, it is just that, an estimate. This estimate ignores temporal issues altogether, as any sort of temporal division would increase the difficulty in creating an estimate. This estimate also fails to consider the probable variation in amount of lithic
materials present across different areas of the quarry. The excavated areas varied in density of lithics excavated, thus using the average density of materials from these areas accounts for some of this variability.

This estimate also assumes that the excavated areas are representative of the materials across the area. The areas selected for excavation were chosen based on the surface collections performed at the quarry. The surface collections, discussed in Section 6.2, covered the extent of the quarry and illustrated that materials were present across its entirety. Areas chosen for excavation included locations where surface collections revealed both large and small amounts of lithic debitage as well as areas both close to and at a distance from the quarry face. Thus, the combination of systematic collection across the quarry and the variety of areas excavated indicates that the materials collected are representative of materials from the quarry as a whole. Furthermore, comparisons of lithics from different areas of the quarry (see Chapter 6 and Section 8.1) illustrate that they are similar throughout the quarry, with no major variability in the materials collected. Given the similarities of lithics throughout the quarry, I argue that the density and attributes of the lithics can be used to extrapolate for the entire quarry area, to provide the estimate of the total number of cores produced.

Although the estimate created here has its limitations, the estimate of 56,213 – 38,197,163 cores produced at Callar Creek Quarry provides a metric with which to evaluate the intensity of lithic production and potential for transport of cores away from the quarry. The amount of lithic production suggests periodic or part-time production and the transport of raw materials away from the quarry for further reduction and use elsewhere.
8.4 Production Tools

To follow the discussion of the nature of quarrying and production of lithic materials at Callar Creek Quarry, I provide a discussion of the tools utilized for such production. Given the nature and longevity of production in the quarry, tools used for quarrying and the production of lithic materials are relatively rare, a not uncommon in quarry settings (see Cobb 2000). Tools useful for quarrying might include bifaces while the production of lithic materials requires hammerstones which will not fracture on impact with the core.

Although formal tools are not necessary for quarrying, bifaces might be useful for such activities. A total of nine bifaces were recovered from the quarry, four from surface collections and five from excavations. Of these bifaces, two were broken during production and the remaining seven were late stage bifaces, two of which were broken during use. Both broken bifaces illustrate impact fractures, evidence of breakage from impact with another object, possibly from striking other hard raw materials when used in quarrying. The bifaces were of varying quality and constructed from variable raw materials, some of relatively high quality and others of rather low quality, including a single limestone biface (Figure 8.22). The two bifaces which were broken in production were presumably produced within Callar Creek Quarry, although limited evidence of biface thinning or production flakes was recovered during quarry investigations. All bifaces are General Utility Bifaces (GUB) and rather large (one of the bifaces recovered during the surface collection weighed 422.2 grams, illustrating the large size of some of these materials) (Table 8.8). The bifaces from Callar Creek Quarry could have been used for a variety of purposes, but their presence within the quarry debitage suggests use for
the extraction of raw materials; bifaces could have been used to dig out large chert cobbles from the soil matrix.

Figure 8.22: photographs of bifaces from the quarry (Op 374A/3, LT – 506; Op 374E/3 LT-526, LT-631)

The single limestone biface supports the use of these implements as quarrying tools (Horowitz et al. 2014). A study of limestone bifaces indicates their properties, including the large overall size and thickness of the bifaces (see Table 8.8), probably resulted from a functional preference for bifaces with these properties for specific tasks including quarrying. Limestone bifaces might be particularly useful in a chert quarry as they are less likely to fracture on impact with chert cobbles than chert bifaces. As such, it seems likely that the bifaces from the quarry, particularly the limestone biface, were used for quarrying.

Few examples of possible production tools exist within the quarry. In fact, a single hammerstone fragment was collected from the debitage mound, a piece of granite broken in half with wear on one side indicative of battering (Figure 8.23). The only other groundstone in the quarry is a fragment of a granite bark beater from Op 374A/2 (Figure 8.24). Although there is no evidence the bark beater was used in lithic production, as
such a small fragment remains, it is possible that a broken bark beater was repurposed for use in the quarry, presumably as a hammerstone.

The lack of evidence for hammerstones in the quarry can be explained through a discussion of the local geology. Materials best suited for hammerstones are those which do not possess the properties which encourage conchoidal fracture, as they are less likely to break when used for percussion. Materials which fracture conchoidally tend to possess
the following characteristics: relatively small internal grain size, brittle, elastic, and internal homogeneity (Andrefsky 2005; Odell 2003; Whittaker 1994). Raw materials for chipped stone tool production preferably possess these characteristics, while hammerstones do not, to discourage the fracturing of a hammer through percussion (Andrefsky 2005; Odell 2003; Whittaker 1994). As discussed elsewhere in this dissertation, the geologic formations around Callar Creek Quarry contain chert bearing limestones, with chert and limestone as the most prevalent local raw materials (Cornec 2004). Limestone, the most prevalent local raw material, can be used for construction, the production of lime plaster, ornament production, and on occasion, lithic tool production (i.e. G. Braswell et al. 2008; Cap 2015; Cap et al. 2015; Dahlin et al. 2011; Hearth and Fedick 2011; Horowitz et al. 2014; Kamp et al. 2006; Murakami 2010; Stockton 2013; Wyatt 2008). Limestone, however, is a poor material for use as a hammerstone for hard hammer percussion, the production type most readily practiced at the quarry. Although small limestone cobbles can be used in soft hammer production, and have been identified elsewhere in the Maya area (see Paling 2008), the softness and friability of the raw material decreases its utility for hard hammer percussion. Similarly, chert is a poor raw material for hammerstones, as chert possesses properties which encourage conchoidal fracture, making chert likely to fracture during production, although evidence from the households around CCQ indicates some use of chert for hammerstones.

Favorable raw materials for hammerstones, items lacking in the properties of conchoidal fracture, include granites, basalts, and other non-fine grained extrusive igneous rock (Whittaker 1994). Such materials are used as hammerstones worldwide (i.e.
Bradley and Suthren 1990; Cobb 2000; Franklin et al. 2012; Kyle 1996; Mitchell and Foster 2000; Patton 1991; Stoltman et al. 1984; Singer 1984; Stoker and Cobean 1984; Turnbaugh et al. 1984; Whittaker 1994; Will et al. 2014). The Maya Mountains are the closest source of such material to Callar Creek Quarry (Abramiuk and Meurer 2006; Graham 1987; Dixon 1956). The difficulty in transporting granite and other similar resources, due to its weight, increases the value and scarcity of these resources. The one definite hammerstone from Callar Creek Quarry is made of granite, and although no sourcing has been performed, it probably comes from the Maya Mountains. Due to the scarcity, and presumed difficulty in obtaining such resources, residents of Callar Creek Quarry reused broken groundstone tools as hammerstones, as supported by evidence from the household groups.

Evidence from the household areas, including construction fill contexts, supports the use of broken manos and metates as hammerstones (see Clark 1988; Weeks 1980 for examples of this elsewhere in the Maya area). Callar Creek Quarry 1 contained six granite mano fragments possibly reused as hammerstones (Figure 8.25). The small size of the items makes it difficult to confirm the original use as manos, but battering along the edges indicates use as hammers. One hammerstone was recovered from off-structure excavations at CCQ-1, a granite hammerstone with definitive evidence of battering. Fill contexts also contained two chert cores, with evidence for use as hammerstones (Ops 381C and 381D/2) (Figure 8.26), indicating some use of chert for hammering.
Callar Creek Quarry 2 construction fill contained three hammerstones and five mano fragments, of which one shows definitive evidence of reuse as a hammerstone, and two others illustrate probable reuse for hammering (Figure 8.27). The construction fill of CCQ-2 Str. 1 also revealed two quartz hammerstones (Ops 373B/3 and 373B/12); both show evidence of battering and are broken, presumably due to their use in lithic
production (Figure 8.28). The closest source of quartz to the Belize Valley is the Maya Mountains (Cornec 2004).

Figure 8.27: Hammerstones from CCQ -2 (Ops 373A/12; 373B/1; 373B/7)

Figure 8.28: Quartz fragments from CCQ -2 (Ops 373B/3 and 373B/12)

Evidence from the household groups around CCQ support the use of recycled manos, and other groundstone tools, as hammerstones. The reuse of groundstone tools resulted from the lack of acceptable raw materials for hard hammer percussion available locally, and the expense of transport of materials suitable for hard hammer percussion.
The use of predominately granite, and some quartz, hammers, indicates a reliance on non-local raw materials, hence explaining the lack of production tools at the quarry. Due to the high value of these materials, individuals curated them until breakage decreased their utility. The identification of a few chert cobbles with battering indicates the occasional expedient use of locally available raw materials for hammering. These findings indicate that the local geology necessitated acquisition of raw materials from regions to produce tools with locally available raw materials.

The variety of materials utilized at Callar Creek Quarry for production, including chert cobbles, reused manos, granite, and quartz, is not unusual in the Maya area or elsewhere. Studies across the Maya region report the presence of reused chert cores, limestone, quartzite, and groundstone items used as hammerstones (Aoyama 2006, 2009; Clark 1988; Dahlin et al. 2011; Delu 2007; Gonzalez Cruz and Cueva Garcia 1998; Moholy-Nagy 2003; McAnany and Peterson 2004; Mitchum 1991; Oland 2013; Paling 2008; Shafer 1991; Weeks 1980) while lithic collections through time and space relate use of granite, quartz, limestone, chert, chalcedony, basalt, sandstone, schist, and other similar materials as hammerstones (Cobb 2000; Franklin et al. 2012; Kyle 1996; Mitchell and Foster 2000; Singer 1984; Stoker and Cobean 1984; Will et al. 2014; Turnbaugh et al. 1984). The wide variety of materials used for lithic production indicates the use of the most readily available materials as production tools, and also points to a scarcity of such materials in many locations. The presence of high quality cherts for knapping tends to go hand in hand with a lack of good quality materials for hammerstones, as such materials are generally found in different geologic contexts, as is the case in western Belize.
Although excavations recovered few tools to produce lithic materials in either the quarry or structure groups, enough information remained to indicate that residents utilized granite objects, mostly reused manos, and some quartz and chert cobbles for the production of lithic materials. Quarrying activities probably occurred with the assistance of bifaces, although no distinctive wear patterns indicate such use.

8.5 Conclusions: The Utility of the Organizational Approach

This chapter related the reduction sequence of the materials produced in Callar Creek Quarry in conjunction with a detailed description of the lithic materials recovered from quarry and household contexts. The reduction sequences, and comparisons between the lithic materials, indicate that the inhabitants of CCQ-1 and 2 produced materials within the quarry, probably monitoring and managing access to the raw materials.

As illustrated by the discussion of the reduction sequence from Callar Creek Quarry, technological organization provides a framework to use detailed lithic analysis to examine larger scale issues such as economic organization. In particular, Callar Creek Quarry highlights the importance of the role of technological choice and resource availability for past peoples. Resource availability guides the ways in which individuals manage resource consumption, including the wastefulness or conservation of raw material reduction techniques. At Callar Creek Quarry, reduction techniques are wasteful. Large cobbles are tested and discarded if found to contain flaws or large inclusions. Furthermore, the large size of many of the flakes indicates that materials were not intensively reduced. The lack of reduction intensity points to the wasteful nature of reduction in the quarry, probably a result of the abundance of available material. The households themselves also had higher percentages of informal, or flake tools, than in
some other households, probably a result of the ease of accessibility to chert resources. Instead of producing formal tools, Callar Creek Quarry householders could simply utilize informal flake tools which were readily available from quarry debris or produce informal flake tools from the chert cobbles found nearby. The ease of availability of these items influenced the manner in which reduction occurred at the quarry as well as at the surrounding households.

The Callar Creek Quarry data also provide us with an understanding of the importance of technological choice in quarry reduction practices. The choices made at Callar Creek Quarry reflect the producers’ intent – to reduce materials and test cobbles for further reduction away from the main quarry area. The materials reduced from the quarry spanned a wide range of raw material quality – some of which was discarded while other poor quality raw materials were utilized. The reduction at Callar Creek Quarry focused on generalized core reduction, mostly hard hammer percussion, a factor probably influenced by the large size of many of the cobbles, and the early generalized reduction most commonly practiced at the quarry, which does not require other types of reduction processes. The variation in extraction processes at the quarry points to the knowledgeability of quarry residence about the type of materials present and their utility for various production contexts.

These data illustrate the utility of technological organization approaches to lithic studies in Mesoamerica. Not only do these approaches illustrate the past economic organization of the area, but they also provide information concerning technological choice, resource availability, and the interplay of these factors in past decision making.
Chapter 9: Discussion

9.1. Introduction

The previous three chapters presented data from Callar Creek Quarry detailing the extraction and production of materials from the quarry and the relative involvement of local residents in these activities. These data illustrate that chert extraction and production focused on early stage, generalized core reduction and the exchange of items away from the quarry. This chapter returns to information presented in earlier chapters, which situated Callar Creek Quarry within the broader regional context of the upper Belize River valley (UBRV) and the Maya lowlands in general, to compare the extraction, production, and distribution processes which occurred at the quarry with those from other known lithic extraction and production sites. These comparisons permit a greater understanding of the variability in ancient Maya economic activity both within the UBRV and the broader Maya region.

This chapter begins by situating Callar Creek Quarry within the broader political dynamics of the region and then comparing Callar Creek Quarry to two chert production areas in the UBRV. The comparisons will then broaden to compare Callar Creek Quarry with chert production areas in other areas of the Maya lowlands, with an additional discussion of the regional variation in the extraction and production of other material
types. With this information, the chapter returns to the model for economic organization presented in Chapter 2 and discusses the impact of source location, production, and extent of distribution on the relative involvement of elite and non-elite actors in the ancient Maya economy. A discussion of the applicability of the model to other world region follows.

9.2 Continuity and Change

Callar Creek Quarry’s relationship with the economic and political developments of the UBRV illustrates the continuity of the occupation and use of the quarry in the face of political turmoil in the surrounding region. As described in Chapter 7, evidence from excavations at the CCQ households points to clear political connections between the Buenavista sphere and Callar Creek Quarry, in the form of polychrome ceramics with glyphs, pseudo-glyphs, Buenavista style ceramics, and the Buenavista Device (see Ball and Tascheck 2004). Despite this connection, and CCQ’s almost equidistant position between Buenavista (three km) and Xunantunich (four km), occupation and use of the quarry remains stable throughout the Late to Terminal Classic period when political cycling and conflict occur in the UBRV.

As further discussed in Chapter 5, Buenavista, a major political power in the UBRV in the Early Classic period, and Xunantunich vied for power during the Late Classic I period (A.D. 600-670), while in the Late Classic II period (A.D. 670-780) Xunantunich became the preeminent site in the region. Xunantunich fell from power in the Terminal Classic period (A.D. 780 – 890; see LeCount and Yaeger 2010). The neighboring site of Callar Creek, also in the Buenavista sphere, was abandoned in the
Terminal Classic period, with evidence of desecratory terminations throughout the site (Kurnick 2013).

Evidence from excavations at Callar Creek Quarry indicate that the quarry and households were used and occupied for the entirety of this period, and that CCQ-2 was constructed during the LC II or TC periods (A.D. 670-890), the time of the most political upheaval in the UBRV (see Chapters 6 and 7). Thus, the residents of CCQ seem insulated from the broader political dynamics in the region, despite their connection to these events through participation in the Buenavista political community.

This continuity in the face of changing political patterns could be related to the access of CCQ residents to a necessary resource – chert materials. Their access to this resource seems to provide a buffer against political changes, suggesting that access to chert materials was a mechanism of risk reduction. CCQ residents’ access to raw materials provided them with economic power and a source of economic wealth which permitted them to continue their occupation of the region despite political upheavals.

As will be discussed in the next section, there is no evidence of direct involvement of political leaders from nearby sites in the extraction of materials at the quarry. Although CCQ residents may have extracted materials for exchange in elite-managed marketplaces or as taxation or tribute, they had sufficient autonomy concerning the extraction and distribution of the lithic materials that they were not negatively impacted by the political unrest in the region during the Late Classic II and Terminal Classic periods. The continuity of the CCQ residents highlights their economic autonomy; although they were dependent on others in the UBRV for certain goods, they maintained enough economic independence to weather political changes. Similar
patterns can be seen at small sites elsewhere in the UBRV, as these settlements persist in
the face of changing political structures.

The importance of economic activities in insulating CCQ residents from regional
political dynamics and their connectedness with those same political entities indicates
that, for CCQ residents, economic activity served both as a method of integration into
regional political communities and as a mechanism for insulating them from regional
political changes, in part through wealth acquisition. Economies then, were both
embedded in and separated from region socio-political processes. Economies served both
to integrate CCQ residents into socio-political communities and acquire symbols of
socio-political status and connectedness while also acquiring the economic wealth which
insulated them from changes to those same socio-political systems.

9.3 Regional Comparisons in the Belize Valley

As discussed previously, evidence supports the restriction of access to Callar
Creek Quarry materials by the residents of the households adjacent to the quarry. As
little can be learned about the distribution of materials from the quarry, other than that
they were distributed away from the quarry, as discussed in Chapter 8, an examination of
other areas of extraction and production in the Mopan Valley can shed light on the
distribution mechanisms of lithic materials in the UBRV. San Lorenzo and Succotz, both
introduced elsewhere in this dissertation, are areas of chert extraction and lithic
production near Callar Creek Quarry. Although by no means the only areas of lithic
production in the UBRV, they are the most proximate to Callar Creek Quarry, and at the
time of writing, the most thoroughly investigated. Other lithic deposits include a
debitage mound and potential production area for bifacial tools near Esperanza, and a
debitage mound near Teakettle. At present, these sites have not been investigated, so no
comparisons with these areas are possible.

In the San Lorenzo and Succotz production areas, the extraction and production of
chert raw materials occurred in the quarry and within adjacent households. The form of
chert deposits in the three case studies varies as chert from San Lorenzo is a secondary
chert deposit consisting of buried chert cobbles redeposited due to fluvial action,
presumably as part of flooding events, while both Callar Creek Quarry and Succotz are
primary sources of in situ bedded cherts. All three are located near or within household
groups in either small settlements (San Lorenzo and Succotz) or hinterland areas (Table
9.1) (Yaeger 2000; VandenBosch 1999). The similarity in the extraction and production
contexts, and the temporal comparability of the sources, all were extensively used in the
Late Classic period, makes San Lorenzo and Succotz excellent areas for comparison with
Callar Creek Quarry.

The extraction of materials from Succotz and San Lorenzo resembles that at
Callar Creek Quarry. At all three sites chert extraction occurred through quarry faces,
which now have a scalloped appearance from digging unevenly into the hillside to extract
raw materials. The scalloped appearance of the quarry faces results from removing more
materials from some areas than others. Materials from Callar Creek Quarry were also
removed from the surface and by digging away from the quarry face, displaying more
diversity in extraction techniques than the other two sites.
Table 9.1: Table comparing Callar Creek quarry, San Lorenzo, and Succotz in terms of their locations and the types of chert.

<table>
<thead>
<tr>
<th></th>
<th>Callar Creek Quarry</th>
<th>San Lorenzo (Yaeger 2000)</th>
<th>Succotz (VandenBosch 1999)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type Material</strong></td>
<td>Chert</td>
<td>Chert</td>
<td>Chert</td>
</tr>
<tr>
<td><strong>Primary/Secondary Deposit</strong></td>
<td>Primary</td>
<td>Secondary</td>
<td>Primary</td>
</tr>
<tr>
<td><strong>Type Deposit</strong></td>
<td>Bedded</td>
<td>River cobbles</td>
<td>Bedded</td>
</tr>
<tr>
<td><strong>Production/Extraction Location</strong></td>
<td>Between 2 household groups</td>
<td>Adjacent to household</td>
<td>In lot of adjacent households</td>
</tr>
<tr>
<td><strong>Regional location</strong></td>
<td>Hinterland</td>
<td>Small settlement</td>
<td>Small settlement</td>
</tr>
<tr>
<td><strong>Temporal Use</strong></td>
<td>Archaic – Postclassic</td>
<td>Late Preclassic – Late Classic</td>
<td>Preclassic – Late Classic</td>
</tr>
<tr>
<td><strong>Most Intensive Period of use</strong></td>
<td>Late Classic</td>
<td>Late Classic</td>
<td>Late Classic</td>
</tr>
</tbody>
</table>

The chert raw materials found in the region are highly variable. Chert deposits throughout the UBRV are noted for their variability in contrast to some of the other areas of Belize, particularly the Northern Belize Chert Bearing Zone (NBCBZ) (see Hester and Shafer 1984, 1991; Shafer and Hester 1983) where uniformly high quality chert is common throughout the region. Chert at Callar Creek Quarry is found in large nodules and in *in situ* chert beds, with nodules as large as 1 meter found in some areas. The chert quality ranges from high quality, small grained cherts with minimal inclusions to larger-grained lower quality cherts. Chert of varying qualities co-occurs in the same nodule, indicating its creation as part of the same formation processes. The San Lorenzo deposit predominantly contains rounded cobbles, as the cobbles were deposited by riverine activity, also illustrated by the smooth cortex on the cobbles. The color and quality of the
chert from this deposit varied greatly as well. The quality ranges from high quality to low quality raw materials, with evidence of the testing of raw materials for quality occurring near the extraction point (Yaeger 2000). The chert from deposits at Succotz is the highest quality and most uniform of the three (VandenBosch 1999).

The production goals at the three sites differ slightly. As discussed at great length in Chapters 6-8, production at Callar Creek Quarry focused on generalized core and flake tools. Production at San Lorenzo focused on generalized lithic production, particularly of flake tools, as well as biface production and finishing. Yaeger (2000: 1062) identified biface production at SL-31, one of two household groups located near the quarry cut, through the high density of bifacial thinning flakes and the presence of 10 bifacial preforms. SL-31 contained a total of 649 flakes, of which just over 50 % are secondary flakes (Yaeger 2000: 1086-1087). Evidence for the generalized production of materials, at SL-28, another household group near the quarry cut, comes from the higher densities of lithic materials as compared with other households at San Lorenzo, and the generalized nature of these materials. Yaeger (2000:1086-1087) records a total of 303 flakes, of which 67 % are secondary flakes.

The lithic materials from Succotz illustrate an exclusive focus on formal tool production, with the goal of producing General Utility Bifaces (GUBs). Evidence for the prevalence of biface production comes from the presence of high densities of chertdebitage, including bifacial thinning flakes and broken bifaces. VandenBosch’s (1999; VandenBosch et al. 2010: 276) excavation revealed densities between 900,000 and 2 million flakes per cubic meters and an average of 13.9 bifaces per cubic meter. The bifaces included examples of those broken in production, biface preforms, and utilized
and discarded bifaces (VandenBosch 1999:254). Although VandenBosch did not record
the presence of bifacial thinning flakes, the presence of bifaces broken in production
indicates biface production occurred within the area (Table 9.2).

Production at all three locations occurred on a small scale. Although production
occurred on a scale greater than that required for the household level, the amount of
production does not indicate full time specialization, instead indicating some sort of part-
time production of lithic materials. At Callar Creek Quarry, production intensity is
difficult to determine, due to the generalized nature of reduction, but estimates of the
number of generalized cores necessary to produce the number of flakes collected from
the quarry stands at between 600 and 1,800 cores, for less than 1 % of the quarry, while
the estimate for the amount of cores produced at the quarry as a whole, including
unexcavated portions, is 56,213 – 38,197,163 cores (see Chapter 8 for more information).

Production estimates for San Lorenzo are similarly difficult due to a lack of
concrete products with which to measure reduction. Although it is clear some households
at San Lorenzo produced more lithic materials than others, Yaeger (2000) states that all
households produced lithics, and suggests that lithic materials were exchanged within the
community. At Succotz, the density of flakes per cubic meter is comparable with large
scale production areas such as Colha. The average density of production at Colha is 5
million flakes per cubic meter (Roemer 1991), which is greater, although more within the
same range, than the 2 million flakes per cubic meter at Succotz (VandenBosch et al.
2010). Although on a smaller scale than Colha, the Succotz debitage indicates
production on a scale beyond that necessary for use within the two households, indicating
that the bifaces produced were exchange elsewhere.
Table 9.2: Table comparing the extraction and production of materials from Callar Creek Quarry, San Lorenzo, and Succotz

<table>
<thead>
<tr>
<th></th>
<th>Callar Creek Quarry</th>
<th>San Lorenzo (Yaeger 2000)</th>
<th>Succotz (VandenBosch 1999)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extraction</strong></td>
<td>Surface, quarry cut, other excavations</td>
<td>Quarry cut</td>
<td>Quarry cut</td>
</tr>
<tr>
<td><strong>Material Produced</strong></td>
<td>Generalized cores and flake tools</td>
<td>Flake tools Bifaces/biface finishing</td>
<td>Bifaces</td>
</tr>
<tr>
<td><strong>Types of Production</strong></td>
<td>Generalized reduction (hard hammer)</td>
<td>Generalized reduction Bifacial production</td>
<td>Bifacial production</td>
</tr>
<tr>
<td><strong>Stages of reduction</strong></td>
<td>Early</td>
<td>All</td>
<td>All</td>
</tr>
</tbody>
</table>

Production at the three sites can be considered intermittent crafting, the discontinuous or periodic production of goods within a domestic context (Hirth 2009) and a common method of risk reduction (Brumfiel and Nichols 2009; Hirth 2009) in cases of resource stress. Intermittent crafting is a manner of integrating craft production into the household economy without disrupting other household economic activities. The craft production may be seasonal, so as not to interrupt agricultural production, or performed by individuals not involved in other aspects of the domestic economy (Hirth 2009). Consideration of these production contexts as intermittent crafting results from the scale of production; not enough materials were produced for full-time specialization. Furthermore, intermittent crafting helps explain how residents benefited from the lithic production - not solely economically, but as a mechanism of reducing the risk in everyday economic activities. The interdependence of household economies, as explored by various scholars, is also a manner of risk reduction. The nature of chert extraction in these examples provides additional support for the presence of intermittent crafting and
distribution beyond the household level. As chert is abundantly available throughout the UBRV, including along the river bed (in the summer 2015 I collected large quantities of medium quality chert from walking along the modern river course), the additional effort expended by the residents of these three areas on lithic extraction through quarrying would not be advantageous unless residents profited from the extraction and production of chert materials. Quarrying itself serves as an indication of the profitability of chert extraction and production as other, more easily obtained lithic materials, could also be exploited.

The question of chert distribution is a difficult one as chert materials, particularly in the Maya lowlands, are difficult to source due to the intra-source variation, lack of clear chemical differentiation, and the prevalence of secondary deposits of lithic materials, such as that at San Lorenzo. The intensity of production, and whether it is greater than the household need, can tell us something about how materials may have been distributed. At Callar Creek Quarry, evidence for the distribution of lithic materials comes from the lack of cores within the quarry. Over 99% of materials recovered from quarry excavations were debitage, with only 152 cores recovered from the quarry, as opposed to approximately 36,000 pieces of debitage. I used several estimates of the number of flakes which can be produced from a core which provided a range of 600-1,800 cores necessary to produce the amount of debitage recovered from the quarry. Although such estimates are problematic, given the variation in raw material size, amount of reduction, and the nature of reduction sequences, all of which affect the number of flakes which can be removed from a core; the range of cores suggested as necessary to produce the total number of flakes is so much greater than the number of cores recovered
from the quarry. Thus these estimates are taken as an indicator of the removal of cores from the quarry for use elsewhere (see Chapter 8). Where, or how, these materials were distributed is unknown.

Evidence from San Lorenzo suggests that local materials were distributed throughout the community. Most households within San Lorenzo show evidence of small scale lithic production, at a scale commensurate with household use (Yaeger 2000). Although the two households adjacent to the quarry area show greater involvement in the lithic production industry than other households, no evidence indicates that materials were distributed outside the community. However, we do not have enough evidence to argue definitely about the distribution of goods either within or away from the site.

As discussed above, in Succotz the amount of biface production is greater than that necessary for a single household, indicating distribution of these materials beyond the household level. The density of production is far greater than would be necessary for household production, and is similar to Colha (Roemer 1991). While we cannot trace the distribution of these materials, it seems likely that they circulated within the immediate region (Table 9.3).

| Table 9.3: Table showing production intensity and distribution at the three quarries |
|---------------------------------|-----------------|-----------------|-----------------|
| Production Intensity | Callar Creek Quarry | San Lorenzo | Succotz |
| Small scale | Small scale | Small scale |
| Product Distribution | Outside quarry – location/extent uncertain | Uncertain – probably within San Lorenzo community | Beyond household – location/extent unknown |
Although Callar Creek Quarry, San Lorenzo, and Succotz share commonalities in the techniques of production and extraction, the differences between the three areas, particularly in the types of objects produced and scale of production, permits an examination of a wider range of material production and the role of socio-economically diverse individuals in such production.

Comparisons between the wealth and status of the residents of CCQ and San Lorenzo\textsuperscript{1}, as represented by their material culture, illustrate greater similarities between the residents of CCQ and the rural elite of SL-22 at San Lorenzo than the lithic producing households at the site (see Chapter 6 for details on these comparisons). Yaeger (2000) argues that the SL-22 residents may have managed access to lithic resources although they did not produce lithics themselves. These comparisons indicate that access to and management of lithic resources may be the source of wealth for CCQ residents, rather than the process of lithic production. The importance of raw material access to CCQ residents is further illustrated by the ancestor shrine in CCQ-1 (see Chapter 6) which illustrates residents’ claim to the land and, presumably, the resources it holds. The wealth of Callar Creek Quarry residents was displayed through their material possessions, rather than through investment in architecture, as discussed in Chapter 6.

To examine the role of household residents and neighboring political powers in the extraction and production of materials in these three cases, this chapter utilizes the set of expectations laid out by Costin (1991) for independent versus attached production. Costin states that in situations where elites manage production activity or contexts these production areas are frequently found attached to elite domestic structures; production

\textsuperscript{1} Comparisons with the Succotz households are not possible at this time due to the presentation of data by VandenBosch (1999).
areas are physically separated from other activity areas, to increase the ease of monitoring or restrict access to these production areas; administrative artifacts are commonly found; and production and source areas have distinct production facilities and clear boundaries. These expectations are useful as a heuristic device for determining the direct management of a resource by individuals residing near the site (Costin’s non-elites) versus involvement by larger scale political entities in the extraction and production of raw materials (Costin’s elites). The categories of independent and attached specialization are themselves heuristic devices as the organization of production can be arranged on a gradient, and does not fit neatly into these categories (i.e. Clark 1995; Costin 1998, 2001, 2004, 2016; Inomata 2001b; Helms 1993; Janusek 1999; Patterson 2005). However, for this research the presence of markers of involvement of non-local individuals are useful for determining the direct involvement of local residents in the extraction and production of lithic materials. That is, the absence of these markers suggests local residents managed the extraction and production of the chert raw materials; although local residents may have had direction or encouragement from political leaders through tribute or taxation, those political leaders were not directly involved in the extraction of materials.

An evaluation of the three examples discussed here finds no similarities to Costin’s markers of non-local management. All three quarry and production areas discussed are located near, or within, households and at some distance from elite architecture or residences. Callar Creek Quarry, is, in fact, located at some distance from the nearest minor center, the site of Callar Creek, approximately two km away.
None of the three chert extraction and production areas show evidence of formalized restriction of access – in fact they are all located in relatively open areas. No constructions or paths limited the entrance to any of the source areas. Similarly, no architecture defines the boundary of these source areas. Once again, however, it would be difficult to restrict such large areas, and, as chert is found throughout the UBRV, restricting access to a particular source area would just push people to other sources. It is possible, however, that the households adjacent to the quarries restricted access by others to the source, whether by limiting access to the quarry, or by extracting payment for individuals for use of quarry materials. This line of inquiry is discussed in Chapter 6 and Section 9.2. No evidence of administrative artifacts exists at these three sites, although this is unsurprising given the focus of Maya texts on political and ritual activities rather than economic activities (Martin and Grube 2008).

The best, and most unequivocal evidence, against attached production comes from the lack of separate production facilities. Separate production facilities, specifically for lithic production, exist in the Maya area (see Whittaker et al. 2009), so we might expect to find them in areas of elite managed production. While all three sites have debitage mounds, which are areas for the discard of debitage from the production process, none of them contain distinct areas for knapping.

No evidence from the three areas supports the presence of management by anyone other than the local residents of the lithic extraction or production process, although many of the markers Costin (1991) utilized are equivocal in this case (Table 9.4). The lack of formalized production facilities and areas remains the strongest evidence for a lack of direct management of the lithic production processes from people who did not reside at
Callar Creek Quarry, San Lorenzo, and Succotz. As noted above, this lack of involvement does not mean that residents were not responding in some ways to tribute or taxation requests, but that these requests did not directly impact the manners in which chert was extracted and produced.

Further evidence for the lack of outside management of the extraction and production processes come from comparisons with quarrying and production in areas with known top-down management of such processes. In Roman and Egyptian studies, imperial control of certain raw material access is discussed in written texts and archaeological studies confirm a degree of imperial control over the quarrying process and the resulting products (Degryse et al. 2009; Harrell and Storemyr 2009; Kelany et al. 2009; Lollet et al. 2008; McCallum 2009; Peacock and Maxfield 2007; Teather 2011; Torrence 1984; Weisberber 1983). Evidence for such control includes organized work areas (Harrell and Storemyr 2009; Storemyr et al. 2010), transportation routes (Harrell and Storemyr 2009; Heldal 2009; Kelany et al. 2009; Storemyr et al. 2010), the scale and organization of production (Heldal 2009), widespread distribution of finished products (McCallum 2009), and organized villages for workers (Harrell and Storeymr 2009;
Peacock and Maxfield 2007). None of the three case studies discussed here illustrate such traits, particularly not the organization of work areas, transportation, or organization of residences for workers. Instead, we can look at markers of the independence of resource production.

Costin (1991) suggests independent production, here utilized as a marker of the involvement of local residents, occurs near domestic architecture, in unrestricted locations, and lacks separated production facilities. The Callar Creek Quarry, Succotz, and San Lorenzo examples all fit these criteria, as they are all located near, or within household, areas, lack formal production facilities, and permit unrestricted access (Table 9.5).

| Table 9.5: Characteristics associated with non-local involvement in production (after Costin 1991) |
|---------------------------------------------------------------|------------------------------------------------|------------------------------------------------|
| Callar Creek Quarry | San Lorenzo | Succotz |
| Away from elite architecture | Yes | Yes | Yes |
| Non-restricted location | Yes | Yes | Yes |
| Association with domestic architecture | Yes | Yes | Yes |
| No separate production facilities | Yes | Yes | Yes |

The use of the characteristics of management by non-local residents of production contexts as presented by Costin suggest that the three examples presented here are examples of local production without direct influence from neighboring political communities. The Callar Creek Quarry, San Lorenzo, and Succotz examples demonstrate that utilitarian tools, such as generalized cores, flake tools, and bifaces, manufactured on locally available materials, were produced by local residents in the Late to Terminal
Classic in the UBRV. These producers were probably in some instances reacting to tribute or taxation demands from major political centers, but the day-to-day operation of lithic extraction and production was organized by the local residents.

The extraction and production of lithic materials from these three contexts by local residents leads to the question of the degree to which lithics were exclusively produced by specialists. That is, did households rely on an individual or individuals to obtain lithic materials, or did they also independently produce lithic materials? Evidence from Succotz and Chan, where biface production occurred (VandenBosch 1999; Hearth 2012), suggest that biface production was a specialized activity with bifaces obtained from specialized producers within small settlements. Furthermore, the presence of a final stage finishing area for chert and limestone bifaces at the Buenavista del Cayo marketplace indicate some individuals obtained bifaces through this system rather than producing them within residential units (Cap 2015a,b). The evidence from biface production at Succotz, Chan, and Buenavista indicates some specialized production of bifacial implements occurred in the UBRV.

To further examine the amount of tool production at households in the region, particularly the production of non-formal tools, I compiled a comparison of lithic densities of household excavations in the UBRV, focusing on the Mopan Valley. Testing by the Xunantunich Settlement Survey (XSS) of a survey line between Xunantunich and Callar Creek provides plentiful comparable household data (see VandenBosch 1999) as well as household excavations at San Lorenzo (Yaeger 2000), Chaa Creek (Connell 2000), Dos Chambitos (Robin 1999) and Chan (Robin 1999). Unfortunately, some contexts lack easily comparable data as detailed descriptions of lithic quantities, and
information on excavation area/density were not uniformly presented, thus complicating such comparisons.

From the lithic data present, all households examined in the UBRV performed some lithic production. For instance, all households at San Lorenzo contained some lithic materials (Table 9.6). As illustrated in Table 9.6, the debitage density in the various households was low, but present in all cases. Densities which included tool counts were not drastically greater than the debitage counts.

<table>
<thead>
<tr>
<th>Location</th>
<th>Debitage Density (Debitage/m²)</th>
<th>Lithic Density (All lithics/m²)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL-13</td>
<td>3.5</td>
<td>4.1</td>
<td>Yaeger 2000: Table III:13 pp 1087-88</td>
</tr>
<tr>
<td>SL-22</td>
<td>.4</td>
<td>.6</td>
<td>Yaeger 2000: Table III:13 pp 1087-88</td>
</tr>
<tr>
<td>SL-28</td>
<td>4.7</td>
<td>4.9</td>
<td>Yaeger 2000: Table III:13 pp 1087-88</td>
</tr>
<tr>
<td>SL-31</td>
<td>19.7</td>
<td>20.3</td>
<td>Yaeger 2000: Table III:13 pp 1087-88</td>
</tr>
</tbody>
</table>

Other household excavations from the UBRV did not separate debitage counts from the total lithic assemblage, increasing the difficulty in determining whether production occurred at these households. The high counts, however, of materials from Chan, Dos Chambitos, and Chaa Creek (Table 9.7) indicate that lithic production occurred in these areas. These counts are elevated above those from San Lorenzo as the densities for San Lorenzo are presented in relation to excavation area as opposed to volume. Although the counts of tools vs. debitage are not presented, the high number of lithics from these areas indicates household lithic production.
Table 9.7: Table showing lithic density (by excavation volume) for households from Chan (CN) Chaa Creek (CC), and Dos Chambitos (DC).

<table>
<thead>
<tr>
<th>Location</th>
<th>Lithic Count</th>
<th>Density (All Lithics/m³)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC-1</td>
<td>409</td>
<td>110.84</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-15</td>
<td>60</td>
<td>240</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-17</td>
<td>40</td>
<td>111.11</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-18</td>
<td>571</td>
<td>220.46</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-19</td>
<td>189</td>
<td>136.96</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-2</td>
<td>37</td>
<td>38.14</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-25</td>
<td>1123</td>
<td>1369.51</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-27</td>
<td>492</td>
<td>305.59</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-3</td>
<td>573</td>
<td>295.38</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-30</td>
<td>1799</td>
<td>1799</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-33</td>
<td>116</td>
<td>99.15</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-4</td>
<td>535</td>
<td>247.69</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-5</td>
<td>197</td>
<td>59.7</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-63</td>
<td>33</td>
<td>37.08</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-64</td>
<td>423</td>
<td>919.57</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-67</td>
<td>434</td>
<td>183.9</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-7</td>
<td>303</td>
<td>187.04</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-70</td>
<td>29</td>
<td>96.67</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CC-9</td>
<td>148</td>
<td>72.91</td>
<td>Connell 2000: Table 9.80; pp 553</td>
</tr>
<tr>
<td>CN-1</td>
<td>2479</td>
<td>209.7</td>
<td>Robin 1999: Table 14 pp 272</td>
</tr>
<tr>
<td>CN-4</td>
<td>435</td>
<td>85.9</td>
<td>Robin 1999: Table 14 pp 272</td>
</tr>
<tr>
<td>CN-5</td>
<td>329</td>
<td>99.6</td>
<td>Robin 1999: Table 14 pp 272</td>
</tr>
<tr>
<td>CN-6</td>
<td>346</td>
<td>185</td>
<td>Robin 1999: Table 14 pp 272</td>
</tr>
<tr>
<td>CN-7</td>
<td>1404</td>
<td>253.7</td>
<td>Robin 1999: Table 14 pp 272</td>
</tr>
<tr>
<td>DC-1</td>
<td>29</td>
<td>63.8</td>
<td>Robin 1999: Table 14 pp 272</td>
</tr>
</tbody>
</table>

This examination of lithic densities supports VandenBosch’s (1999) conclusion concerning lithic production throughout the XSS transect. He determined that some households contained more evidence of lithic production than others, indicating that although all households produced some tools, some households emphasized lithic production more than others.

The evidence from lithic production areas and households in the UBRV indicates that household lithic production was commonplace and occurred in all commoner
households. Some households specialized in lithic production, particularly, although not exclusively, on bifacial production, and these materials were then distributed to other households. Much variation in the organization of lithic production exists within this chert-rich area, with individuals producing some of their own tools and acquiring other lithic materials from specialized producers through exchanges between households and within marketplaces.

9.4 Resource Variability and Production outside the UBRV

The previous section described the variability of chert production within the UBRV; to further examine the variation in ancient economic systems, this section addresses production processes throughout other areas of the Maya lowlands, beginning with a discussion of chert extraction, production, and distribution processes outside the UBRV, and then examining other types of materials, particularly obsidian and jade.

9.4.1 Chert

Outside the UBRV, other parts of the Maya region illustrate variability in the organization of chert extraction and production. The largest area of chert production in the Maya area, Colha, also demonstrates variability in the role of individuals in the lithic production process. During the Late Classic period, King (2000; see also Masson 2001) argues that Colha residents produced chert materials and distributed them elsewhere. Based on the segmented and varied production of both lithic tools and agricultural goods at the site, she argues residents operated interdependently, produced different items, and traded within the site, without the direct oversight of elite individuals or management from outside Colha.
The variation in involvement of socio-economically diverse individuals in chert production activities continues elsewhere in the Maya area. In the Blue Creek region of northern Belize, Barrett (2004) found that political leaders managed the distribution of chert resources particularly in the Early to Late Classic period. One aspect of Barrett’s (2004, 2006, 2011) investigation revealed that many of the chert resources in the Blue Creek region were finite resources. That is, the resources were completely exploited by the end of the Late Classic period. The finite nature of these resources suggests that chert scarcity was problematic. While Barrett does not discuss factors resulting in the elite management of chert resources, I suggest that resource scarcity may have increased the involvement of political leaders in the distribution of chert resources, as they attempted to maintain access to such an important resource in the face of dwindling resource availability.

Evidence from La Milpa, also in northern Belize, points to the management of production areas by political leaders, due to the presence of a biface production area within the main area of the La Milpa North neighborhood, an elite residential area close to the civic-ceremonial center of the site (E. Heller personal communication 2015). Investigations in eastern Guatemala, near the Belize/Guatemala border, revealed a different picture about the nature of chert extraction and production. Paling (2015) in investigations at Hamontún and K’o found that chert production, mostly of utilitarian tools, occurred in household groups without evidence of the involvement of political leaders.

Elsewhere in the Maya area, Andrieu (2011; personal communication 2014) argues that political rulers managed at least the final stages of biface production as final
stage biface production debris occurs commonly in elite tombs. The phenomenon of covering royal elite tombs with layers of lithic production debris is spatially restricted to the southern Maya lowlands (Andrieu 2011). Andrieu (2011) interprets these lithic deposits as indicative of royal elite management of the activities which produced the debris. However, within the southern lowlands, variation in lithic production contexts, such as the difference between the Bedrock and Succotz workshops, suggest that biface production occurred in a variety of contexts, both within and outside political centers, and that the management of raw materials and production contexts varied greatly. The evidence from royal elite tombs indicates they had access to these final stage biface materials, but evidence from other stages of the production process indicates production occurred without royal elite management, thus pointing to variability in the economic management of production and distribution mechanisms.

Andrieu’s (2013) studies in Campeche, Mexico found that households used tools made both of non-local high quality cherts and locally available lesser quality cherts. Her analysis found that both types of chert were manufactured mostly outside household contexts. The higher quality cherts were utilized exclusively for formal tools, particularly projectile points, and other finely made forms; indicating preferential use of different materials. As Andrieu (2013) points out, a lack of evidence for production contexts in this region impedes a fuller understanding of the production and distribution processes.

This brief discussion of some of the chert production contexts in the Maya lowlands, particularly in western Guatemala, Belize, and southern Mexico, reveals extensive variation in chert extraction and production processes and contexts. Within some of the contexts where chert resources are both locally available and widely
distributed, local residents manage the extraction and production of resources (i.e. Callar Creek Quarry), whereas in situations of resource scarcity or when the majority or resources are imported (i.e. Bedrock), political leaders’ involvement in the management of production of these resources increases. The variation in management of lithic production illustrates the importance of studying the extraction, production, and distribution of material types in various regions of the Maya area rather than extrapolation from lithics studies in a single region. The following sections examine the extraction and production of other resources in the Maya area to evaluate whether these patterns hold in for other material goods.

9.4.2 Obsidian

Obsidian production and exchange in the Maya area operated mostly under the management of political leaders, although variation exists in different areas. Most importantly for this case, studies of obsidian at source areas versus in areas of obsidian importation show variation in material distribution.

In one of the few studies of obsidian extraction and production at a source area in the Maya region, G. Braswell (1996) examined obsidian extraction and production at San Martin Jilotepeque (SMJ). SMJ, in the highlands of Guatemala, contains an uneven distribution of obsidian resources across the landscape. G. Braswell (1996) found that the production and exchange of SMJ obsidian was not highly politically centralized or controlled; instead, access to obsidian resources was decentralized and area residents differentially extracted raw materials for use within households.

In contrast with the open extraction and production of obsidian materials in SMJ, Aoyama (1996, 1999, 2011) illustrated that in the Copan area, obsidian production and
distribution was closely associated with political leaders. Aoyama (1996, 1999, 2011) found that access to obsidian decreased as distance from the site core and economic wealth of households decreased, leading him to suggest Copanec political leaders distributed obsidian throughout the polity. Copan, in the Maya lowlands, is not a location in which obsidian naturally occurs. Instead, obsidian comes from the Guatemalan highlands or Central Mexico. The local vs. non-local nature of the raw material source contributes to differences in elite involvement in resource extraction, production, and distribution.

9.4.3 Jade

Jade extraction and production provides an interesting comparison to these other resources due to the extremely limited source area and the complexity of its extraction, production, and distribution. The main jade source in Mesoamerica, the Motagua Valley of Guatemala, contains jade in boulders throughout the region (Rochette 2014; Taube et al. 2011). Investigations in the region illustrated that initial reduction occurs near source areas with further reduction in workshop areas near or in households. Local households extracted and processed the raw materials; the small settlements around the source do not exhibit signs of wealth as a result of their participation in the jade trade (Rochette 2014; Taube et al. 2011).

Despite the relatively open access to jade raw materials in the Motagua Valley, finished products have relatively restricted distributions, with certain forms occurring most commonly in royal elite contexts. In fact, access to jade becomes more restricted as production proceeds (Kovacevich 2011, 2013; see also Walters 1989). Analysis of jade

Geologically, this material is jadeite, though by convention in the Maya area it will be referred to here as jade.
production at Cancuen presents a mixed picture concerning the actors in the production process. Kovacevich (2011, 2013; see also Walters 1989) proposes that access becomes more restricted as production proceeds, with earlier stages of jade production occurring across a broader range of households and later stages of reduction occurring only in high status households. Alternatively, Demarest (2013; Andrieu et al. 2014; Demarest et al. 2014) argues that royal elites controlled the entirety of the jade production sequence but did not perform any jade production. That is, although jade production occurred in households of varying status, royal elites managed this production. Despite the differing view of the management of jade production and the level of involvement of different individuals, the contrast between the access to jade at the source, where it was found widely in all households, and at the production location, particularly in the final stages of production, contrast in a manner similar to that seen for chert and obsidian. Jade extraction and preliminary production at the source was performed by local residents who show no evidence of increased wealth or socio-political status, while when physical distance between the source and the production area increased, royal elite involvement in management of the resource also increased.

9.4.4 Patterns of Past Maya Economies and Resource Accessibility

As discussed in the three preceding sections, variability in the ancient Maya economy existed in the involvement of individuals of different socio-political status in the extraction and production of different materials. Chert, obsidian, and jade illustrate similar patterning in the role of political leaders and other individuals in these processes depending on the distribution and accessibility of raw materials. The role of landscape variability and the uneven distribution of raw materials across the landscape on the
involvement of diverse actors in extraction and production processes brings us back to the model of economic organization laid out in Chapter 2, which argues for the utility of studying past economies as a system of articulated economies using a life-history approach focused on raw material source location, production location, and extent of distribution. This model argues that the system of articulated economies in the ancient Maya economy can be understood as a system through which different goods operated through varying economic modes, in turn influenced by the location of the raw material source, production, and distribution mechanisms. At its most basic level, this model argues that the local versus non-local nature of raw materials, the production location, and extent of distribution can be used as predictive measures for the involvement of different actors in the economic activities of specific material types.

This model can be evaluated using the evidence from Callar Creek Quarry and the comparative data from the UBRV and other regions of the Maya area presented in this chapter. The model predicts that materials from Callar Creek Quarry, an example of a mode three resource, would be managed by local residents, as the materials are local, abundant, and produced in the immediate region. The evidence from Callar Creek Quarry supports the proposed model. Similarly, elsewhere in the UBRV and at the site of Colha, where chert is abundant and easily accessible, and production occurred near the source, extraction, and production of chert resources was managed by local residents. However, in areas with limited resource availability, such as in the Blue Creek region, where lithic resources dwindled quickly (Barrett 2006), or in areas without many chert resources such as parts of the Peten, Guatemala (Andrieu 2011; Andrieu and Roche 2015) and the northern Yucatan Peninsula (Dahlin et al. 2011; Hearth and Fedick 2011), the
management of lithic resources was of greater importance to political leaders. In those areas with fewer locally available resources, imported raw materials played a larger role, the acquisition of which involved royal elites. As such, this variability further supports the propositions in the model concerning the importance of source locations and raw material availability in economic involvement of various individuals.

The part of the proposed model which we can best examine from the data presented here is the importance of the local versus non-local nature of raw material. This model proposes that much of the variation in the economic signatures visible in the archaeological record can be traced, at least in part, to the variation in raw material accessibility (see Schortman and Urban 2004 for a discussion of the importance of raw material location and the role of elite management of resources as a source of power). I do not wish to be environmentally deterministic with this claim, but rather to suggest raw material accessibility as a factor which explains some of the variation in Maya economic systems. To summarize the implications of the evidence presented here, I argue that local materials are more likely to be managed by local residents while those coming from further away provide more opportunities for political leaders to restrict and manage the flow of the raw materials to other individuals. Furthermore, resource frequency, how much material is available and the quality of said material, also influences the management of resources, with scarce resources providing more economic and political incentive for management than resources which are widely available. As such, throughout the Maya area, I expect the role of economic involvement in quotidian activities as a source of political power, status, and economic gain varied greatly. This variability is perhaps not unexpected due to the relative decentralization of political
power across the Maya region and the multiple political strategies used by elites and non-elites to negotiate wealth and status. For instance, Robin et al. (2014) propose that at the small settlement of Chan, rural elites used a community-based approach to maintain power and continuity in the community, which stands in contrast to the individual-centric approach of the Classic period Maya kings. The presence of these various political strategies leaves room for a multitude of economic strategies which cross-paths with the political strategies in numerous manners.

### 9.5 Global Comparisons

The variability in economic organization and the role of elite and non-elite individuals in economic activity in the Maya area reflects a relationship between economies, individuals of varying socio-political status, and local raw material availability, as reflected by the model of economic organization discussed in the preceding section. The applicability of this model to other complex societies is discussed here, with a particular focus on the importance of the quantity and availability of raw materials on economic organization.

To return to the areas of economic comparison from Chapter 1, this section addresses the Inka and the Mississippian. Among the Inka, clear evidence of centralized, political management of production areas exists. Extraction areas for certain goods including obsidian, stone for building construction, gold, silver, copper, and other metals and minerals (Cantarutti 2013; Ogburn 2013; Salazar et al. 2013; Tripcevich and Contreras 2013) demonstrate evidence for elite management in the presence of roads leading to or associated with the source area (Ogburn 2013), storage areas (Cantarutti 2013), state sponsored ritual activity in or near the quarry or mine (Vaughn et al. 2013),
and increased volume and organization in extraction activities with the arrival of the Inka (Salazar et al. 2013). Inka production areas were also spatially segregated from other areas, with restricted access, and featured production facilities for specific goods, all characteristics described by Costin (1991) as attached specialization, or production which occurred under elite management. Inka administrative centers, such as Huánuco Pampo, contained specialized storage and production areas for specific activities including weaving (Morris 1967, 2004; Morris et al. 2011). The architectural styles of the storehouses and production facilities at Huánuco Pampa, and other Inka administrative centers, are easily recognized as Inka structures (Morris 1967, 2004). As such, the presence of Inka management of these areas is clear.

The clear elite management by the Inka of goods such as metals, precious stones, and building materials fits the model of economic variability examined in Chapter 2 as the source areas for these materials are restricted to a single location which is generally isolated both from the location of manufacture and use. As such, the restriction of materials to a few or a single source and the geographic isolation of these sources, may have influenced royal Inka management of these areas. The use of many of these items as status symbols (Cantarutti 2011) highlights the importance of these items among the Inka and perhaps provides an additional avenue of explanation for the large-scale investment of time and infrastructure to obtain certain materials.

The majority of goods extracted from isolated sources under royal Inka management were luxury or status goods. Unfortunately, less concrete information about utilitarian items and the contexts of their extraction and production exist among the Inka. We can assume that some variation probably existed in the management of these
materials (see Burger 2013; Mayer 2002, 2013; Stanish and Cobean 2013) despite the
lack of more precise information. The available information on the Inka economy,
however, illustrates the explanatory power of the model of economic organization
presented here as it helps explain some of the involvement of political leaders in certain
aspects of the Inka economy.

In applications of the model to the Mississippian, examples of both utilitarian and
luxury goods can be discussed. One utilitarian good, salt, illustrates management by
elites of the source area, due to the location of a small polity located near the salt
processing area which managed the production and exchange of salt (Meyers 2006). The
limited quantities of this material, and particularly its limited source area, may have
contributed to elites’ desire and ability to manage this area, as postulated elsewhere.

Lithic resource extraction and production among the Mississippian illustrates
variation similar to the Maya area in terms of the involvement of political elites in the
extraction and production of materials. Near the source of one of the most commonly
utilized chert resources, Mill Creek, extraction and production occurred without elite
involvement, although political elites managed the distribution of the finished tools
(Cobb 2000). This pattern fits the trend seen in the Maya area, particularly with jade, as
well as the characteristics predicted by the economic model discussed here, where items
are managed independently near source areas and the political elite involvement in their
economic role increases with distance from the source.

These discussions illustrate how political leaders; management of economic
activity is understood outside the Maya area. In both the Inka and the Mississippian
cases, markers of elite management are distinct and seen at some production locations.
Resource accessibility, location, and quality influence the role of elites in the economic activity involving certain materials.

9.6 Conclusions

This chapter provided comparative data sets for Callar Creek Quarry. The materials from the quarry were compared with those from other chert production areas in the upper Belize River valley and the surrounding region. These comparisons illustrate the diversity present in ancient Maya economic systems, and in particular, demonstrate the importance of resource source location and availability to the role of political leaders and other individuals in explaining that diversity.

Through comparisons with other world areas, this chapter illustrates that resource availability and accessibility influences the economic involvement of political leaders in other regions as well. These processes depend on a variety of factors, some of which can be explained by the model for economic organization presented in Chapter 2, particularly the importance of the location and relative scarcity or abundance of certain resources.
Chapter 10: Conclusion

10.1 Introduction

This dissertation addresses the role of lithic materials in Maya economic organization, focusing on the Late/Terminal Classic, from the viewpoint of a source area, Callar Creek Quarry. As discussed in previous chapters, the extraction and reduction of chert materials from the source focused on early stage production of lithic materials, under the auspices of the residents of the surrounding household groups. This chapter summarizes the previously presented data and draws conclusions from concerning organizational approaches to lithic technology, the importance and draw of lithic raw material source areas to settlement, the implications of this study for terminology concerning source areas and the distribution of lithic raw material sources throughout Mesoamerica, and the implications of the study for our understanding of variability in the Maya economic system and other economic systems around the world.

10.2 Callar Creek Quarry Summary

For residents at Callar Creek Quarry, who lived in at least two related households, lithic production was an important part of their existence, as a means of economic support and community interactions, but by no means the only activity in which they participated. Lithic related tasks were a part-time activity for the CCQ residents, based
on the quantity of debitage present at the household and quarry, who also participated in farming activities and other typical household tasks, such as weaving and food preparation, as exemplified from finds of spindle whorls, chert tools, and mano and metate fragments within their residential complexes. Recurrent lithic extraction and production provided CCQ residents with extra economic security as they did not depend solely on the vagaries of agricultural production and had other means to acquire necessary goods, such as ceramics and groundstone implements.

CCQ residents lived in at least two households which were probably part of the same kin-based corporate group. While ceramic evidence points to a possible use of the region in the Middle/Late Preclassic, the initial construction occurred in the Early Classic period. The second smaller residential complex was first built and occupied in the Late Classic or early Terminal Classic period and probably represents an expansion of the family group into this new area.

The relationship between the CCQ householders and the quarry is cemented by the local geology. The residential complexes and the quarry are located on a high point on the landscape; to reach any of these areas, one must climb up a rather steep hill. The positioning of the residential complexes to the northeast and southwest of the quarry means that to reach the quarry you would walk by these areas, thus making it less likely that people would enter the quarry to obtain their own lithic materials without first visiting the CCQ residents.

CCQ residents were not the only householders in the area to extract and produce lithic materials nor did they hold a monopoly on chert resources, as they are easily accessible across the landscape. Within five km around CCQ several other small lithic
sources exist, and, the chert outcrop which is most visible in the area around CCQ extends for some distance, so occasional pockets of chert are visible on the surface near the quarry. The Mopan River also provided opportunities for lithic acquisition.

In terms of lithic production activities, CCQ residents extracted raw materials within the bounds of the quarry. Extraction involved using the visible cobbles on the surface of the quarry and digging into the soil matrix to remove large chert cobbles and beds. Residents probably used bifaces or other digging tools to extract the chert materials. These cobbles were then tested for quality and either discarded or further reduced. Residents focused on producing generalized cores and some flake tools. The hammerstones residents used to produce lithics were either locally available chert cobbles, which are frustratingly poor implements for lithic production, or recycled imported materials, such as recycled mano fragments found with evidence of battering. Residents also used some other household objects within the quarry, such as ceramics, presumably for carrying water and other foodstuffs to the quarry.

Beyond the immediate bounds of the quarry, CCQ residents removed some of the tested lithic material to their nearby residences for use in domestic contexts, but large quantities of reduction did not occur within the residential complexes. Other quarry-related materials which ended up in domestic contexts include hammerstones which were used for reducing tools and some quantities of quarry discards used as construction fill. The Late/Terminal Classic period construction of CCQ-2 used large amounts of quarrydebitage as fill, suggesting residents used the available resources wherever possible.

Other quarry products, such as tested raw materials and prepared cores were exchanged with nearby settlements – either through peoples’ visits to the quarry or their
transport of raw material to other locations including specialized production areas – such as some of the many known biface production areas in the region - or to one of the regional marketplaces, like the one at Buenavista. While analysis of the exact distribution of the chert materials is impossible at this point due to the difficulties in sourcing chert, it seems likely that CCQ residents distributed their chert through numerous mechanisms.

At the most local level, CCQ residents themselves used the chert for tools and as construction fill. Residents also probably exchanged materials with neighboring households through economic mechanisms such as reciprocity and barter. We know from studies of lithic production elsewhere in the region that households produced much of their own lithic toolkits, particularly flake tools. Residents of the region could have used raw materials obtained from the CCQ residents to produce materials within their own residences. These materials could have been used as multifunctional tools for a variety of household tasks (scraping, cutting, etc.), for other crafting activities, and for subsistence practices such as farming.

In addition to the use of CCQ chert for generalized household lithic production, the materials might have been used for production in specialized workshops. Lithic production across the region was segmented with different stages of production occurring in different areas. CCQ may have provided tested cobbles to workshops which produced other tools, such as bifaces. Such exchanges could have occurred through a multiplicity of mechanisms, such as reciprocal exchanges, barter, or market exchange.

CCQ residents could have also exchanged materials in regional marketplaces. The best identified marketplace in the region is at Buenavista and, given the political ties
between CCQ and Buenavista, it seems likely that were residents distributing chert through market exchanges, they would have done so at Buenavista rather than at the slightly more distant marketplace of Xunantunich. Raw material exchange in the marketplace might not leave a distinctive signature if reduction was not occurring at the market. Evidence from the Buenavista marketplace suggests final stage finishing of bifaces and the production of obsidian blades occurred at the market, but revealed no evidence of earlier stages of lithic reduction. Thus, if CCQ materials were distributed at the Buenavista marketplace, they either were not worked there or they were taken to the marketplace by lithic producers who had acquired raw materials from CCQ and reduced them into tools elsewhere.

The multiple ways CCQ residents could have distributed their materials illustrates the multiple economies which operated in the region. Reciprocity, barter, and market exchange all operated concurrently under different circumstances. Gift-giving and taxation/tribute almost certainly also occurred, and may have been avenues CCQ residents’ acquisition of Buenavista-style ceramics and other imported materials like shell beads. The economic interactions of CCQ residents provided them with local and regional connections which helped them integrate into the regional political landscape.

CCQ residents found themselves in the middle of a complex political landscape with the regional centers of Xunantunich, Actuncan, and Buenavista all located within a five km radius. The largest site close to CCQ is the minor center of Callar Creek, which was affiliated with the regional center of Buenavista. CCQ residents may have been part of the broader Buenavista political community as they had access to Buenavista style polychrome ceramics, while their connections with the broader region are illustrated in
the shared ceramic traditions found throughout this part of the Mopan Valley during the Late Classic period.

Thus, although CCQ residents may not have directly participated in economies of prestige and status items, they were integrated within the broader Buenavista political community, possibly through the mediation of the more proximately located elites at Callar Creek. They may not have interacted directly with the ruling elites at Buenavista, but probably considered themselves part of this political community. The interactions they had with other residents of the region outside of the main sites probably solidified these relationships and feelings of connection with the broader community. If nothing else, the residents of CCQ-1 saw Buenavista every day, as to this day the site is visible from the plaza and structures of the residential complex.

Despite regional connections with Buenavista, and presumably Callar Creek, it is important to keep in mind that residents lived at CCQ both before and after the powerful elites ruled from Buenavista. Many of the polychromes at CCQ date to the Early Classic period and the Buenavista style sherds probably date to the Early Classic period or the Early Late Classic period. Although they were integrated into this larger regional community, there was a continuity of occupation and lithic extraction and production at the site that did not depend on elite power and traditions. In fact, occupation at CCQ continued basically unchanged during the heart of political instability in the UBRV during the Late to Terminal Classic period. Instead, residents probably continued to interact with other occupants of the region who continued to live in the region throughout the Terminal Classic period and later.
While the lives of CCQ residents were in many ways shaped by their relationship with the lithic raw material to which they had access, their lives were in no way monolithic. They participated in day-to-day activities like other rural Maya farmers, interacted with other occupants of the hinterland, and maintained connections and identity to larger regional polities, in this case Buenavista, and by extension the closer but smaller site of Callar Creek. Their lithic production activities aided in this integration and residents’ economic security by providing additional sources of economic stability.

10.3 Technological Organization

The organizational approach to lithic studies provides an avenue through which to address lithic production and its relationship with other aspect of past societies. Lithics are excellent materials to study as they preserve well in the archaeological record, are a reductive technology, and are ubiquitous in many areas. By utilizing organizational approaches in complex societies, lithic studies can be brought to the fore of important anthropological questions of interest to scholars of such societies.

Organizational approaches provide a nuanced understanding of the variability in extraction and production techniques utilized in the past due to the emphasis on detailed analyses of the lithic materials and the conclusions which can be reached from these technological analyses (see Chapter 4 for a discussion of the utility of the organizational approach). As discussed in Chapter Six, at Callar Creek Quarry resource extraction occurred in three different manners as a result of differences in the accessibility of the lithic raw materials. The production of goods, as seen through the comparisons of the respective reduction sequences discussed in Chapter Eight, remained consistent across the quarry and surrounding household areas. Although this may be in part due to the
informal manner of reduction, the lack of variability is also suggestive of the production of materials by the same group of people, thus supporting the use of the quarry by local residents.

The use of a detailed attribute analysis linked to the analytical framework of the organizational approach allowed this analysis of the economic role of raw material extraction and production to Callar Creek Quarry residents. The generalized production of lithics at the quarry can, through the relationship between measurable qualities of lithics and technological strategies discussed in Chapter Four, be related to the exchange mechanisms and segmented lithic production observed in the UBRV. As discussed in the preceding chapter, the majority of lithic production activities in the UBRV consist of only a segment of the reduction sequence, and Callar Creek Quarry is no exception. Thus, the residents of the quarry participated in a regional lithic economy based on segmented household production. While the organizational approach provides the framework to link the attributes of the lithic materials to the broader economic activity, the specific importance of lithic raw material sources to householders in the UBRV, and the implications of this importance require further discussion and will be addressed in the following section.

10.4 Lithic Raw Materials as a Factor in Settlement

Among the issues raised in this dissertation is the importance of raw material resources on the landscape as a factor in settlement, as, at Callar Creek Quarry, chert raw material served as a major draw for settlement. Use of chert resources at Callar Creek Quarry began at the latest during the Archaic period, although earlier use of the area cannot be discounted, indicating knowledge of the raw material prior to the first
permanent settlements around the source (see Chapter Six for more details). In the Middle/Late Preclassic periods when early occupation around Callar Creek Quarry began, and when the quarry was utilized, settlement elsewhere in the region would not have been particularly dense (Chase and Garber 2004; Garber 2004; Leventhal et al. 2010). In fact, compared to elsewhere in the UBRV, population density in the Callar Creek hinterlands remained low through time (Kurnick 2013; Yaeger et al. 2016). On such a (relatively) sparsely populated landscape, the location of the chert raw material source was a factor in the placement of the households in the immediate quarry surroundings. Use of the quarry persisted after the end of occupation at the adjacent households, in the Terminal Classic period, as at least visits to the area occurred as late as the Historic period. The continuity and longevity of use and visits to this location provides further evidence for the significance of the spot on the landscape, as well as the importance of the resource to peoples’ livelihoods.

In addition to the ease of access to lithic raw materials granted from living practically on top of a chert source, proximity to Callar Creek Quarry also provided residents with economic benefits. The economic benefit probably stems from residents’ direct access to the chert resource rather than their status as tool producers. Thus, it is access to resources rather than tool production that is most economically beneficial. Callar Creek Quarry residents’ wealth contrasts with ethnographic and ethnoarchaeological studies of lithic producers which suggest that lithic tool producers were generally the last settlers in a region and thus had less access to high-quality agricultural lands, forcing a reliance on lithic production (see Arnold 1985; Deal 1998). These studies focused on lithic producers who did not reside adjacent to lithic sources,
supporting the importance of access to chert resources rather than lithic production as the more economically beneficial activity (see Chapter 6 for a discussion of the wealth of CCQ residents).

The information presented in this dissertation points to lithic source areas as economically favorable locations which encouraged early, rather than later settlement, around the quarry. Archaeological case studies of lithic resource areas elsewhere in the Maya area, particularly in Yucatan, found a similar pattern (see also Dahlin 2009; Masson and Freidel 2012; Hare and Masson 2010; Masson et al. n.d., 2016). It should be noted, however, that in Yucatan, particularly northern Yucatan, chert is not common and hence a more economically valuable resource than in the UBRV where it is common. Thus, the comparative wealth of lithic producers in Yucatan may be related to the economic value of chert resources in that region. Regardless of this situation, access to chert resources was economically beneficial to CCQ residents, as it was to other lithic producers.

The advantageous nature of living adjacent to a chert source area is highlighted through comparisons between the CCQ households and other lithic producing households. When compared with residences at San Lorenzo, CCQ-1 and 2 share more similarities with SL-22, one of the wealthiest households and possibly that which managed access to the San Lorenzo lithic source, than with SL-28, a lithic producing household (see Chapter 7 for further discussion). The similarities between CCQ-1 and 2 and wealthier San Lorenzo households indicate that access to raw material resources provides additional economic opportunities. Thus, resource extraction, rather than just lithic production of materials obtained from other source areas, is the more economically
advantageous activity. We can extrapolate from this pattern to suggest that the management of raw material resources provides a level of wealth which is not seen when lithics are produced outside source areas.

A further economically advantageous aspect of residence near lithic source areas is the diversification of economic activities which accompanies lithic resource extraction and production. Economic diversification serves to reduce risk (see Hirth 2009a). By employing multiple economic activities households can ensure that their reliance on any one type of activity is limited, thus reducing risk due to failure of one aspect of an economic system. In particular, lithic extraction and production are not susceptible to environmental challenges, as opposed to agricultural activities, so lithic production provides insurance against the vagaries of agricultural production.

The utility of access to lithic resources as a mechanism of risk reduction is highlighted by the continuity in occupation and use of the quarry in the face of regional political turmoil and depopulation. As discussed in Chapter 9, occupation at CCQ continues through the Late Classic II to Terminal Classic periods when Buenavista declines, and CCQ illustrates no evidence of changing political affiliations to Xunantunich. Instead, residence seem somewhat buffered from these political changes due to their economic activity and the local networks which access to this lithic resource has allowed them to create.

Lithic extraction and production at Callar Creek Quarry served as a manner of risk reduction due to the part-time participation of residents in this activity. As discussed in Chapter 8, the amount of lithic production suggests only part-time, or possibly seasonal, production of lithic materials. The part-time, periodic production of lithics was
common throughout the Maya area and in Mesoamerica in general. In fact, the majority of lithic production in Mesoamerica was probably part-time or periodic. There are two possible exceptions to this statement: Colha and Teotihuacan. Production at Colha, which as discussed in Chapters Three and Nine, is not a scale of production typical in the Maya region. At Teotihuacan, production workshops varied in size and scale and some may have represented full-time specialization (see Carballo 2002, 2005; Chapter 1; but see Clark 1986). Full-time craft producers may have also produced goods for elites as part of tax/tribute activities at workshops such as those near the Pyramid of the Moon (Carballo 2005, 2007; see also Andrews 1999). Thus, we should consider lithic extraction and production as advantageous economic activities which reduced risk through the diversification of economic activities. The importance of lithics for diversification of economic activity leads us to a discussion of the ways in which we study and talk about lithic source areas, the subject of the following section.

10.5 Chert source distribution and ‘chert bearing zones’

The ubiquity of chert sources in Mesoamerica, and particularly in Belize, highlights the inconsistencies in the terminology used to refer to various areas where chert is prominent in Mesoamerica, particularly the Northern Belize Chert Bearing Zone (NBCBZ), in relation to the distribution of chert in the region. It is quite clear that many areas outside of this zone contain significant amounts of chert. That is, chert is found in many areas which are not part of this so-called ‘Chert Bearing Zone.’

The term NBCBZ was coined after the discovery of Colha, which is an important and highly influential site. The term is sometimes used to refer to the geographic distribution of a specific type of chert ‘Colha chert,’ which has a distinctive honey-brown
color and is of high quality, making it an easily identifiable and sought after raw material. These characteristics differentiate Colha chert from other chert resources which are not easily sourced and are more variable in quality. Thus, Colha chert represents a unique source in the Maya area; however, the uniqueness of Colha does not imply a lack of chert resources elsewhere in the Maya area.

While it is valid to differentiate areas of Colha chert from other chert bearing soils, the terminology and manner in which this is done is detrimental to chert studies in Mesoamerica for several reasons: 1) The terminology implies to those with little interest or knowledge about lithic materials that there is not chert elsewhere in the Maya region, thus undermining the importance of this ubiquitous and widely utilized resource; 2) the Colha region and other areas of Mesoamerica share a similar geology. By referring to a region as a ‘chert bearing zone’ it implies some geologic difference from the rest of the region which, in fact, is not the case; 3) the term ignores the ubiquity of chert resources throughout parts of central and southern Mexico, Belize, eastern Guatemala, and other areas; 4) it reinforces the idea of Colha as the best example of chert production activities in Mesoamerica. While it is an important example it is in no way representative of chert production and extraction activities in most of Mesoamerica.

While Colha chert is a very important resource with implications for understanding lithic production, we must move beyond terminology which focuses on this resource as the only source of chert materials. The use of the ‘chert bearing zone’ implies that other areas do not have this resource, reinforcing an idea common to many Maya archaeologists that lithic materials are unimportant and cannot provide significant information concerning the Maya. Instead, we should refer to source areas by the names
of the source, so for Colha, Colha chert, a term already used to talk about the materials, should be utilized. Similarly, Callar Creek chert would be applicable to the materials discussed in this dissertation. The use of specific names for chert removes the confusion present in the term NBCBZ, as it underscores the presence of other chert sources over a wider geographic area.

By moving beyond the assumptions generated by current terminology we can develop more nuanced understandings of the ways in which Maya lithic economies functioned highlighting the frequency of household-based lithic production areas, the part-time or seasonal nature of the production activities, and the importance of lithics for understanding economic behaviors on site and regional levels.

10.6 Implications for Maya Economies

This study of lithic resource extraction and production reveals extensive variability in the manners and mechanisms of resource extraction and production in the Maya area. This variability relates to patterns of economic behavior related to raw material source access and distribution. The case study discussed in depth here, Callar Creek Quarry, illustrates local management of extraction and production of utilitarian chert materials. As discussed in Chapter Nine, however, other source areas show other forms of management and production.

The variability in source management falls within the economic patterns outlined in the model discussed in Chapter Two. Callar Creek Quarry falls within mode three objects, those with local source areas, local production, and presumed limited distribution of the raw material and finished product, although further consideration of resource distribution should be conducted. As suggested by the model, these resources operated
under the guise of non-elite individuals. As discussed in Chapter Nine, other areas, where chert resources are not locally available, illustrate greater evidence of the involvement of political leaders in chert resource acquisition and distribution, thus supporting the importance of the location of raw material sources, production areas, and extent of distribution to management of lithic resources. This model provides a framework which divides past economic activity into analytic categories, to highlight the variability present in past economic systems and the ways in which this variability functions.

Expanding beyond Callar Creek Quarry, evidence from lithic source areas illustrates that, in the UBRV, local individuals managed the extraction, production, and presumably distribution, of utilitarian chert objects. At the same time, other goods circulated through varying mechanisms, such as gift-giving, from elite individuals (Ball and Tascheck 2004; Yaeger et al. 2015). Furthermore, goods may have circulated through a variety of exchange mechanisms during their use-life (e.g. chert materials being distributed as preforms through reciprocal exchanges, tribute, or in marketplaces, and in their final form in the marketplace), thus adding variability to the exchange system. As such, much as considered by Masson and Friedel (2012), multiple economies operated concurrently in the UBRV during the Late/Terminal Classic.

The presence of multiple economies among the Late/Terminal Classic Maya impacts the ways in which economies served as a source of integration and disintegration among the Late/Terminal Classic Maya. As political leaders did not directly manage all aspect of economies, certain economic activities were not salient power bases for those leaders. This is not to say that political leaders did not rely on economies as sources of
power, as studies of specific types of goods, i.e. jade or some ceramics (see Chapters Two and Nine for a further discussion of these issues) have shown that they were highly involved in the circulation of these goods; however, investigations at Callar Creek Quarry revealed no evidence of direct involvement by political leaders, such as those seen elsewhere in the ancient world, i.e. Peru, Egypt, and the Roman Empire (see Chapters Two, Three, and Nine for more information).

The lithic economy, however, did serve to connect CCQ residents, and presumably other regional producers, into the regional political community and served as a source of wealth and social status for those individuals. Thus, for Callar Creek Quarry residents, economies were a source of both political integration and independence. Residents had political affiliations to Buenavista, which they showed through ceramic styles, but also used their economic wealth to insulate them from changing political dynamics in the region. By serving as mechanisms of integration and independence, economies can be seen as both embedded in and separated from political and social processes for the Late/Terminal Classic Maya.

This dissertation furthers our understanding of the multiplicity of ancient Maya economies and the relative involvement of actors of different socio-political status in these different economies. Some economies saw greater amounts of involvement by political leaders than others, a pattern which can be partially explained through the relative presence and abundance of raw material resources, as outlined in the economic model discussed in Chapter Two and applied in Chapter Nine. For non-political leaders, economies served both to connect them to political communities and insulate them
against the vagaries of these communities. Economies served as arenas in which socio-political status, wealth, and power were achieved and negotiated.

**10.7 Conclusions**

This dissertation highlights the importance of studies of lithic materials as proxies for perishable goods exchanged in the past and as components of the utilitarian economy in complex societies. The organizational approach to lithic analysis provides a framework which links lithic production to economic activity.

Among the Late/Terminal Classic period Maya of the UBRV, chert materials were extracted and produced by part-time or periodic producers residing near lithic raw material sources. These householders participated in the regional economy through the exchange of these materials which encouraged regional integration, provided opportunities for economic diversification, and served as a method of risk reduction. For these producers, economies served as methods of integration within political communities, insurance against political instability, and sources of wealth.

More broadly, this dissertation illustrates the presence of multiple, overlapping economies. The model discussed in Chapter Nine provides an explanatory mechanism for using raw material source location and abundance, knowable aspects of the archaeological record, to examine and tease apart the co-occurring economies and highlight the importance of these different economies for integration and disintegration for a variety of actors among the Late/Terminal Classic Period Maya. This model, and the importance of raw material location and abundance for understanding economies, is applicable to other complex societies.
This dissertation provides an example of an organizational study of lithic technology which sheds light on economic activity in past societies, highlighting the importance of such studies to understand the multiple economies which operated in the past. A better understanding of the multiplicity of past economies emphasizes the importance of certain economies for specific actors and the degrees to which these actors were involved in different segments of past economies.
Appendix I: Lithic Analysis

Lithic analysis is the main component of this dissertation, as it focuses on the study of a chert source. Attribute analysis was performed on all chert lithic materials from quarry deposits and all off-structure deposits. Chert debitage recovered from fill contexts were subject to aggregate analysis. All lithics of other material types, including obsidian, were subject to the attribute analysis. This includes formal tools and cores from fill contexts which were also subject to attribute analysis, rather than aggregate analysis, so as to gain the most detailed information possible concerning the reduction of lithic materials and about any formal tools from the area. Differences in material type were noted among the attributes recorded. This appendix describes the analysis of all lithic materials first discussing the attribute analysis and then the aggregate analysis.

I.1 Attribute Analysis

The attribute analysis of the lithic materials was performed on individual lithics. All analyses follow the protocols and definitions of lithic materials laid out in seminal texts of lithic analysis such as Andrefsky (2005), Odell (2003) and Whittaker (1994). A variety of attributes were analyzed, focused mostly on attributes which would provide information about the technological processes involved in the production of the lithic materials. All lithics were subject to the same analyses, that is all attributes were
recorded for all analyzed items. If the attribute is not relevant it was coded as such. This section will discuss the analysis of the different attributes and explain their importance and measurement. A list of the attributes measured and the coding utilized follows this section.

Metric attributes were the first attributes analyzed. These include the maximum length, width, and thickness of each item (Figure I.1) (see Andrefsky 2005). Weight was recorded for all items. Length, width, and thickness were measured only for whole flakes, cores, and other tools. Other types of flakes and shatter were not measured as this would not provide an accurate description of the debitage size. Weight was measured in grams on an electronic balance; all other metrics were measured in centimeters using calipers.

Figure I.1 Schematic of the length, width, and thickness measurements of whole flakes
Attributes were also recorded for the raw material quality and color. These attributes were chosen to illustrate the variation in color and quality across the raw material source and to see if differences in the use of the different quality raw materials were present. These attributes were raw material quality, which was divided into high quality, medium quality, and low quality chert, further separated by opacity. Other types of material, limestone, obsidian, etc., were identified in the raw material quality category. Colors were identified based on the range of colors within the quarry. Some gradation exists between the categories. It seems as though the most significant differences between chert colors at the quarry were between the blueish clear material, the clear material, the white, and the brown/grey chert. These are the kinds most commonly found throughout the quarry. Although 16 color categories were utilized, in an attempt to find some pattern or uniformity throughout the debitage, this did not result. Thus the color categories are used sparingly throughout this dissertation as the variability in color and quality of materials throughout the quarry is too great to have much significance. The distribution and variation of lithic raw material sources throughout Callar Creek Quarry are described in more detail in Chapter 6.

Each lithic was assigned to a typological category of flakes, cores, types of tools, etc. This was used to determine which of the remaining attributes were also recorded. For flakes, flake characteristics were recorded, beginning with the flake type. Whole flakes are defined as those with both a platform and a termination; broken flakes are flakes with a platform; and flake fragments only have a termination or an identifiable ventral surface. Shatter has no diagnostic attributes, lacking a platform, termination, and identifiable ventral surface. This category also includes types of blades – proximal,
medial, and distal fragments. Proximal blades have only the platform, medial segments have neither platforms nor terminations, and distal fragments have only the termination (Andrefsky 2005, Odell 2003, Whittaker 1994). All blades analyzed here are prismatic blades.

Flakes were also categorized by production stage. The stages include primary flakes, which have lots of cortex and few or no flake scars; secondary flakes which have some cortex and minimal flake scars; and tertiary flakes which have no cortex and many flake scars (Andrefsky 2005; Sullivan and Rozen 1985). These types are generally linked with the stage of reduction or production which produced the flake. These terms have some issues in comparison between analysts (Sullivan and Rosen 1985), but as all analyses were performed by the author, this difficulty was minimized. They were recorded here as they can potentially provide information about the stages of reduction occurring at Callar Creek Quarry. When combined with other attributes the difficulties in utilizing this attribute are minimized.

The technological method of production was also analyzed. The attribution of the type of percussion utilized in the lithic manufacturing sequence can provide information about the technique of production of the lithic materials and compare these types throughout the assemblage. A variety of types of flakes were identified; the most common include probable hard hammer flakes, thinning flakes, soft hammer flakes, and decortications flakes. Decortication flakes are flakes which are removed to remove cortex from a core. Thinning flakes are the result of bifacial thinning, a technique utilized to create bifaces. The goal of thinning is to take a flake off that will cross over the midsection of the biface and reduce the thickness of the biface while maintaining its
width (Callahan 1979; Johnson 1981). Thinning flakes, usually made with soft hammer percussion, can be identified as they are usually thin, spreading, and have a curved cross-section. Hard hammer flakes are those produced through hard hammer percussion. These flakes have pronounced bulbs of percussion and slight crushing on striking platform areas (Andrefsky 2005; Cotterell and Kamminga 1987). Soft hammer flakes have more diffuse bulbs of force and tend to be more spreading in their form (Andrefsky 2005; Cotterell and Kamminga 1987; Crabtree 1972).

Flake terminations were also recorded. Flake terminations concern the distal end of flakes and can provide information on techniques of manufacture, skill of knappers, reduction goals, and raw material quality, depending on the type of analyses performed and the presence of different termination types. Feather terminations are those which gradually are removed from the core; step terminations snap to form a 90 degree angle, and hinge fractures are when the end of the flake is rounded or sloped. Overshot, or outreposse flakes, are those which go over the edge of the core from which the flake is being removed (Andrefsky 2005; Odell 2003; Whittaker 1994).

The number of dorsal flake scars on each flake was recorded. This provides some idea of the number of flakes removed from a core before the flake itself (see Baumler 1988 for a detailed description). Caution should be taken with this measure as flakes removed late in core reduction can have few flakes if they were removed within the flake scar of one previous flake. This is particularly problematic for small flakes.

The presence and absence of retouch and macroscopic use wear were also recorded. Retouch is the removal of small flakes along the edge of a flake or tool to resharpen or modify that edge for use. Retouched flake tools are used for a wide variety
of technologies around the world and are generally referred to as informal tool technologies, which are sometimes referred to as expedient tools. The presence or absence of retouch was recorded as was the type of retouch, whether an object was unifacially or bifacially retouched. How much of a flake was retouched was also considered. Macroscopic use wear is evidence of use on the edge of flakes which is visible without the use of a microscope. The presence, location, and type of use-wear were recorded when present. Use wear was distinguished from edge damage possibly caused by trampling (by cows) or bag damage by the extent and consistency of the wear as well as through comparisons to known examples of use wear (see Ferris and Andrefsky 2011). This attribute is best considered on an assemblage-wide level and across the assemblage few instances of possible use wear were identified suggesting it did not occur commonly in the CCQ assemblage. Retouch and use-wear allow a discussion of whether flakes in the quarry were utilized for other purposes or whether only reduction occurred in the area.

Several aspects of flake platforms were also analyzed. Striking platforms are those areas where the hammer made contact with the core to produce a flake. Platform characteristics were analyzed on whole and broken flakes, as other flake categories do not have platforms to analyze. The number of platform facets and the width of the platform were measured. Facets, the number of different ‘faces,’ on the platform were counted while the width was measured, in millimeters, at the widest part of the platform using plastic calipers. Both the platform facets and width can be important in providing information concerning the sequence of reduction occurring. For instance, flakes removed later in the reduction sequence are more likely to have greater numbers of facets
than those removed at the beginning. Furthermore, the number of facets can provide information about the reduction strategy. Reduction techniques which require platform preparation, such as bifacial thinning, are more likely to have higher numbers of facets on platforms than reduction techniques which do not require platform preparation. The size of the platform is also indicative of the core reduction technique. The type of hammer used also impacts the platform size as use of soft hammers tends to result in small platforms. Platform preparation was also noted. If obvious platform preparation, such as grinding of platforms, had occurred, this was noted. The characteristics of the platform can provide important information concerning the stage of reduction and manufacturing technique utilized to produce the debitage.

The percentage of cortex on flakes, and all other lithic materials, was also recorded. Percentage of cortex can provide information concerning the place in the reduction sequence of a flake, as flakes removed earlier in reduction tend to have more cortex than those removed later. Cortex was recorded in four mutually exclusive percentage categories; 0-25, 26-50, 51-75, 76-100.

The presence or absence of possible heat treatment of each particular lithic was also recorded. Heat treatment tends to result in a glossy and waxy feel on lithic materials. Heat treatment can also alter the color of lithic materials and heat treated materials tend to be reddish or pink (Andrefsky 2005; Odell 2003; Whittaker 1994), although, as discussed in Chapter 6, Callar Creek Quarry lithics tend to turn white, rather than red when heat treated. When these characteristics were noted, an item was recorded as having been subject to possible heat treatment. While heat treatment is difficult to determine on a single lithic piece, the lack of markers of heat treatment across the
assemblage points to the lack of heat treatment of CCQ materials. The experimental evidence also provides a comparison with which to recognize possible instances of heat treatment.

Additional attributes of non-flakes were also recorded. These included core type. Cores were divided into types based on their technological characteristics. Unidirectional and multidirectional cores were the most common. Unidirectional cores have flakes removed in only one direction. Multidirectional cores have flakes removed from multiple directions on the core. Core fragments are pieces of cores and the types of cores from which they were removed cannot be determined.

Bifaces were also subject to additional analyses. The surface area of the bifaces was measured in centimeters. This was measured by tracing the bifaces on graph paper and counting the number of squares contained within the outline. Biface surface area is useful for the application of certain indices of biface reduction, such as the Johnson Thinning Index (JTI) (Johnson 1981). The JTI was created by Johnson (1981) to account for the fact that a general goal of biface production is to thin a biface while maintaining its width. He also realized, however, that compensation for natural differences in size was a necessity to allow for comparisons between bifaces of different sizes. In order to allow for comparisons between bifaces of different sizes, Johnson chose to use the plan view area and the weight to determine the JTI. The JTI is the weight of a biface divided by its plan view area. This index, and other morphometric measures of reduction, can provide information about the stage of reduction of bifaces. The reduction stage of bifaces was also recorded. These stages were defined by Callahan (1979) and Whittaker (1994) to include five stages: (1) Blank; (2) edged biface; (3) thinned biface; (4) preform;
(5) finished points (see also Beck et al. 2002; Johnson 1981). The biface stage and JTI, along with other information on bifaces, can be used to discuss the stage of reduction of bifaces, and compare the bifaces with those found at other sites (Horowitz and McCall 2013; Horowitz 2010).

For lithics with catalog numbers that number was also recorded. Any formal tools, such as bifaces, have a catalog number, as do all obsidian specimens. Cores and flakes were not numbered. Comments on any lithic materials were recorded in an additional data field. Counts of lithic materials, by location, are shown in Table I.1. Only materials from the quarry and off-structure deposits at CCQ-1 and 2 were subject to the attribute analysis (a total of 39,951). The remainder (16,350) were subject to aggregate analysis as discussed below.

The raw data from the attribute analysis is not presented here due to the difficulties in presenting such a large quantity of data in a readable fashion in print. The attribute analysis resulted in a data matrix of 26 x 39,951, thus a total of 1,038,726 cells. A summary of attribute analysis results is discussed throughout Chapter 8. The raw data will be available through tDAR (The Digital Archaeological Record) beginning in 2022 (following a five year embargo).

The attribute analysis of lithic materials was aimed at determining the sequence of reduction of materials from the quarry and evaluating the diversity of lithic production and reduction techniques utilized. As such, attributes which focused on production techniques and strategies were chosen. The attributes and the coding system utilized are listed below.
Table I.1: Counts of lithic materials by location

<table>
<thead>
<tr>
<th>Context</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry (Op 370, 374)</td>
<td>35,652</td>
</tr>
<tr>
<td>CCQ-1 Fill (Op 381)</td>
<td>10,992</td>
</tr>
<tr>
<td>CCQ 1 Off-Structure (Op 381)</td>
<td>1,522</td>
</tr>
<tr>
<td>CCQ-2 Fill (Op 373)</td>
<td>5,358</td>
</tr>
<tr>
<td>CCQ-2 Off-structure (Op 373)</td>
<td>2,777</td>
</tr>
<tr>
<td>Total</td>
<td>56,301</td>
</tr>
</tbody>
</table>

I.1.2 Attribute Analysis Coding

Provenience Information (Op, Subop, Lot)

Length (mm)

Width (mm)

Thickness (mm)

weight (g)

Raw Material Color
1 - whitish blue fine grained chert
2 - clear/white fine grained chert
3 - white chert
4 - brown striped chert
5 - clear/brown fine grained chert
6 - pinkish/white chert
7 - darker grey chert
8 - dark brown chert
9 - red chert
10 - coarse grained grey chert
11 - Limestone
12 - yellow chert
13 - orange chert
14 - golden brown chert
15 - clear brown chert
16 - tan
17 - other

Raw Material Quality
1 - very coarse chert
2 - coarse chert
3 - medium opaque chert
4 - medium translucent chert
5 - fine opaque chert /chalcedony
6 - fine translucent chert/chalcedony
7 – limestone
8 - chert with many inclusions
9 - chert with heterogenous, variable texture
10 - coarse translucent
11 - obsidian
12 - slate
13 – other

Tool Classification
1-debitage
2-biface
3- uniface
4- core
5 - retouched flake
6- burin
7- scraper
8 – drill
9 - denticulate
10 – awl
11- notched
12 - blade
13- hammerstone

 Flake Characteristics
0 - unapplicable
1 - whole flake
2 - broken flake
3 - flake fragment
4 - shatter
5 - bipolar flake
6 - split flake
7 - whole blade
8 - proximal blade
9 - distal blade
10 - medial blade

Flake Stage
0- inapplicable
1- primary flake  
2 - secondary flake  
3 - tertiary flake  
4 - retouch flake  
5- unknown  

Flake Technology  
0 – inapplicable  
1 - decortication flake  
2 - secondary flake (not used here)  
3-retouched flake  
4-platform preparation flake  
5 - bipolar flake  
6- thinning flake  
7- general hard hammer  
8- unknown  
9- soft hammer flake  
10 - rejuvenation flake  

Flake Termination  
0- inapplicable  
1- feather termination  
2 - step fracture  
3 - hinge fracture  
4- overshot  
5 - other/unknown  

Dorsal Flake Scars (number)  

Retouched  
0- N/A  
1- less 50 % of one edge  
2 - greater 50 % of one edge  

Type of Retouch  
0 - N/A  
1- unifacial flaking  
2 - bifacial flaking  
3 – grinding  
4 – battering  

Use Wear  
0 - N/A
1 - present less than 50% of one edge
2 - present greater than 50% of one edge

Platform Width (mm)

Platform Facets (number)

Platform Preparation
0 – inapplicable
1- none
2- battering
3- ground
4- other

Cortex
1 - none
2- 0-25%
3 - 26-50%
4- 51-75%
5 - 76 - 100%

Fire Altered
1 - no
2 - yes

Core Classification
0 - inapplicable
1- polyhedral core
2- non-polyhedral blade core
3- pyramidal core
4 - discoidal core
5 - multidirectional core
6- unidirectional core
7 - core fragment

Biface surface area (cm)

Biface stage

Catalog number (formal tools only)

Comments
I.2 Lithic Aggregate Analysis

The aggregate analysis of fill contexts from Callar Creek Quarry 1 and 2 was performed due to the sheer quantity of materials recovered from these contexts. As mentioned above, 16,350 lithics were subject to aggregate analysis. Although attribute analysis provides detailed information about lithic production, and the methods and sequences of such production, it is also time consuming. Aggregate analysis was developed as a manner of rapidly analyzing large quantities of debitage (Ahler 1989; Andrefsky 2001, 2004; Bradbury and Franklin 2000; Carr and Bradbury 2004; Hall and Larson 2004; Larson 2004; Root 2004; Sullivan and Rosen 1985); hence the large quantities of materials led to the application of this technique.

Aggregate analysis, also called mass analysis, is a method of lithic analysis designed to deal with large collections of lithic materials and to divide these materials by certain categories, either technical criteria, size, or various other mechanisms (Ahler 1989; Andrefsky 2001, 2004; Bradbury and Franklin 2000; Carr and Bradbury 2004; Hall and Larson 2004; Larson 2004; Root 2004; Sullivan and Rosen 1985). Aggregate analysis, as discussed here, utilizes the definition laid forth in Hall and Larson (2004), “we expand aggregate analysis to include any technique that uses non-technological criteria to subdivide the entire assemblage before considering the technology of the assemblage as a whole” (Larson 2004: 5). By this definition, aggregate analysis includes mass analysis, item completeness, and minimum analytical nodule analysis (MANA). Larson and Hall (2004) also include refitting (Larson 2004: 6) although this is not commonly adopted. The utility of these subdivisions of aggregate analysis is that they divide the assemblage with a method which does not involve analysis of the entire
assemblage. For instance, mass analysis divides first by size, item completeness sorts by type of flakes, MANA divides by sub-groups of raw materials, and refitting studies sort by raw material before refits are attempted (Larson 2004).

Aggregate analysis, and all its subgroups, have both advantages and disadvantages. Aggregate analysis allows the speedy examination of large amounts of lithics. For example, performing the attribute analysis of Op 373A/1-12 took approximately 13 hours while the aggregate analysis of the same materials took approximately nine hours. This works out to a difference of approximately 40 lithics per hour. Although the difference of four hours, and 40 lithics per hour, may not seem great, Op 373A/1-12 was a relatively small suboperation, with only 1,257 lithics. In areas with greater amounts of lithics, such as Op 373B/1-16, the time savings from performing the aggregate analysis would have been much greater. In an eight hour day, the use of aggregate analysis would enable an additional 320 lithics analyzed a day, about ¼ of the material from Op 373A/1-12.

In an aggregate analysis, assumptions are made concerning what types of items tend to be related to specific categories and generalized characteristics of flakes. These assumptions have been tested through a combination of statistical analyses and experimental archaeology (Andrefsky 2004; Bradbury and Carr 2009; Carr and Bradbury 2004; Larson 2004; Shott 2004). While experimental archaeology and statistical analyses can provide a good idea about materials from the general analysis, Shott (2004) and Andrefsky (2004, 2007) point out that mixing of reduction sequences and techniques can be problematic with such techniques (see also Bradbury 1998; Bradbury and Carr 2009; Railey and Gonzalez 2014). Such problems are why the aggregate analysis was utilized
only for lithics from the construction fill from Callar Creek Quarry rather than for materials from the quarry; we lack the original context for these items. Much of the lithic debitage in the fill may have come from the quarry or nearby production areas, but the exact nature and source of these materials is unknown, so these materials cannot be used to create a production sequence for the quarry, and can thus be subject to a less detailed analysis. While attribute analysis provides information aggregate analysis cannot (Ferring 1988), in these contexts further information would contribute little to our understanding of the lithic reduction process at Callar Creek Quarry.

The aggregate methodology used here, described in detail below, is a combination of mass analysis and item completeness analysis. It most closely resembles that put forth by Root (2004) as he combined size, cortex, and technological attributes (see also Bradbury and Carr 2004). Size cannot be used on its own to discuss the reduction process, although flake size is an indicator about certain reduction processes and stages, but additional information is necessary to fully examine the production of materials. As such, Root (2004) suggested also looking at cortex, as its proportion varies with techniques and stage of reduction, as well as technological classes. The combination of these items permits the analysis of a broader class of information, shedding additional light on the reduction of materials, without having to perform an attribute analysis on each individual piece of debitage.

The information recorded in the aggregate analysis was based on the information from the attribute analysis, and in many cases, utilized the same coding (see below) and the same categories. However, instead of each item being subject to an individual analysis, the lithics were analyzed in groups based on size, color of raw material,
percentage of cortex, item completeness, and type of flake. The sorting of items into categories was nested; items were first separated by size and then within each size category separated by color, then cortex percentage, item completeness, and finally, type of flake. This resulted in up to 20 categories, but for any one context all categories were rarely used, so there were many fewer groups. The number of lithics in each group, and the weight of the group, were then recorded. An example of such a group is whole, brown flakes larger than 16 cm with no cortex. All materials which fit this description were counted and weighed as a unit. A change in any one of these variables would result in a separate grouping, which was counted and weighed on its own. Photographs were taken throughout to provide an overview of the materials. Only the debitage was subject to the aggregate analysis. All formal tools and cores were analyzed using the attribute analysis described in Section I.1.

Size was measured using the size grade technique (Ahler 1989; Andrefsky 2005; Baumler and David 2004; Bradbury and Carr 2009; Carr and Bradbury 2001, 2004; Healan 1995; Root 1992; Whittaker 1994). Size grades enable a general idea of size without having to analyze each individual piece. Instead, squares of the various sizes were outlined on graph paper and each lithic was checked to see within which square it fit. The size grades utilized here were 1, 2, 4, 8, and 16 cm. Other examples of such methods (Baumler and Davis 2004; Behm 1989; Carr and Bradbury 2004; Healan 1995) use much smaller size grades (i.e. between 2-8 mm or < 1 in). However, due to the large size of lithic materials present in these materials, such scales of analyses would provide little or no information about the size of materials. Instead, grades between 1-16 cms

---

1 While there is the possibility of greater numbers of categories if all flake types and item completeness categories were present, but they were not. Therefore many of the codes listed below were not utilized in the aggregate analysis but are included for consistency.
were utilized, as most materials fit within these measurements, and this permitted
distinctions between smaller (1-2 cm) and larger (4-16 cm) debitage. Practically no
debitage fit within the smaller categories, it was concentrated within the larger size
grades, further demonstrating the efficacy of these size grades rather than the smaller,
previously utilized measures. The lack of smaller debitage probably resulted from the
use of 1/4” mesh to screen materials (see Appendix IV for a discussion of the excavation
methodology), although samples of all contexts were subject to flotation and the
microartifacts recovered were also analyzed (see Appendix III).

The color designations were similar to those discussed above for the attribute
analysis and the same coding system was utilized. In this case, however, items were
generally lumped into more general categories so as not to have an overwhelming
number of different groupings within the aggregate analysis. As the description of the
chert from Callar Creek Quarry had been performed, it was apparent that the white, clear,
and brown materials are the most ubiquitous and have the most distinctions between
them. So, these are the three most common color designations utilized within the
aggregate analysis. Other color designations were utilized on an as-needed basis.

The materials were then sorted by amount of cortex, using the same 25%
exclusive intervals described above for the attribute analysis materials, and employing the
same coding system. Item completeness, that is whether they were whole flakes, broken
flakes, or flake fragments, etc., and the method of production, mostly hard vs. soft
hammer percussion in this case, were also recorded. The count is the number of
materials in each group and the weight (in grams) was measured for each group.
The aggregate analysis necessitated large amounts of space (Figure I.2) but it was an efficient manner of quickly examining a large number of lithics. As these materials were from fill contexts not as much information could be gleaned from them as could be from the materials from off-structure and quarry deposits. Instead, this permitted an efficient manner to gain a general understanding of the materials utilized as construction fill for the structures around Callar Creek Quarry.

Figure I.2 Photograph showing the large amount of space necessary for aggregate analysis.

The raw data from the aggregate analysis is not presented here due to the difficulties in presenting such a large quantity of data in a readable fashion in print. A summary of aggregate analysis results are discussed in Chapter 6 and Appendix I.3. The raw data will be available through tDAR (The Digital Archaeological Record) beginning in 2022 (following a five year embargo).

1.2.1 Aggregate Analysis Coding

Provenience Information (Op, Subop, Lot)

Size Grade
1 - 1 cm (1-2 cm)
2 - 2 cm (2 - 4 cm)
4 - 4 cm (4-8 cm)
8 - 8 cm (8-16 cm)
16 - 16 cm (16 cm and up)

Color (general)
1 - whitish blue fine grained chert
2 - clear/white fine grained chert
3 - white chert
4 - brown striped chert
5 - clear/brown fine grained chert
6 - pinkish/white chert
7 - darker grey chert
8 - dark brown chert
9 - red chert
10 - coarse grained grey chert
11- Limestone
12 - yellow chert
13 - orange chert
14- golden brown chert
15- clear brown chert
16 - tan
17 - other

Note: white, clear, and brown were used almost exclusively in the aggregate analysis.

Cortex
1 - none
2- 0-25%
3 - 26-50%
4- 51-75%
5 - 76 - 100%

Item Completeness
0- inapplicable
1 - whole flake
2 - broken flake
3 - flake fragment
4- shatter
5 - bipolar flake
6- split flake
7- whole blade
8- proximal blade
9 - distal blade
10 - medial blade

Technological Classification
0 – inapplicable
1 - decortication flake
2 - secondary flake (not use here)
3- retouched flake
4- platform preparation flake
5 - bipolar flake
6 - thinning flake
7- general hard hammer
8- unknown
9- soft hammer flake
10 - rejuvenation flake

Count

Weight

Comments

I.3 Attribute/Aggregate Analysis Comparisons

Although the aggregate analysis provides a more general view of lithics than the attribute analysis, the information collected from these two methods of analysis is, in many ways, comparable. To illustrate the comparability of the two types of analyses, a sample of materials which were analyzed through an attribute analysis were subject to the aggregate analysis and vice versa. From the materials originally analyzed with the attribute analysis, Ops 374D/1, 374D/2, and 374D/3, all from the quarry, were also analyzed with the aggregate analysis methodology. These three lots contained a total of 3,169 lithics. Of the materials originally subject to an aggregate analysis, Ops 373A/1, 373A/2, 373A/3, 373A/4, 373A/5, 373A/6, 373A/7, 373A/8, 373A/9, 373A/10, and 373A/12 were also analyzed with an attribute analysis. These materials are fill from Callar Creek Quarry 2 Structure 2. A total of 1,257 lithics were contained in these lots.
As is apparent, all lots from Op 373A/1-12 were analyzed in both methods (Op 373A/11 did not contain any lithic materials) while only the first three lots from Op 374D/1-10 were analyzed with both methods. This is due to the discrepancies in the number of lithics from the two contexts. Even though only three lots were analyzed from Op 374D/1-3 there are still over two times as many lithics as from the entirety of Op 373A/1-12.

In most cases of aggregate analysis the data are compared with experimentally produced assemblages and a discriminate function analysis, or other statistical analysis, is applied to divide the debitage into categories by type of reduction (e.g. Andrefsky 2004; Bradbury and Carr 2009; Carr and Bradbury 2004; Larson 2004; Shott 2004). In this case, I chose to instead compare the aggregate data with the attribute analysis performed here. As the aim of reduction and the type of reduction performed can be elucidated from the attribute analysis, if similarities between the aggregate and attribute analyses existed, then the aggregate analysis can be used to argue for the type of reduction. Two main causes of the utility of the comparison of the aggregate and attribute data exist. The first is that a set of materials which were originally measured using the attribute data were also analyzed with the aggregate methodology and vice versa for an additional set of materials. As both methods were present for the same data set, comparisons between the two sets of data could be made in this way, rather than through statistical comparisons with experimental data. Additionally, the materials from Callar Creek Quarry would be extremely difficult to compare with published literature on aggregate analyses and the statistical methods used in those cases. The materials from Callar Creek Quarry were analyzed using different size grades than usually utilized due to the extremely large size
of the raw materials. The size grades used in most mass analyses would have proved pointless in this case. As such, the choice was made to compare the aggregate analysis to the attribute analysis to show the validity of the proposed information resulting from the aggregate analysis.

As discussed elsewhere, the attribute analysis reveals that the main goal of the reduction at the quarry, and in the surrounding area, was generalized reduction for the production of flake tools and generalized flake cores, both for use in the immediate region and for exchange. Several attributes contributed to the identification of this information, including the amount of cortex, counts of dorsal flake scars, platform facets and preparation, in addition to the information on knapper skill, gained from terminations and types of lithic materials present in the assemblage. Although much of these data were not collected in the aggregate analysis (dorsal flake scars, platform facets and preparation, and flake terminations) they still provide us with sufficient information to discuss the types of knapping which led to the creation of the debitage used in construction fill.

In terms of comparisons between the two types of analyses, aggregate analysis actually makes it easier to look at the non-weight size of materials than attribute analysis. Although the weight of materials is recorded for both, and therefore easily comparable, it is difficult to compare other size measures in the attribute analysis, which are recorded as length, width, and thickness measures, without additional calculations. Size grades, as recorded in the aggregate analysis, are advantageous for size comparisons as the proportions, percentages, or counts of lithics of different sizes can be easily compared without any additional calculations.
Aggregate analysis data can be used to examine the production stage and end production (core vs. tool) of lithic reduction (Bradbury 1998; Bradbury and Carr 2004, 2009; Morrow 1997; but see Andrefsky 2004, 2007; Shott 2004). In the attribute analysis performed here, reduction stage was recorded for each item. This attribute was not part of the aggregate analysis; however, factors used to determine reduction stage were recorded during the aggregate analysis including the method of production, cortex, and size. Analysis of the cortex amount from the aggregate analysis demonstrates similar recordings of cortex amount to the attribute analysis (Figure I.3).

![Comparison of Cortex Amount Between Aggregate and Attribute Analysis of Op 373A](image)

Figure I.3: Graph showing the relationship between cortex proportions for the attribute and aggregate analysis of Op 373A/1-12.

While on its own, cortex amount would not seem to indicate early stages of reduction, due to the large numbers of lithics without any cortex, the size and shape of the raw
materials must be considered. The size and the shape of raw materials result in changes in the possible amount of cortex; the ratio of the surface area to volume varies according to both of these factors, and hence the maximum possible amount of cortex present also varies (Dibble et al. 2005; Douglass 2010; Douglass et al. 2008; Holdoway 2014; Lin et al. 2010). Figure I.4 shows the relationship between surface areas volume for spheres, the closest approximation to the shape of Callar Creek Quarry raw material. This figure illustrates that as the volume increases surface area does not increase at the same rate. Raw material sources with large cobbles, like this one, have lower average cortex/volume ratios than ones with small nodules (Dibble et al. 2005) (Figure I.4). As such, the high amount of debitage without cortex should not be taken as an indicator of a lack of early stage reduction. Using the known information on the size and shape of raw materials, the amount of cortex on Callar Creek Quarry materials can be used as an indicator of early stages of reduction.

Figure I.4: Graph showing the relationship between surface area and volume for spheres. (After Dibble et al. 2005 Figure 2).
As mentioned above, size comparisons of lithics are easy to perform with the aggregate analysis. A chart of the size grades for the Op 373A/1-12 and Ops374D/1-3 materials can be seen in Figure I.5. These data demonstrate that the lithics center around size grades four and eight, with relatively few items in the smaller size grades, and only a few in the larger size grades. The generally large size of the materials is suggestive of early stages of lithic reduction and core reduction. Larger flakes are generally associated with earlier stages of reduction (Andrefsky 2006; Whittaker 1994). In comparisons with other aggregate analyses, the data from Callar Creek Quarry is already demonstrably larger, as seen by the larger size grades necessitated by the large material size. In terms of the average weight of the raw materials, the weight of materials from Ops 373A/1-12 is 21.05 grams. This reflects the dumping of quarry debris into the construction fill; hence a lack of smaller lithics pieces. The average weight from Ops 374D/1-3, from the quarry, is much lower, 8.64 grams. The difference in average weight probably reflects the greater number of the smaller items from debitage in the quarry deposits. The size grades and weight of the materials indicate early stage reduction of materials.

Examination of the flake production mechanism indicates the majority of the flakes were probably produced through hard hammer production, 88 % (n = 1,086) in Ops 373A/1-12 and 93 % (n = 2,914) in Ops 374D/1-3. While not a definitive marker of early stage reduction, the presence of almost exclusively hard hammer percussion rules out the production of other, more formalized, materials, such as bifaces, which are produced through thinning and usually require soft hammer production. The attribute analysis also indicated that hard hammer percussion was probably the dominate
mechanism of manufacture (Op 373A/1-12: 76% (n = 935); Op 374D/1-3: 67% (n = 2,145))

The analysis of the information garnered from the aggregate analysis of Ops 373A/1-12 and 374D/1-3 indicate that the data are sufficient to determine the types of reduction which occurred. The amount of cortex, size of materials, and type of percussion, all items used to determine stage of reduction, were recorded, and hence can be used to further investigate the reduction stage of materials, despite arguments to the contrary (i.e. Andrefsky 2007). Andrefsky (2007) argues that debitage mixing, knapper style and error, and raw material package size and type all negatively affect the ability of

---

2 The disparity between the attribute and aggregate analysis in the percentages of hard hammer percussion flakes can be explained by the higher proportion of ‘other’ flakes in the attribute analysis. More flakes were given and unknown/other designation during this analysis than during the aggregate analysis. This is due to the broader generalizations which were made during the aggregate analysis.
mass analysis to look at lithic reduction. While in general this is correct, in this case mixing, raw material package size, and knapper diversity have already been considered. The aggregate analysis did not occur in a vacuum; a thorough understanding of the raw material size and type, the knapping style, and potential for mixing existed prior to the performance of the aggregate analysis. Due to these extenuating circumstances, the aggregate analysis data can be, and was, compared with information from a more detailed attribute analysis and indicates many of the same trends. Although not as detailed as the informative from the attribute analysis, determination of whether items were in early stages of core reduction or from later core reduction or tool preparation can be determined with the aggregate analysis.

This generalized comparison of attribute and aggregate analysis illustrate that for many situations aggregate analysis provides comparable information to attribute analysis. In this way, information obtained from the two different types of analyses can be compared. Each type of analysis has its utility in different situations, particularly given the amount ofdebitage and the types of reduction which occurred.

**1.4 Obsidian**

The majority of lithic materials from the quarry consist of chert items, as it is a chert quarry, however, obsidian items were identified in excavations both within the quarry and households. The obsidian materials were subject to the same attribute analysis as all other lithic materials although each piece of obsidian received a catalog number, as is typical with MVAP materials. 19 obsidian pieces were collected during investigations, the majority of which, 11, were from CCQ-1 (Table I.2). Of the obsidian pieces, 15 were prismatic blades or blade fragments, and the remaining four were flakes.
The two obsidian flakes from the quarry appear to be thinning flakes and probably were produced due to retouching of an existing obsidian piece. The two remaining flakes, both from fill contexts at CCQ-1 were larger chunks, indicating residents probably had some access to obsidian not in its finished form; that is these items would not have been produced through retouching formal tools of obsidian, nor from prismatic blades or blade cores (see Table I.3).

<table>
<thead>
<tr>
<th>Context</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry (Op 370, 374)</td>
<td>6</td>
</tr>
<tr>
<td>CCQ-1 Fill (Op 381)</td>
<td>9</td>
</tr>
<tr>
<td>CCQ 1 Off-Structure (Op 381)</td>
<td>2</td>
</tr>
<tr>
<td>CCQ-2 Fill (Op 373)</td>
<td>2</td>
</tr>
<tr>
<td>CCQ -2 Off-structure (Op 373)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
</tr>
</tbody>
</table>

Of the 15 blades from the quarry and surrounding mound groups all were partial segments, and many showed intensive retouching and use. Seven of the blades indicate intensive retouching along the edges, suggesting obsidian was a relatively scarce commodity, where obsidian blades were not frequently obtained. The overall length of blade fragments was also short, with an average of only 1.87 cm, demonstrating the intensive utilization of these items, as well as their overall small size.

The obsidian from CCQ suggests that residents did not have ready access to obsidian, due to the intensive retouching and small size of the blades. The presence of several flakes indicates residents did access formal (non-blade) obsidian tools and obsidian in some other form, presumably as cores, due to the presence of flakes which are not retouch or from a blade core. Overall, however, the obsidian indicates that the residents did not have frequent access to such materials.
<table>
<thead>
<tr>
<th>Context</th>
<th>SF Number</th>
<th>Type</th>
<th>Other</th>
<th>Photographs</th>
</tr>
</thead>
<tbody>
<tr>
<td>373B/2</td>
<td>OB – 1083</td>
<td>Distal prismatic Blade Fragment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>373B/14</td>
<td>OB-1108</td>
<td>Proximal prismatic blade fragment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>374A/2</td>
<td>OB-1103</td>
<td>Proximal prismatic blade fragment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>374A/7</td>
<td>OB-1081</td>
<td>Whole flake</td>
<td>Soft hammer percussion flake</td>
<td></td>
</tr>
<tr>
<td>374A/7</td>
<td>OB-1084</td>
<td>Whole flake</td>
<td>Soft hammer percussion</td>
<td></td>
</tr>
<tr>
<td>374C/1</td>
<td>OB-1080</td>
<td>Medial prismatic blade fragment</td>
<td>Heavily retouched</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>OB</td>
<td>Description</td>
<td>Condition</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>----</td>
<td>------------------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>374D/4</td>
<td>OB-1143</td>
<td>Medial prismatic blade fragment</td>
<td>Heavily retouched</td>
<td></td>
</tr>
<tr>
<td>381B/9</td>
<td>OB-1159</td>
<td>Proximal prismatic blade fragment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>381B/10</td>
<td>OB-1160</td>
<td>Medial prismatic blade fragment</td>
<td>retouch</td>
<td></td>
</tr>
<tr>
<td>381B/11</td>
<td>OB-1162</td>
<td>Proximal prismatic blade fragment</td>
<td>retouch</td>
<td></td>
</tr>
<tr>
<td>381B/11</td>
<td>OB-1161</td>
<td>Whole flake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Unit</td>
<td>Label</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>-------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>381D/7</td>
<td>OB-1176</td>
<td>Medial prismatic blade fragment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>381D/9</td>
<td>OB-1177</td>
<td>Shatter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>381D/16</td>
<td>OB-1178</td>
<td>Proximal prismatic blade fragment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>381E/4</td>
<td>OB-1179</td>
<td>Retouch Medial prismatic blade fragment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>381G/2</td>
<td>OB-1197</td>
<td>Retouch Medial prismatic blade fragment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>374F/4</td>
<td>OB-1149</td>
<td>Medial prismatic blade fragment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample</td>
<td>Collection</td>
<td>OB</td>
<td>Description</td>
<td>Retouch</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>--------</td>
<td>------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>381J/3</td>
<td>OB-1242</td>
<td>Medial prismatic blade fragment</td>
<td>Retouch</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Collection</td>
<td>OB-1243</td>
<td>Proximal prismatic blade fragment</td>
<td>Heavily retouched</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix II: Non-Lithic Materials Analysis

II.1 Ceramic Analysis

Ceramic analysis of the materials from Callar Creek Quarry was performed on all ceramics recovered from both surface collections and excavations. The main goals of the ceramic analysis were to utilize the ceramics as indicators of the timing of use and construction of the quarry and surrounding residential groups and identify the function of the structures around the quarry. The ceramic analysis was based on Yaeger (2000)’s conventions of analysis (see also LeCount 1996; Peuramaki-Brown 2012).

All ceramics were subject to the same analysis, what Yaeger (2000) refers to as the chronological sort. This level of analysis was chosen as it provides an opportunity to examine the temporal designation of the ceramics, if evident, as well as the form, and possible function, of the vessel, another key component of the ceramic analysis. The designations for each group of ceramics were coded using the system presented below, which is modified slightly from (Yaeger 2000).

The first characteristic recorded was the provenience information, operation, suboperation, and lot. Ceramics were then sorted by ware. The ware designations are based on a long history of ceramic analysis in the Belize Valley, particularly Gifford (1976; see also LeCount 1996, 2010; LeCount et. al 2002). When known, the type-
variety designation was recorded. Type-variety is a well-known manner of separating ceramic materials based on similarity in characteristics (Gifford 1960; Rice 2005; Sabloff and Smith 1969). Although widely critiqued (e.g. Duff 1996; Parker and Kennedy 2010) the type-variety system provides an opportunity to easily compare assemblages between sites and utilize ceramics for temporal designations (see Aimers 2013; Aimers and Graham 2013; Ball 2014; Ball and Tascheck 2013; Bill 2013; Ek 2016; LeCount 1996, 2010, LeCount et al. 2002; Rice 2013; Urban et al. 2013, among others, for more information and conventions concerning the use of type-variety in the Maya region). The chronological designation of the ceramics was then recorded, if known.

The type-variety system in the Belize Valley is based on Gifford’s (1976) ceramic chronology at Barton Ramie, a relatively small settlement in the Belize Valley. The chronology for the area has been refined by other scholars, most notably LeCount’s (1996; LeCount et al. 2002) work at Xunantunich, which further refined the chronology and develop more specific chronologies for certain items. Figure II.1 shows the chronological systems used at Barton Ramie, Xunantunich, and for comparison, the Uaxactun sequence from the nearby Peten region. The phases most utilized in this dissertation are from Barton Ramie, including the Spanish Lookout (Late to Terminal Classic period) and Jenny Creek (Middle Preclassic period ) phases, and for specific Late Classic period contexts, phases from Xunantunich, including the Samal, Hats’ Chak, and Tsak’ phases. Within the Late Classic period, LeCount (1996; LeCount et al. 2002) developed a fine-grained chronology for specific types including Mount Maloney bowls and jars, and some Cayo Group jars. These items have microseriations, with variations in the rim and lip form demonstrating a particular time period. The Mount Maloney bowls
and jars change in known ways over time, allowing the differentiation between Late Classic I, Late Classic II, and Terminal Classic period ceramics (Figure II.2). Cayo Group jars also have distinctive rim and lip form including piecrust rims and other diagnostic features (Figure II.3). The specific characteristics of these ceramics enable determination of fine-grained dating sequences from these relatively common ceramic items. The microseriations of the Mount Maloney and Cayo Group jars allowed the dating of the construction phases and occupation of the structures discussed in this dissertation.

<table>
<thead>
<tr>
<th>Period</th>
<th>Time</th>
<th>Barton Ramie</th>
<th>Xunantunich</th>
<th>Uaxactun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Classic</td>
<td>A.D./B.C.</td>
<td>Mount Hope</td>
<td>Ok'inal</td>
<td>Mamom</td>
</tr>
<tr>
<td>Late</td>
<td>600</td>
<td>Barton Creek</td>
<td>Nohol</td>
<td>Muyal</td>
</tr>
<tr>
<td></td>
<td>700</td>
<td>Jenney Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classic</td>
<td>300</td>
<td>Floral Park</td>
<td>Pek'kat</td>
<td>Chichen</td>
</tr>
<tr>
<td>Late</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>700</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal</td>
<td>300</td>
<td>Spanish Lookout</td>
<td>Tsak'</td>
<td>Tepeu</td>
</tr>
<tr>
<td>Late</td>
<td>400</td>
<td>Tiger Run</td>
<td>Hats' Chaak</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td>Samal</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td></td>
<td>Ak'ab</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>700</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Early</td>
<td>800</td>
<td>Hermitage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classic</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>700</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classic</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>700</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure II.1: Chart showing the chronological sequences and phase designations from Barton Ramie, Xunantunich, and Uaxactun. After LeCount et al. 2002: Figure 3.
Figure II.2: Figure showing the microseriation of Mount Maloney bowls from the Late Classic period. Shows from left to right, a Late Classic I (Samal), Late Classic II (Hats’ Chak), and Terminal Classic (Tsak’) Mount Maloney bowl. After LeCount et al. 2002: Figure 4.

Figure II.3: Figure showing Late Classic II (Hats’ Chak) phase diagnostic Cayo Group jars. After LeCount et al. 2002: Figure 6.

The next group of information recorded focused on vessel form. The vessel part, that is was the vessel a body sherd, rim, or other part of the vessel, was recorded. A more specific designation of form, for instance was the sherd from a bowl, vase, or plate, was also noted. The shape designations were based on Sabloff (1975), who provides exact dimensions and proportions for determining form. Notation of form was done conservatively, if a secure attribution of form was not possible, then the form was not noted. A more general form, i.e. jar, rather than a more specific form, i.e. restricted jar,
was noted if the more specific type determination could not be made. A specific category for temporally diagnostic rim and lip shapes was also recorded. This information is particularly relevant as a microseriation of Mount Maloney rims was identified by LeCount et al. (2002), so the presence of such rims records important temporal information.

The next group of information recorded was related to decoration. The type of decoration was recorded, for instance whether decorations were incised, painted, etc. The style of decoration, whether the elements are linear, patterned, etc., was also recorded.

For sherds which were drawn or for some temporally diagnostic rims the rim diameter and percentage of the rim was also noted. The final information recorded was the frequency of sherds and the weight of those sherds, recorded in grams. A representative sample of ceramics from each lot was photographed. Any particularly interesting or rare decoration was also photographed (see Figure II.4).

Figure II.4: Ceramics showing typical photography of ceramic artifacts. Provenience information: Op 381D/12.
A total of 21,408 sherds were recovered from excavation. The breakdown of context is found in Table II.1.

Table II.1: Count of sherds by context from Callar Creek Quarry. This includes all ceramics, including those labeled as special finds.

<table>
<thead>
<tr>
<th>Context</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry (Op 370, 374)</td>
<td>2,724</td>
</tr>
<tr>
<td>CCQ-1 Fill (Op 381)</td>
<td>9,938</td>
</tr>
<tr>
<td>CCQ 1 Off-Structure (Op 381)</td>
<td>1,939</td>
</tr>
<tr>
<td>CCQ-2 Fill (Op 373)</td>
<td>5,258</td>
</tr>
<tr>
<td>CCQ -2 Off-structure (Op 373)</td>
<td>1,573</td>
</tr>
<tr>
<td>Total</td>
<td>21,408</td>
</tr>
</tbody>
</table>

II.1.1 Special Ceramics

Ceramics which were particularly rare or had polychrome paint were categorized as special finds. Special finds are stored with other special find items, rather than the other ceramics, and are identified with a special finds number. Painted polychromes and whole vessels are the most common special find ceramics.

All special find ceramics from Callar Creek Quarry were analyzed. They were subject to the same type of analysis as all other ceramics, as detailed above, and utilized the same coding system. Special find numbers were recorded under the catalog number column on the ceramic coding sheet.

All special find ceramics were photographed and drawn. Drawings were performed using standard artifact drawing conventions and all colors were represented using the standard colors utilized by Gifford (1976) (see Table II.2 for a description of all ceramics designated as ‘special finds’).

Eighteen ceramics were classified as special finds. Of these 18 ceramics two of these are whole vessels, both discussed elsewhere in this dissertation. The remaining
Sherds are polychromes with two exceptions. One is a punctated sherd and the other a figurine fragment (see Table II.2). The majority of these ceramics are Peten Gloss Wares; the difficulty in dating such ceramics has made it difficult to establish a secure chronological dating for many of them, but they are probably from the Early to Late Classic.

### II.1.2 Ceramic Coding

The codes utilized here are modified from Yaeger (2000) so as to provide a comparative dataset for the analysis of ceramics within MVAP and also with ceramic analysis performed under the XAP project.

**Provenience**
- Op, Sub-Op, Lot

**Ware and Group:**

**Unknown/Unspecified**
- 0. Eroded/Unslipped Calcite
- 1. Calcite Polychrome
- 2. Calcite Bichrome
- 3. Calcite Monochrome
- 4. Fine Paste

**Uaxactun Unslipped Ware**
- 10. Unknown/Unspecified
- 11. Cayo Group
- 12. Tu-Tu Camp Group
- 13. Jones Camp Group
- 14. White Cliff Group
- 15. Zibal Group
- 16. Mopan Group
- 17. Socotz Group
- 18. Jocote Group
- 19. Other

**Pine Ridge Carbonate Ware**
- 20. Unknown/Unspecified
- 21. Dolphin Head Group
- 22. Vaca Falls Group
23. Mount Maloney Group
24. Garbutt Creek Group
25. Mountain Pine Group
26. Saturday Creek Group
27. Unknown Polychrome

Ash Wares (British Honduras Volcanic Ash Ware and Vinaceous Tawny Ware)
30. Unknown/Unspecified
31. Belize Group
32. Chunhuitz Group – Unknown
33. Chunhuitz Group - Monochrome
34. Chunhuitz Group – Polychrome
35. Unslipped Polychrome
36. Cream Slip
37 Unknown Polychrome
38. San Lorenzo Group

Peten Gloss Ware
40. Unknown/Unspecified
41. Unknown Polychrome
42. Late Classic Groups
43. Minanha Group
44. Dos Arroyos Group
45. Balanza Group
46. Pucte Group
47. Aguilas Group
48. Holmul Group
49. Other

Waxy Wares (Paso Caballo Waxy Ware and Flores Waxy Ware)
50. Unknown Red Slip
51. Unknown Orange Slip
52. Unknown Cream Slip
53. Unknown Black Slip
54. Sierra Group
55. Flor Group
56. Juventud Group
57. Polvero Group
58. Pital group
59. Other

Mars Orange Ware
60. Unknown/Unspecified
61. Savana Group

Holmul Orange Ware
70. Unknown/Unspecified
71. Aguacate Group

Other semi-Waxy Red and Orange (Gale Creek Red Ware)
   80. Unknown/unspecified
   81. Hilbank Group
   82. Vaquero Creek Group

Other Wares and Groups with Unspecified Wares
   91. Opaque Carbonate Ware (Chial Group)
   92. Tumbac Ware Unslipped Ware (Chan Pond and Macaw Bank Groups)
   93. Fine Orange Ware (Altar Group)
   94. Sotero Group
   95. Macal Group
   96. Yaha Group
   97. Fowler Group

Type Variety
NEW TOWN CERAMIC COMPLEX
Ware Unspecified
0100 Augustine Ceramic Group
0110 Augustine Red: Augustine Variety
0120 Ramsey Incised: Ramsey Variety
0130 Mauger Gouged-incised: Mauger Variety
0140 Swallow Black-on-red: Swallow Variety
0150 Pek Polychrome: Pek Variety

0200 Paxcaman Ceramic Group
0210 Paxcaman Red: Paxcaman Variety
0220 Bluefield Gouged-incised: Bluefield Variety
0230 Ixpop Polychrome: Ixpop Variety

0300 Daylight Ceramic Group
0310 Daylight Orange: Daylight Variety
0320 Daylight Orang: Darknight Variety
0330 White Creek Incised: White Creek Variety
0340 Amberhead Black-on-orange: Amberhead Variety

Chaple Unslipped Ware
0400 Maskall Ceramic Group
0410 Maskall Unslipped: Maskall Variety

Uaxactun Unslipped Ware
0500 More Force Ceramic Group
0510 More Force Unslipped: More Variety
0520 More Force Unslipped: Variety Unspecified (Yellow)
0530  More Force Unslipped: Variety Unspecified (Red-filmed)

Calabash Unslipped Ware
0600 Rio Juan Ceramic Group
0610  Rio Juan Unslipped: Variety Unspecified
0620  Rio Juan Unslipped: Rio Juan Variety

SPANISH LOOKOUT CERAMIC COMPLEX
Pine Ridge Carbonate Ware
1000 Dolphin Head Ceramic Group
1010  Dolphin Head Red: Dolphin Head Variety
1020  Silver Creek Impressed: Silver Creek Variety

1100 Garbutt Creek Ceramic Group
1110  Garbutt Creek Red: Garbutt Creek Variety
1120  Garbutt Creek Red: Variety Unspecified
1130  Garbutt Creek Red: Paslow Variety
1140  Rubber Camp Brown: Rubber Camp Variety

1200 Vaca Falls Ceramic Group
1210  Vaca Falls Red: Vaca Falls Variety
1220  Kaway Impressed: Kaway Variety
1230  Kaway Impressed: Callar Creek Variety
1240  Duck Run Incised: Duck Run Variety
1250  Roaring Creek Red: Roaring Creek Variety

1300 Mount Maloney Ceramic Group
1310  Mount Maloney Black: Mount Maloney Variety

1400 Yalbac Ceramic Group
1410  Yalbac Smudged-brown: Yalbac Variety

British Honduras Volcanic Ash Ware
1500 Belize Ceramic Group
1510  Belize Red: Belize Variety
1511  Belize Red: Incised Variety
1520  Platon Punctated-incised: Platon Variety
1530  McRae Impressed: McRae Variety
1540  Gallinero Fluted: Gallinero Variety
1550  Martins Incised: Martin Variety
1560  Puhui-zibal Composite: Puhi-zibal Variety
1570  Montego Polychrome: Montego Variety
1580  Frenchmans Composite: Frenchmans Variety
1590  Big Falls Gouged-incised: Big Falls Variety

Vinaceous Tawny Ware
1600 Chunhitz Ceramic Group
1610 Chunhuitz Orange: Variety Unspecified
1620 Xunantunch Black-on-orange: Variety Unspecified
1630 Benque Viejo Polychrome: Variety Unspecified
1640 Vinaceous Tawny Polychrome-on-natural type

Uaxactun Unslipped Ware
1700 Tu-Tu Camp Group
1710 Tu-Tu Camp Striated: Tu-Tu Camp Variety
1720 Tu-Tu Camp Striated: Tzimin Variety
1730 Tu-Tu Camp Striated: Variety Unspecified (Appliqued)
1740 Tu-Tu Camp Striated: Variety Unspecified (Beaverdam)

1800 Cayo Ceramic Group
1810 Cayo Unslipped: Cayo Variety
1820 Cayo Unslipped: Variety Unspecified (Buff, Appliqued)
1830 Cayo Unslipped: Variety Unspecified (Red, Appliqued)
1840 Cayo Unslipped: Variety Unspecified (Red slipped)
1850 Alexanders Unslipped: Alexander Variety
1860 Alexanders Unslipped: Croja Variety
1870 Alexanders Unslipped: Beaverdam Variety
1880 Humes Bank Unslipped: Humes Variety

Tumbac Unslipped Ware
1900 Macaw Bank Group
1910 Micaceous Self-slip Type

Peten Gloss Ware
2000 Meditation Ceramic Group
2010 Meditation Black: meditation Variety

2100 Achote Ceramic Group
2110 Achote Black: Variety Unspecified
2120 Cubeta Incised: Variety Unspecified

2200 Palmar Ceramic Group
2210 Palmar Orange polychrome: Variety Unspecified
2220 Zacatel Cream polychrome: Variety Unspecified
2230 Paixban Buff polychrome: Variety Unspecified
2240 Yuhactal Black-on-red: Variety Unspecified
2250 Tunich Red-on-orange: Tunich Variety

2300 Danta Ceramic Group
2310 Joyac Cream polychrome: Variety Unspecified

2400 Asote Ceramic Group
2410 Torres Incised: Variety Unspecified
2500 Tialipa Ceramic Group
  2510 Tialipa Brown: Variety Unspecified
  2520 Canoa Incised: Variety Unspecified
  2530 Calabaso Gouged-Incised: Variety Unspecified

2600 Nanzal Ceramic Group
  2610 Corozal Incised: Variety Unspecified

Ware Unspecified
  2700 Yaha Creek
  2710 Yaha Creek Cream: Yaha Creel Variety

British Honduras Ash Ware
  2800 San Lorenzo Black Group
  2810 San Lorenzo Black

Opaque Carbonate Ware
  2900 Chial Ceramic Group
  2910 Chial Orange-Red

TIGER RUN CERAMIC COMPLEX
Pine Ridge Carbonate Ware
  3000 Mountain Pine Ceramic Group
  3010 Mountain Pine Red: Mountain Pine Variety
  3020 Guana Creek Impressed: Guana Creek Variety
  3030 Mountain Pine Red: Old Jim Variety
  3040 San Pedro Impressed: San Pedro Variety
  3050 Rosario Incised: Rosario Variety
  3060 Mount Pleasant Red: Mount Pleasant Variety
  3070 Pascua Impressed: Pascua Variety

3100 Saturday Creek Ceramic Group
  3110 Saturday Creek Polychrome: Saturday Creek Variety
  3120 Saturday Creek Polychrome: Variety D
  3130 Saturday Creek Polychrome: Variety F

Peten Gloss Ware
  3200 Tasital Ceramic Group
  3210 Gloria Impressed: Variety Unspecified

3300 Molino Ceramic Group
  3310 Molino Black: Variety Unspecified

3400 Teakettle Bank Ceramic Group
  3410 Teakettle Bank Black: Variety Unspecified
  3420 Teakettle Bank Black: Teakettle Bank Variety
3430  Mangrove Brown-black: Mangrove Variety
3440  Limon Black-cream: Limon Variety

3500 Saxche Ceramic Group
3510  Saxche Orange-polychrome: Variety Unspecified
3520  Uacho Black-on-orange: Variety Unspecified
3520  Sibal Buff-polychrome: Variety Unspecified
3530  Juleki Cream-polychrome: Variety Unspecified

Ware Unspecified
3600 Sotero Ceramic Group
3610  Sotero Red-brown: Sotero Variety
3620  Silkgrass Fluted: Silkgrass Variety
3630  Orange-walk Incised: Orange-walk Variety
3640  Orange-walk Incised: Banana Bank Variety

3700 Macal Ceramic Group
3710  Macal Orange-red: Macal Variety
3720  Chambers Incised: Chambers Variety

Uaxactun Unslipped Ware
3800 Jones Camp Ceramic Group
3810  Jones Camp Striated: Jones Camp Variety

3900 White Cliff Ceramic Group
3910  White Cliff Striated: Variety Unspecified (Brown)
3920  White Cliff Striated: Variety Unspecified (Dark Brown)
3930  White Cliff Striated: Variety Unspecified (Red)

4000 Zibal Ceramic Group
4010  Zibal Unslipped: Zibal Variety
4020  Zibal Unslipped: Variety Unsp.-Brown
4030  Zibal Unslipped: Variety Unsp.-Buff

HERMITAGE CERAMIC COMPLEX
Ware Unspecified
4500 Fowler Ceramic Group
4510  Fowler Orange-red: Fowler Variety
4520  Fowler Orange-red: Spring Camp Variety
4530  San Ignacio Red-on-brown: San Ignacio Variety

Peten Gloss Ware
4600 Minanha Ceramic Group
4610  Minanha Red: Minanha Variety
4620  Minanha Red: Rio Frio Variety
4630  St. Herman Impressed: St Herman Variety

4700 Dos Hermanos Ceramic Group
4710  Dos Hermanos Red: Variety Unspecified
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4720</td>
<td>Mahogany Creek Incised: Mahogany Creek Variety</td>
</tr>
<tr>
<td>5000</td>
<td>Balanza Ceramic Group</td>
</tr>
<tr>
<td>5010</td>
<td>Balanza Black: Variety Unspecified</td>
</tr>
<tr>
<td>5020</td>
<td>Balanza Black: Cadena Creek Variety</td>
</tr>
<tr>
<td>5030</td>
<td>Lucha Incised: Variety Unspecified</td>
</tr>
<tr>
<td>5040</td>
<td>Lucha Incised: Gallo-blanco Variety</td>
</tr>
<tr>
<td>5050</td>
<td>Paradero Fluted: Oak-burn Variety</td>
</tr>
<tr>
<td>5060</td>
<td>Eastern Branch Plain: Eastern Branch Variety</td>
</tr>
<tr>
<td>5100</td>
<td>Pucte Ceramic Group</td>
</tr>
<tr>
<td>5110</td>
<td>Pucte Brown: Variety Unspecified</td>
</tr>
<tr>
<td>5120</td>
<td>Santa Teresa Incised: Santa Teresa Variety</td>
</tr>
<tr>
<td>5130</td>
<td>Chorro Fluted: Chorro Variety</td>
</tr>
<tr>
<td>5200</td>
<td>Actuncan Ceramic Group</td>
</tr>
<tr>
<td>5210</td>
<td>Actuncan Orange-polychrome: Actuncan Variety</td>
</tr>
<tr>
<td>5220</td>
<td>Actuncan Orange-polychrome: Blancaneau Variety</td>
</tr>
<tr>
<td>5230</td>
<td>Batellos Black-on-red: Variety Unspecified</td>
</tr>
<tr>
<td>5240</td>
<td>Boleta Black-on-orange: Variety Unspecified</td>
</tr>
<tr>
<td>5300</td>
<td>Dos Arroyos Ceramic Group</td>
</tr>
<tr>
<td>5310</td>
<td>Dos Arroyos Orange-polychrome: Dos Arroyos Variety</td>
</tr>
<tr>
<td>5320</td>
<td>Dos Arroyos Orange-polychrome: Variety A and H</td>
</tr>
<tr>
<td>5330</td>
<td>Dos Arroyos Orange-polychrome: Variety B</td>
</tr>
<tr>
<td>5340</td>
<td>Dos Arroyos Orange-polychrome: Variety E and E-2</td>
</tr>
<tr>
<td>5350</td>
<td>Dos Arroyos Orange-polychrome: Variety K</td>
</tr>
<tr>
<td>5360</td>
<td>Dos Arroyos Orange-polychrome: Variety L</td>
</tr>
<tr>
<td>5370</td>
<td>Caldero Buff-polychrome: Variety Unspecified</td>
</tr>
<tr>
<td>5380</td>
<td>Yaloche Cream-polychrome: Variety Unspecified</td>
</tr>
<tr>
<td>5400</td>
<td>Aguila Ceramic Group</td>
</tr>
<tr>
<td>5410</td>
<td>Aguila Orange: Variety Unspecified</td>
</tr>
<tr>
<td>5420</td>
<td>Pita Incised: Variety Unspecified</td>
</tr>
<tr>
<td>Uaxactun Unslipped Ware</td>
<td></td>
</tr>
<tr>
<td>5500</td>
<td>Mopan Ceramic Group</td>
</tr>
<tr>
<td>5510</td>
<td>Mopan Striated: Mopan Variety</td>
</tr>
<tr>
<td>5520</td>
<td>Mopan Striated: Variety White</td>
</tr>
<tr>
<td>5530</td>
<td>Mopan Striated: Variety Black, reed impressed</td>
</tr>
<tr>
<td>5600</td>
<td>Socotz Ceramic Group</td>
</tr>
<tr>
<td>5610</td>
<td>Socotz Striated: Varieties Unspecified</td>
</tr>
<tr>
<td>5620</td>
<td>Socotz Striated: Socotz Variety</td>
</tr>
<tr>
<td>5630</td>
<td>Socotz Striated: Variety Dark Brown</td>
</tr>
<tr>
<td>5640</td>
<td>Socotz Striated: Variety Buff</td>
</tr>
<tr>
<td>5650</td>
<td>Socotz Striated: Variety Gray</td>
</tr>
<tr>
<td>5660</td>
<td>Socotz Striated: Variety White</td>
</tr>
<tr>
<td>5670</td>
<td>Socotz Striated: Variety White appliquéd</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>5700</td>
<td>White Cliff Group</td>
</tr>
<tr>
<td>5710</td>
<td>White Cliff Striated: White Cliff Variety</td>
</tr>
<tr>
<td>5720</td>
<td>White Cliff Striated: Variety White</td>
</tr>
<tr>
<td></td>
<td>Ware Unspecified</td>
</tr>
<tr>
<td>5800</td>
<td>Hewlett Bank Ceramic Group</td>
</tr>
<tr>
<td>5810</td>
<td>Hewlett Bank Unslipped: Hewlett Bank Variety</td>
</tr>
<tr>
<td></td>
<td>FLORAL PARK CERAMIC COMPLEX</td>
</tr>
<tr>
<td></td>
<td>Holmul Orange Ware</td>
</tr>
<tr>
<td>6200</td>
<td>Aguacate Ceramic Group</td>
</tr>
<tr>
<td>6210</td>
<td>Aguacate Orange: Variety Unspecified</td>
</tr>
<tr>
<td>6220</td>
<td>Aguacate Orange: Aguacate Variety</td>
</tr>
<tr>
<td>6230</td>
<td>Aguacate Orange: Variety Thick-walled</td>
</tr>
<tr>
<td>6240</td>
<td>Aguacate Orange: Variety Matte finished</td>
</tr>
<tr>
<td>6250</td>
<td>Aguacate Orange: Ramonal Variety</td>
</tr>
<tr>
<td>6260</td>
<td>Aguacate Orange: Holja Variety</td>
</tr>
<tr>
<td>6270</td>
<td>Aguacate Orange: Privaccion Variety</td>
</tr>
<tr>
<td>6300</td>
<td>Aguacate Ceramic Group</td>
</tr>
<tr>
<td>6310</td>
<td>Guacamallo Red-on-orange: Guacamallo Variety</td>
</tr>
<tr>
<td>6320</td>
<td>Guacamallo Red-on-orange: Camalote Variety</td>
</tr>
<tr>
<td>6330</td>
<td>Gavilan Black-on-orange: Gavilan Variety</td>
</tr>
<tr>
<td>6340</td>
<td>Gavilan Black-on-orange: Sakan Variety</td>
</tr>
<tr>
<td>6350</td>
<td>Ixcanrio Orange-polychrome: Ixcanrio Variety</td>
</tr>
<tr>
<td>6360</td>
<td>Ixcanrio Orange-polychrome: Tikan Variety</td>
</tr>
<tr>
<td>6370</td>
<td>Coquericot Buff-polychrome: Coquericot Variety</td>
</tr>
<tr>
<td></td>
<td>Uaxactun Unslipped Ware</td>
</tr>
<tr>
<td>6400</td>
<td>Monkey Falls Ceramic Group</td>
</tr>
<tr>
<td>6410</td>
<td>Monkey Falls Striated: Variety Unspecified</td>
</tr>
<tr>
<td>6420</td>
<td>Monkey Falls Striated: Monkey Falls Variety</td>
</tr>
<tr>
<td>6430</td>
<td>Monkey Falls Striated: Variety Brown</td>
</tr>
<tr>
<td>6440</td>
<td>Monkey Falls Striated: Variety Red</td>
</tr>
<tr>
<td>6450</td>
<td>Monkey Falls Striated: Variety Orange</td>
</tr>
<tr>
<td></td>
<td>Tumbac Unslipped Ware</td>
</tr>
<tr>
<td>6500</td>
<td>Chan Pond Ceramic Group</td>
</tr>
<tr>
<td>6510</td>
<td>Chan Pond Unslipped: Variety Unspecified</td>
</tr>
<tr>
<td>6520</td>
<td>Chan Pond Unslipped: Chan Pond Variety</td>
</tr>
<tr>
<td>6530</td>
<td>Negroman Punctated-incised: Negroman Variety</td>
</tr>
<tr>
<td></td>
<td>MOUNT HOPE CERAMIC COMPLEX</td>
</tr>
<tr>
<td></td>
<td>Paso Caballo Waxy Ware</td>
</tr>
<tr>
<td>6900</td>
<td>Quacco Creek Ceramic Group</td>
</tr>
<tr>
<td>6910</td>
<td>Quacco Creek Red: Quacco Creek Variety</td>
</tr>
<tr>
<td>7000</td>
<td>San Felipe Ceramic Group</td>
</tr>
</tbody>
</table>
San Felipe Brown: San Felipe Variety
San Antonio Golden-brown: San Antonio Variety
San Antonio Golden-brown: Variety Orange-interior

Sarteneja Ceramic Group
Savannah Bank Usulutan: Savannah Bank Variety
Sarteneja Usulutan: Variety Unspecified

Escobal Ceramic Group
Escobal Red-on-buff: Variety Unspecified

Gale Creek Red Ware
Vaquero Creek Ceramic Group
Vaquero Creek Red: Vaquero Creek Variety
Vaquero Creek Red: Variety Thin-walled
Bullet Tree Red-brown: Bullet Tree Variety

Uaxactun Unslipped Ware
Stumped Creek Ceramic Group
Stumped Creek Striated: Varieties Unspecified
Stumped Creek Striated: Stumped Creek Variety

Old River Ceramic Group
Old River Unslipped: Variety Unspecified
Old River Unslipped: Old River Variety

BARTON CREEK CERAMIC COMPLEX
Paso Caballo Waxy Ware
Sierra Ceramic Group
Sierra Red: Varieties Unspecified
Sierra Red: Orange-paste Variety
Sierra Red: Buff-paste Variety
Sierra Red: Maroon Variety
Sierra Red: Orange-double slip Variety
Sierra Red: Society Hall Variety

Alta Mira Fluted: Variety Unspecified
Laguna Verde Incised: Variety Unspecified
Correlo Incised-dichrome: Variety Unspecified
Repasto Black-on-red: Variety Unspecified

Happy Home Orange Ceramic Group
Happy Home Orange: Happy Home Variety

Flor Ceramic Group
Flor Cream: Varieties Unspecified
Flor Cream: Variety H-3
Flor Cream: Variety H-3, Black-paste
8240 Flor Cream: Variety H-4
8250 Accordian Incised: Variety Unspecified
8260 Mateo Red-on-cream: Variety Unspecified
8270 Iguana Creek White: Iguana Creek Variety

8300 Polvero Ceramic Group
8310 Polvero Black: Varieties Unspecified
8320 Polvero Black: Variety G-2
8330 Polvero Black: Variety G-3
8340 Polvero Black: Variety G-4
8350 Polvero Black: Variety G-7
8360 Lechugal Incised: Macaw Bank Variety
8370 Never Delay Impressed-black: Never Delay Variety

Gale Creek Red Ware
8400 Hillbank Ceramic Group
8410 Hillbank Red: Variety Unspecified
8420 Hillbank Red: Hillbank Variety
8430 Hillbank Red: Variety Brown
8440 Hillbank Red: Variety Smudged-orange
8450 Hillbank Red: Variety White-striped
8460 Hillbank Red: Rockdondo Variety
8470 Starkey Incised: Starkey Variety

Uaxactun Unslipped Ware
8500 Sapote Ceramic Group
8510 Sapote Striated: Variety Unspecified
8520 Sapote Striated: Sapote Variety
8530 Sapote Striated: Variety Black-rimmed
8540 Sapote Striated: Variety Red-rimmed
8550 Sapote Striated: Variety Impressed
8560 Sapote Striated: Variety Impressed-appliquéd
8570 Sapote Striated: Variety Deep Striated

8600 Paila Ceramic Group
8610 Paila Unslipped: Varieties Unspecified
8620 Red Bank Appliquéd: Red Bank Variety
8630 Caves Branch Unslipped: Caves Branch Variety

JENNY CREEK CERAMIC COMPLEX
Uaxactun Unslipped Ware
8900 Jocote Ceramic Group
8910 Jocote Orange-brown: Varieties Unspecified
8920 Jocote Orange-brown: Jocote Variety
8930 Jocote Orange-brown: Amergris Variety
8940 Chacchinic Red-on-brown: Variety Unspecified
8950 Chacchinic Red-on-orange-brown: Chacchinic Variety
8960 Palma Daub: Variety Unspecified
8970 Palma Daub: Palma Variety
9000 Sayab Ceramic Group
9010 Sayab Daub-striated: Sayab Variety
9020 Sayab Daub-striated: Hulse Variety
9030 Cooma Striated: Cooma Variety

Mars Orange Ware
9100 Savana Ceramic Group
9110 Savana Orange: Variety Unspecified
9120 Savana Orange: Rejolla Variety
9130 Savana Orange: Savana Variety
9140 Reforma Incised: Variety Unspecified
9150 Reforma Incised: Mucnal Variety
9160 Reforma Incised: Reforma Variety

Flores Waxy Ware
9200 Joventud Ceramic Group
9210 Sampoperro Red: Variety Unspecified
9220 Sampoperro Red: Samporperro Variety
9230 Joventud Red: Variety Unspecified
9240 Black Rock Red: Black Rock Variety
9250 Pinola Creek Incised: Variety Unspecified
9260 Pinola Creek Incised: Pinola Creek Variety

9300 Pital Ceramic Group
9310 Pital Cream: Variety Unspecified
9320 Paso Danto Incised: Varieties Unspecified

9400 Chunhinta Ceramic Group
9410 Chunhinta Black: Variety Unspecified
9420 Deprecio Incised: Deprecio Variety

SEIBAL TYPE VARIETIES
Uaxactun Ware
9500 Cambio Ceramic Group
9510 Pedregal Modeled: Appliquéd Head Variety
9520 Miseria Appliquéd: Variety Unspecified
9530 Miseria Appliquéd: Hollow Handle Variety

Peten Gloss Ware
9700 Tinaja Red Ceramic Group
9710 Tinaja Red: Variety Unspecified
9720 Subin Red: Variety Unspecified
9730 Pantano Impressed: Pantano Variety
9740 Pantano Impressed: Stamped Variety
9750 Chaquiste Impressed: Variety Unspecified

Fine Orange Ware
9900 Altar Ceramic Group
### Pabellon Modeled-carved: Pabellon Variety

### Islas Gouged-incised: Islas Variety

### Cedro Gadrooned: Cedro Variety

### Chronological Details

<table>
<thead>
<tr>
<th>Number</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not recorded</td>
</tr>
<tr>
<td>1</td>
<td>Colonial/Modern</td>
</tr>
<tr>
<td>2</td>
<td>Late Postclassic</td>
</tr>
<tr>
<td>3</td>
<td>Early Postclassic</td>
</tr>
<tr>
<td>4</td>
<td>Terminal Classic</td>
</tr>
<tr>
<td>5</td>
<td>Indeterminate Late Classic/Terminal Classic</td>
</tr>
<tr>
<td>6</td>
<td>Indeterminate Late Classic</td>
</tr>
<tr>
<td>7</td>
<td>Late Classic II</td>
</tr>
<tr>
<td>8</td>
<td>Late Classic I</td>
</tr>
<tr>
<td>9</td>
<td>Early Classic</td>
</tr>
<tr>
<td>10</td>
<td>Protoclassic</td>
</tr>
<tr>
<td>11</td>
<td>Late Preclassic</td>
</tr>
<tr>
<td>12</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>13</td>
<td>Early Preclassic</td>
</tr>
<tr>
<td>14</td>
<td>General Preclassic</td>
</tr>
</tbody>
</table>

### Vessel Part

<table>
<thead>
<tr>
<th>Number</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Unknown</td>
</tr>
<tr>
<td>1</td>
<td>Body</td>
</tr>
<tr>
<td>2</td>
<td>Rim</td>
</tr>
<tr>
<td>3</td>
<td>Neck</td>
</tr>
<tr>
<td>4</td>
<td>Neck and rim</td>
</tr>
<tr>
<td>5</td>
<td>Base</td>
</tr>
<tr>
<td>6</td>
<td>Base and rim</td>
</tr>
<tr>
<td>7</td>
<td>Neck and base</td>
</tr>
<tr>
<td>8</td>
<td>Neck, rim, and base</td>
</tr>
<tr>
<td>9</td>
<td>Spout</td>
</tr>
<tr>
<td>10</td>
<td>Handle</td>
</tr>
<tr>
<td>11</td>
<td>Foot</td>
</tr>
<tr>
<td>12</td>
<td>Lid</td>
</tr>
<tr>
<td>13</td>
<td>Figurine</td>
</tr>
<tr>
<td>14</td>
<td>Worked sherd</td>
</tr>
<tr>
<td>15</td>
<td>Flange</td>
</tr>
<tr>
<td>16</td>
<td>Base and body</td>
</tr>
<tr>
<td>17</td>
<td>Body, rim, and base</td>
</tr>
<tr>
<td>18</td>
<td>Shoulder</td>
</tr>
<tr>
<td>19</td>
<td>Ridge</td>
</tr>
<tr>
<td>20</td>
<td>Rim and shoulder</td>
</tr>
</tbody>
</table>

### Primary Form

<table>
<thead>
<tr>
<th>Number</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Unknown/unspecified</td>
</tr>
</tbody>
</table>
1. Body
2. Jar neck
3. Unknown rim
4. Jar rim or pedestal base
5. Base
6. Spout
7. Handle
8. Foot
9. Unknown

10. Open form unspecified
11. Plate
12. Dish
13. Unconstricted Bowl
14. Constricted Bowl
15. Vase
16. Thin walled form (bowl or vase)
17. Cauldron
18. Canteen

20. Closed form, unspecified
21. Restricted Jar
22. Unrestricted jar
23. Tecomate
24. Neckless Olla

30. Specialty Form
31. Comal
32. Incensario (Spiked or Flanged)
33. Drum
34. ‘Incensario Grate’ (body with hole)
35. Chocolate Pot
36. Ear Spool
37. Grater Bowl or Dish
38. Whistle

40. Lid, Unspecified
41. Flat
42. Truncated-Conical
43. Scutate
44. Conical
45. Basin
46. Round
47. Unknown Outcurving, Probably truncated Conical or Conical
48. Incensario lid with Handle
49. Possible incensario Lid

50. Miniature Form, Unspecified
   51. Plate
   52. Dish
   53. Bowl
   54. Vase
   55. Jar
   56. Effigy

60. Figurine
   61. Anthropomorphic
   62. Unknown Modeled Body Part
   63. Unknown modeled Piece, Probably figurine or incensario fragment

70. Worked Sherd
   71. Pendant (with Hole)
   72. Sherd with Prefire hole
   73. Modified round disc
   74. Spindle Whorl
   75. Bead
   76. Worked edge
   77. Modeled spindle whorl with prefire incision
   78. ornament
   79. mend whole

80. Baked Clay mass
   81. Raw Clay Chunk

90-99 Geometric Shape
   90. Column with Outcurving end.
   91. Small Round Ball
   92. Long Cone, Slightly Outcurving
   93. Short, Straight Cone
   94. Large Cylindrical Tube
   95. Ladle
   96. Conical Section, tip Missing

**Diagnostic Rim and Lip Form**
   0. None, Not specified
   1. LCI Mt. Maloney Incurved Bowl – smooth lip with steep bevel
   2. LCII Mt. Maloney Incurved Bowl – tooled lip with moderate bevel
   3. T. Classic Mt. Maloney Incurved Bowl – Squared, horizontal lip
   4. LCI pinched lip jar, Mt. Maloney or other.
   5. LC II Mt. Maloney Jar – outcurved neck, squared lip
   6. T. Classic Mt. Maloney Jar – vertical, then everted neck
7. T. Classic Mt. Maloney Constricted bowl – recurved, everted rim
8. LCII Alexanders: Alexanders jar
9. LCII Alexanders: Beaverdam jar
10. LCII Alexanders: Croja jar
11. LCIIB/T Flaring Lipped Jars
12. T Piecrust Flaring Lipped Jars
13. T shouldered Bowls (e.g. Roaring Creek)
14. Exterior Rim Offset
15. LCIIB tall, vertical necked jar
16. T carinated open form
17. T jar with folded over lip

Decoration
0. Absent
10. Carving
   11. Plano Relief Carving
   12. Model Carving
   13. Gouge Incising
20. Incising
   21. Shallow, sharp incision; prefire
   22. Groove, prefire
   23. scratching; postfire
   24. Deep, sharp incision; prefire
   25. Incise-Impressing; Postfire
   26. Internal Groove, Prefire
30. Impressing
   31. Punctating
   32. Notching
   33. Stamping
   34. Perforating
   35. Patterned Impressing
   36. Cane Stamping
   37. Thumbnail Impressing
   38. Thumbprint Impressing
40. Painting
   41. Positive
   42. Negative
   43. Postfire
50 appliqueing
   51. Spike
   52. Thin Raised line
   53. Winged face, hand-modeled
54. Ridge with notching
55. Ridge with Incising
56. Ridge with Incising and Notching
57. Fillet
58. Impressed Fillet
59. Impressed and Smeared Fillet

60. Tooling
   61. Chamfering
   62. Fluting
   63. Gadrooning

70. Modeling
   71. Handmade
   72. Moldmade

80. Texturing
   81. Striations
   82. Irregular to Regular Drag Marks
   83. Stuccoed surface

90. Additional techniques
   91. Wide, Shallow grooves or ripples
   92. appliqued pinch
   93. Large, tooled ridge

Decoration: Secondary
   See Decoration: Primary

Decoration: Style
0. Absent
1. Indeterminate
10. Single Element
   11 Linear-Continuous
   12. Linear-Segment
   13. Curvilinear
   14. Zig-Zag
   15. Closed Form
   16. Circular
   17. Rectangular
   18. Square

20. Simple Repetitive
   21. Linear
   22. Linear Segments
   23. Checker Board
24. Closed Form
25. Circular

30. Abstract Geometric
   31. Linear
   32. Linear and Closed form Combination

40. Representative
   41. Toad
   42. Serpent
   43. Unknown Face
   44. Old God Face

50. Pseudo-Glyph
60. Composite of Pseudo-Glyph and Geometric
70. Codex Style Scene
80. Complex Representative
90. Bands and Representative

Rim Diameter (cm)
   Only used for drawn sherds or some temporally diagnostic rims

Rim Percentage
   Only used for drawn sherds or some temporally diagnostic rims

Frequency

Weight (g)

Catalog Number (only for items considered special finds)

Comments
Table II.2: Table showing all special find ceramics.

<table>
<thead>
<tr>
<th>SF #</th>
<th>Context</th>
<th>Description</th>
<th>Photograph</th>
<th>Drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR-105</td>
<td>Op 373A/3</td>
<td>Unknown punctuated</td>
<td><img src="image1.jpg" alt="Photograph" /></td>
<td><img src="image2.jpg" alt="Drawing" /></td>
</tr>
<tr>
<td>CR-142</td>
<td>Op 373B/3 (CCQ 2)</td>
<td>Figuring Fragment</td>
<td><img src="image3.jpg" alt="Photograph" /></td>
<td><img src="image4.jpg" alt="Drawing" /></td>
</tr>
<tr>
<td>CR-143</td>
<td>Op 381B/5 (CCQ 1)</td>
<td>Zonal Whitewear (Cream) Polychrome Buenavista Device</td>
<td><img src="image5.jpg" alt="Photograph" /></td>
<td><img src="image6.jpg" alt="Drawing" /></td>
</tr>
<tr>
<td>CR-144</td>
<td>Op 381B/6 (CCQ 1)</td>
<td>Peten Gloss Ware; black and red on orange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------------</td>
<td>------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CR-145</td>
<td>Op 381B/8 (CCQ 1)</td>
<td>Saxche/Palmar Polychrome Peten Gloss Ware; Glyphs from the Primary Standard Sequence. Possibly Early Classic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CR – 146</td>
<td>Op 381D/8</td>
<td>Unknown Peten Gloss Ware</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>--------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CR – 147</td>
<td>Op 381D/11</td>
<td>Yaloche Cream Polychrome; Peten Gloss Ware; Early Classic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CR-148</td>
<td>Op 381D/12 (CCQ 1)</td>
<td>Saxche/Palmar Polychrome; Peten Gloss Ware; Possibly Late Classic; Pseudo glyphs</td>
<td>![Image 1]</td>
<td>![Image 2]</td>
</tr>
<tr>
<td>--------</td>
<td>------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>CR-149</td>
<td>Op 381D/5</td>
<td>Foot</td>
<td>![Image 3]</td>
<td>![Image 4]</td>
</tr>
<tr>
<td>CR-154</td>
<td>Op 381B/9 (CCQ 1)</td>
<td>Saxche/Palmar Polychrome; Peten Gloss Ware; Pseudo glyphs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>------------------</td>
<td>----------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CR-155</td>
<td>Op 381B/9</td>
<td>Possible Yaloche Cream polychrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CR - 156</td>
<td>Op 381B/9</td>
<td>Guacamallo Red on Orange; Holmul Orange Ware; Protoclassic (Floral Park)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CR – 157</th>
<th>Op 381D/12</th>
<th>Yaloche Cream Polychrome; Peten Gloss Ware; Early Classic</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR – 158</td>
<td>Op 381D/11</td>
<td>Possibly Dos Arroyos Polychrome; Peten Gloss Ware</td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>CR - 159</td>
<td>Op 381B/7</td>
<td>Peten Gloss Ware Polychrome (black and red on cream)</td>
</tr>
<tr>
<td>CR – 160</td>
<td>Op 381B/12</td>
<td>Caldero Buff Polychrome; Hermitage (Early Classic)</td>
</tr>
<tr>
<td>----------</td>
<td>-----------</td>
<td>---------------------------------------------------</td>
</tr>
</tbody>
</table>

![Image of Caldero Buff Polychrome; Hermitage (Early Classic)](image_url)
<table>
<thead>
<tr>
<th>CR - 161</th>
<th>Op 381J/3 (CCQ 1)</th>
<th>Black slipped (interior and exterior) Complete Vessel</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR-162</td>
<td>Burial</td>
<td>Complete vessel – Dolphin Head Red Bowl, L/T Classic</td>
</tr>
</tbody>
</table>
II.2 Shell

Shells were recovered from all areas of the quarry and surrounding residential groups. The goal of the shell analysis was to develop an understanding of the types of shells present and identify for what they might have been utilized. As such, analysis focused on the identification of different types of shells, at the most basic level, and when possible, included species attribution. The portion of the shell, whether it was whole, partial, or fragmentary, was also recorded as were any alterations to the shells. Many of the shells identified are frequently thought to have both ritual purposes and to have served as a food source for the ancient Maya. The portion of the shell which remains and the presence of any alterations can provide information concerning whether the shells were used as food or served some other purpose (Healy et al. 1990). All shells were photographed (Figure II.5)

Figure II.5: Photograph showing typical photography of shell artifacts (Op 381J/4).
Two hundred thirty-three shells were collected during investigations at Callar Creek Quarry. Of these, the majority of the shells were collected from structure fill at CCQ-1. Few shells were found in off-structure deposits neither at the residential groups nor at the quarry (Table II.3). In terms of the types of shells recovered, the most common were undiagnostic shell fragments. Jute were identified fairly frequently, however, and were represented by the two most commonly identified types of jute (Healy et al. 1990). Jute are shells which were commonly eaten by Maya peoples, and continue to be today, but which are not locally found around Callar Creek Quarry, indicating trade and exchange with other regions on the part of the residents of the area.

<table>
<thead>
<tr>
<th>Context</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry</td>
<td>7</td>
</tr>
<tr>
<td>CCQ-1 Fill</td>
<td>178</td>
</tr>
<tr>
<td>CCQ 1 Off-Structure</td>
<td>35</td>
</tr>
<tr>
<td>CCQ-2 Fill</td>
<td>6</td>
</tr>
<tr>
<td>CCQ -2 Off-structure</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>233</td>
</tr>
</tbody>
</table>

**II.2.1 Shell Coding**

Lot

Weight (g)

Species
1. Jute (*indiorium*)
2. Jute (*glaphyrus*)
3. Unknown bivalve
4. Unknown spiral
5. Unknown

Count

Modification
1. No
2. Yes

Portion
1. Whole
2. Missing tip
3. Fragment
4. Bivalve half
5. Partial bivalve halve
6. Hole

II.3 Daub

Daub was analyzed by counting and weighing the daub by lot. All daub was photographed (Figure II.6). Only 11 pieces of daub were collected during investigations at Callar Creek Quarry, all from Op 381. Four of these pieces are from off-structure deposits at CCQ-1. Six are from excavations of Structure 5 of CCQ-1 and the remaining piece of daub was collected during excavations of Structure 4 of CCQ-1.

Figure II.6: Photograph showing typical photography of daub artifacts (Op 381K/1).
II.4 Slate

Slate was analyzed by counting and weighing each individual piece of slate. All slate items were photographed (Figure II.7). Slate is a commonly identified item in the Belize Valley as it comes from the Maya Mountains, located relatively proximately to the Belize Valley, and slate was carved and used to produce tools in other locations in the Belize Valley (J. Braswell 1998). Only 11 pieces of slate were collected during investigations at Callar Creek Quarry, ten of which were from CCQ-1 (Op 381) and the remaining one was from off-structure excavations at CCQ-2 (Op 373). Of the materials from CCQ-1, four pieces were from excavations of Structure 4, three from excavations of Structure 5, and the remaining three were recovered from off-structure excavations. From the small quantity of slate recovered, little can be said about its use or importance at Callar Creek Quarry.

Figure II.7: Photograph showing typical photography of slate artifacts (Op 381H/2).
II.5 Bone

Bone was counted and weighed and, when possible, identified by species or type of species. Three bones were recovered which were not from the excavation of Burial 1. Of these, two were probably bird bones, from excavations of Structure 4 at CCQ-1, and the other is an unknown bone fragment from off-structure excavations at CCQ-1. Analysis of Burial 1 was conducted by Carolyn Friewald during the 2016 field season. The report of her investigation will be contained in future MVAP reports.

II.6 Groundstone

Groundstone analysis focused on identifying the functional aspects of the material. All groundstone received a catalog number, as per MVAP laboratory procedures. All groundstone was subject to analysis, with the analysis categories listed below. Metric measurements, length, width, thickness, and weight, material type, form, and possible function were noted. All groundstone implements were photographed (Figure II.8).

24 groundstone implements were recovered, the forms of which are seen in Table II.4. Mano fragments were the most common type of groundstone, followed by hammerstone and metate fragments. One bark beater was found in quarry deposits. The majority of the groundstone was recovered from fill contexts (Table II.5) although there were two groundstone tools, the bark beater and a hammerstone, from quarry contexts and two from off-structure deposits, one from CCQ-1 and one from CCQ-2 (Table II.6).
Figure II.8: Photograph showing typical photography of groundstone artifacts (Op 381J/1).

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>2</td>
</tr>
<tr>
<td>Hammerstone</td>
<td>6</td>
</tr>
<tr>
<td>Mano</td>
<td>9</td>
</tr>
<tr>
<td>Metate</td>
<td>6</td>
</tr>
<tr>
<td>Bark Beater</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>

Table II.4: Counts of groundstone by type.

<table>
<thead>
<tr>
<th>Context</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry</td>
<td>3</td>
</tr>
<tr>
<td>CCQ1 (fill)</td>
<td>12</td>
</tr>
<tr>
<td>CCQ1 (off-structure)</td>
<td>1</td>
</tr>
<tr>
<td>CCQ2 (fill)</td>
<td>7</td>
</tr>
<tr>
<td>CCQ2 (off-structure)</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>

Table II.5: Counts of groundstone by context.
II.6.1 Groundstone Coding

Lot

Length (mm)

Width (mm)

Thickness (mm)

Weight (g)

Material

Tool

Catalog Number

Comments

Table II.6: Table describing groundstone materials.

<table>
<thead>
<tr>
<th>Op</th>
<th>SF-number</th>
<th>Description</th>
<th>Photograph</th>
</tr>
</thead>
<tbody>
<tr>
<td>373A/12</td>
<td>GS-318</td>
<td>Granite hammerstone</td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Thesaurus</td>
<td>Artifact Description</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td>373B/1</td>
<td>GS-321</td>
<td>Granite mano fragment reused as hammerstone</td>
<td></td>
</tr>
<tr>
<td>373B/1</td>
<td>GS-320</td>
<td>Granite hammerstone</td>
<td></td>
</tr>
<tr>
<td>373B/4</td>
<td>GS-317</td>
<td>Granite mano fragment</td>
<td></td>
</tr>
<tr>
<td>373B/6</td>
<td>GS-306</td>
<td>Granite mano fragment</td>
<td></td>
</tr>
<tr>
<td>373B/7</td>
<td>LT-530</td>
<td>Granite hammerstone</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>373B/12</td>
<td>GS-319</td>
<td>Granite mano fragment</td>
<td></td>
</tr>
<tr>
<td>373C/2</td>
<td>LT-706</td>
<td>Granite mano fragment</td>
<td></td>
</tr>
<tr>
<td>374A/4</td>
<td>GS-322</td>
<td>Granite bark beater fragment</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Type</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
<td>----------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>374E/2</td>
<td>GS-323</td>
<td>Granite hammerstone</td>
<td></td>
</tr>
<tr>
<td>381A/10</td>
<td></td>
<td>Granite mano fragment</td>
<td></td>
</tr>
<tr>
<td>381C/1</td>
<td></td>
<td>Granite metate fragment</td>
<td></td>
</tr>
<tr>
<td>381C</td>
<td>GS-329</td>
<td>Granite metate fragment</td>
<td></td>
</tr>
<tr>
<td>381D/7</td>
<td></td>
<td>FGV mano fragment reused as hammerstone</td>
<td></td>
</tr>
<tr>
<td>381D/11</td>
<td>GS-330</td>
<td>Granite metate fragment</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
<td>-------------------------</td>
<td></td>
</tr>
<tr>
<td>381F/1</td>
<td>GS-328</td>
<td>Granite metate fragment</td>
<td></td>
</tr>
<tr>
<td>381F/4</td>
<td>GS-331</td>
<td>Granite mano fragment</td>
<td></td>
</tr>
<tr>
<td>381F/7</td>
<td>FGV unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>381J/1</td>
<td>Granite metate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>381J/1</td>
<td>GS-332 Granite mano</td>
<td></td>
<td></td>
</tr>
<tr>
<td>381J/2</td>
<td>GS-333 FGV mano fragment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
II.7 Special Finds

Special finds in this context refer to items which do not fall into any of the other categories of materials discussed here but are still of significance. These items are also given a catalog number, which is recorded when the items are analyzed. For special finds metric measurements (length, width, thickness, and weight) were recorded as was the material and the type of artifact, if known. All items were photographed and some were drawn.

Six items were noted as special finds from Callar Creek Quarry, all from on-structure excavations at CCQ-1. These include a shell bead and two shell pendants, the
bead and one pendant from Structure 4 and the other pendant from Structure 5. A spindle whorl was also identified in excavations of Structure 4. The other two items were recovered from excavations of structure 4 at CCQ-1 and are unknown (Table II.7).
<table>
<thead>
<tr>
<th>Context</th>
<th>SF #</th>
<th>Description</th>
<th>Photograph</th>
<th>Drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op 381A/2</td>
<td>SP - 073</td>
<td>Spindle Whorl</td>
<td><img src="image1" alt="Spindle Whorl" /></td>
<td><img src="image2" alt="Spindle Whorl" /></td>
</tr>
<tr>
<td>(CCQ-1 Str. 4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Op 381A/10</td>
<td>SP - 071</td>
<td>Shell pendant</td>
<td><img src="image3" alt="Shell Pendant" /></td>
<td><img src="image4" alt="Shell Pendant" /></td>
</tr>
<tr>
<td>(CCQ-1 Str. 4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>Site Code</td>
<td>Description</td>
<td>Image</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>-----------</td>
<td>--------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>Op 381A/10</td>
<td>SP - 072</td>
<td>Shell bead</td>
<td><img src="image1.png" alt="Shell bead image" /></td>
<td></td>
</tr>
<tr>
<td>Op 381D/11</td>
<td>SP - 075</td>
<td>Unknown</td>
<td><img src="image2.png" alt="Unknown image" /></td>
<td></td>
</tr>
</tbody>
</table>

**Op 381A/10 (CCQ-1 Str. 4)**

**Op 381D/11 (CCQ-1 Str. 4)**
<table>
<thead>
<tr>
<th>Op 381J/4 (CCQ-1 Str. 5)</th>
<th>SP - 079</th>
<th>Shell pendant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op 381D/8 (CCQ-1 Str. 4)</td>
<td>LT – 707</td>
<td>Marine Shell</td>
</tr>
</tbody>
</table>

Table II.7: Special Finds from Callar Creek Quarry excavations.
Appendix III: Microartifact Analysis

III.1 Introduction

Microartifact analysis, the analysis of materials less than 4 mm in size (Dunnell and Stein 1988; Fladmark 1982; Hull 1987; Rosen 1989), has become an important component of the study of activity areas, including those for the production and knapping of lithic materials (Cap 2007, 2011, 2012, 2015a, b; Dahlin et al. 2007, 2009; de Lucia 2013; Heindel et al. 2012; Hull 1987; Keller 2012b; Rosen 1989). Ethnographic waste disposal studies demonstrate that smaller artifacts are more likely indicative of activity areas since they are less likely to be removed from an area through cleaning processes, such as sweeping (Deal 1985; Hayden and Cannon 1983; Siegel and Roe 1986).

The determination of in situ knapping areas is also an extremely difficult process. Differences between the dumping of materials from lithic production and piles of debitage created from in situ knapping are difficult to illustrate (Clark 1990, 1997; Healan 1992, 1995; Hester and Shafer 1992; Mallory 1986; Moholy-Nagy 1990; Shafer 1985). Again, studies of dumping and other such patterns have illustrated that smaller pieces of lithic materials are indicative of knapping rather than the dumping of waste (Baumler and David 2004; Healan 1995; Whittaker et al. 2009). With this in mind, flotation samples were taken from excavations within Callar Creek Quarry as well as from off-structure deposits and from fill layers, so as to provide a basis for comparison
for the materials from the quarry contexts. These materials were collected to attempt to see if there was evidence of *in situ* knapping at the quarry rather than just the dumping of knapped remains. If knapping occurred, the area where it occurred would contain more microdebitage while dumping activities would contain less. Furthermore, the presence of different patterns of microdebitage across the quarry could indicate differential use of the quarry landscape.

**III.2 Analysis**

Microartifact analysis focused on the analysis of the heavy fraction from flotation samples. Forty-five two liter flotation samples were collected of which 28 were subject to the analyses discussed herein (see Table III.1 for a breakdown of context of the samples). All flotation samples were processed with a standard flotation system, separating the heavy and light fractions; only the heavy fraction has been analyzed as it is the most relevant to the current project. All heavy fraction materials larger than ¼” (which would be recovered during normal screening procedures) were separated from the other materials and subject to attribute analysis for their material type, as laid forth in Appendices I and II (see Table III.2 for a count of macro artifacts recovered from flotation samples). All materials less than ¼” were subject to the analyses discussed here.

<table>
<thead>
<tr>
<th>Context</th>
<th>Number of Analyzed Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry (Op 374)</td>
<td>22</td>
</tr>
<tr>
<td>CCQ-1 Fill (Op 381)</td>
<td>3</td>
</tr>
<tr>
<td>CCQ-1 Off-Structure (Op 381)</td>
<td>1</td>
</tr>
<tr>
<td>CCQ-2 Fill (Op 373)</td>
<td>0</td>
</tr>
<tr>
<td>CCQ -2 Off- Structure (Op 373)</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>28</strong></td>
</tr>
</tbody>
</table>
Materials were first size sorted using geological sieves. They were sorted into 1 mm size categories from 4 mm – less than 1 mm. The materials less than 1 mm were not subject to any investigation as they are too small to be of much significance or to be easily identified. Microartifacts were then sorted into material categories. Sorting was done using a microscope for magnification when necessary. Materials were sorted into limestone (non-artifacts), chert, ceramic, shell, botanicals, and slate. The limestone pieces, ceramics, botanicals, and slate were all weighed and counted and that information was recorded.

Lithic materials (chert) and shells were subject to a more in-depth analysis except for the materials between 1-2 mm; these materials were only counted and weighed due to their small size and the difficulty in determining salient characteristics at this size. The shells were further broken down by the type of shell (see Section III.3 for this breakdown). The shells were analyzed in this manner to account for what are obviously local shell materials (land snails) which occur naturally in the sediment of the area.

<table>
<thead>
<tr>
<th>Context</th>
<th>Lithics Count</th>
<th>Ceramic Count</th>
<th>Shell Count</th>
<th>Organics Count</th>
<th>Groundstone Count</th>
<th>Obsidian Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry (Op 370, 374)</td>
<td>4,144</td>
<td>124</td>
<td>60</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CCQ-1 Fill (Op 381)</td>
<td>67</td>
<td>18</td>
<td>36</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CCQ 1 Off-Structure (Op 381)</td>
<td>64</td>
<td>5</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CCQ -2 Off-structure (Op 373)</td>
<td>43</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>4,318</td>
<td>154</td>
<td>111</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
These shells have no archaeological significance, and therefore the type of shell was also taken into consideration. Lithic materials were broken down by flake type – whole, broken, fragment, or shatter. Within these categories they were sorted according to the presence or absence of cortex. The flake type and cortex designations allow a discussion of lithic reduction and the stages of production during which the flakes were produced. Lithic materials were also sorted by color. The color designations utilized here are a much reduced and condensed version of the color designations used in the lithic attribute analysis. The full gambit of options would have been overwhelming for use in this situation. Instead, the most salient color categories (clear, white, and tan), based on the lithic attribute analysis, were utilized. The clear/blue category includes clear and blue tinged materials, which are generally of higher quality. White was used to encompass a wider range of off-white colors, and brown could also encompass tan, etc. Color designations are helpful in distinguishing quality of material (at least at Callar Creek Quarry) and for maintaining a basis of comparison between the microartifact analysis and analysis of macro artifacts. See Table III.3 for a count of microartifacts by category.
Table III.3: Counts of microartifact by category and context. NOTE: some categories have been removed, i.e. limestone, daub, etc. Only those most relevant are included here. These are raw counts. See Table III.1 for the number of flotation samples analyzed in each category.

<table>
<thead>
<tr>
<th>Context</th>
<th>Lithic 1-2</th>
<th>Lithic &gt;4</th>
<th>Lithic 1-2</th>
<th>Ceramic 1-2</th>
<th>Ceramic &gt;4</th>
<th>Ceramic 1-2</th>
<th>Ceramic &gt;4</th>
<th>Shell 1-2</th>
<th>Shell 2-4</th>
<th>Shell 1-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry (Op 374)</td>
<td>3235</td>
<td>24145</td>
<td>8066</td>
<td>74</td>
<td>148</td>
<td>47</td>
<td>159</td>
<td>1304</td>
<td>1240</td>
<td></td>
</tr>
<tr>
<td>Fill (Op 381)</td>
<td>70</td>
<td>152</td>
<td>11</td>
<td>8</td>
<td>28</td>
<td>6</td>
<td>107</td>
<td>395</td>
<td>289</td>
<td></td>
</tr>
<tr>
<td>CCQ 1 off-structure (Op 381)</td>
<td>34</td>
<td>234</td>
<td>86</td>
<td>1</td>
<td>22</td>
<td>5</td>
<td>2</td>
<td>73</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>CCQ 2 off-structure (Op 373)</td>
<td>6</td>
<td>328</td>
<td>97</td>
<td>3</td>
<td>14</td>
<td>3</td>
<td>15</td>
<td>103</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>3345</td>
<td>24859</td>
<td>8260</td>
<td>86</td>
<td>212</td>
<td>61</td>
<td>283</td>
<td>1875</td>
<td>1675</td>
<td></td>
</tr>
</tbody>
</table>

III.3 Coding

Provenience
Op, Subop, Lot

Material
1- limestone
2- chert
3- shell
4- ceramic
5- botanical
6 - slate

Detailed Material
1 - whole flake
2- flake fragment
3 - broken flake
4- shatter
5 - shell (spiral)
6 - shell (fragment)
7 - shell natural (local)

**Cortex (lithic only)**
- 1 - none
- 2 - cortex
- 0 - N/a

**Chert Color (Modified, lithic only)**
- 1 - clear/blue
- 2 - white
- 3 - brown/grey
- 4 - other

**Size Sort**
- 1 - all
- 2 – 4-3 mm
- 3 - 2-3 mm
- 4 - 1-2 mm
- 5 - less 1 mm
- 6 - non-micro

**Count**

**Weight (g)**

### III.4 Microartifact Analysis Results

Microartifact analysis has been successfully used as an indicator of a variety of activity areas (Cap 2007, 2011, 2012; Dahlin et al. 2007, 2009; de Lucia 2013; Heindel et al. 2012; Hull 1987; Keller 2012b; Rosen 1989). In this case, microartifact analysis aimed to investigate if any *in situ* knapping areas could be identified within the quarry. By analyzing a sample of the materials from quarry contexts, the debitage mound, and fill contexts from surrounding structures, comparative samples from areas which were not production areas, would permit the analysis of the possibility of *in situ* production areas.

The analysis of the microartifacts will focus on the materials between 2 – 4 mm, as this has been demonstrated elsewhere as the most reliable and useful indicator of
activities in an area (Cap 2012; Dunnell and Stein 1989; Nielsen 1991). Perhaps unsurprisingly, the most common materials in the microartifact samples were lithic, which are the focus of this discussion. The counts of lithics from the quarry and adjacent households show widely varying counts (Table III.4). Although the number of analyzed samples for these contexts is low, the off-mound deposits and construction fill show relatively low numbers of lithics as compared with the quarry. The range in samples, however, is quiet large, particularly for the off-structure deposits and quarry. I posit that the construction fill varies less due to the smaller quantities of small debitage. As discussed in Chapter 7, it appears as though quarry debitage, with a preference for larger materials, may have been used as construction fill, thus leading to the smaller amount of microartifacts present in the construction fill.

Table III.4: Table showing descriptive statistics of lithic microartifacts (2-4 mm) counts from 2-4 mm by context. All counts are from 2 liter samples.

<table>
<thead>
<tr>
<th>Context</th>
<th>Average</th>
<th>Range</th>
<th>Max</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>373 off-structure deposits (CCQ2)</td>
<td>164</td>
<td>288</td>
<td>308</td>
<td>20</td>
</tr>
<tr>
<td>381 off-structure deposits (CCQ1)</td>
<td>234</td>
<td>N/A</td>
<td>N/a</td>
<td>N/A</td>
</tr>
<tr>
<td>381 construction fill (CCQ1)</td>
<td>58.67</td>
<td>49</td>
<td>77</td>
<td>28</td>
</tr>
<tr>
<td>Quarry (Op 374)</td>
<td>1,137.5</td>
<td>4,842</td>
<td>4,882</td>
<td>40</td>
</tr>
</tbody>
</table>

The evidence from the off-mound deposits shows a relatively high number of lithics as compared with those from similar contexts elsewhere. Cap (2012) compares Chan and Buenavista lithic counts; the counts from off-structure deposits are much greater than the counts of lithic debitage from the Buenavista plaza chert production area or any context at Chan (Table III.5). The off-structure deposits from Op 381 (CCQ-1)
are roughly comparable with the Buenavista East Plaza lithic production area. The Op 373 (CCQ-2) deposits are much greater, and the quarry deposits are about eight times as dense as the lithic production area based on these counts. The aim here is not to argue that the off-structure deposits from CCQ-1 and 2 are *in situ* reduction areas when, in fact, this is highly unlikely. As the number of samples from these two contexts which were analyzed is rather small, no definitive conclusions can be made. Additionally, these samples were taken from areas around the structures while in search of middens. It is possible, in that case, that the high microdebitage counts from around the structures is from the cleaning of knapping areas. The samples analyzed were not associated with any sort of area which could be thought of as a knapping area. These high microdebitage counts do, however, suggest that knapping was occurring at CCQ-1 and 2. The microdebitage analysis adds an additional line of evidence to the idea that residents of these households were participating in lithic production activities with quarry materials.

<table>
<thead>
<tr>
<th>Location</th>
<th>Counta, b</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chan West Plaza</td>
<td>85</td>
<td>Cap 2013; Table 8.1</td>
</tr>
<tr>
<td>Buenavista East Plaza</td>
<td>654</td>
<td>Cap 2013; Table 8.1</td>
</tr>
<tr>
<td>Lithic Production area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCQ 1 – off structure</td>
<td>820</td>
<td></td>
</tr>
<tr>
<td>CCQ 2 – off structure</td>
<td>1170</td>
<td></td>
</tr>
<tr>
<td>CCQ quarry</td>
<td>5,487.5</td>
<td></td>
</tr>
</tbody>
</table>

a. Counts from the Chan and Buenavista materials are from 10 liter heavy fraction samples; the CCQ materials were adjusted to be comparable.

b. Counts from Callar Creek Quarry are the average for all samples analyzed from that context.

The counts of lithic materials from quarry deposits warrants further examination. As noted in Table III.4, there is a fairly large disparity among the areas of the quarry in terms of frequencies of microlithics. The counts of the materials from each sub-operation
explore the variation across quarry contexts. When examined by suboperation, three of
the five contexts (Ops 374A/1-7, 374B/1-8, and 374E/1-8) show counts which are
relatively consistent, although these would be much higher than the contexts from Chan
or Buenavista, adjusted to account for the differences in sample size (see Table III.6).
Ops 374C/1-7 and 374F/1-9 show much higher levels of microartifacts than the other
suboperations. Op 374F/1-9 was located adjacent to the quarry cut and showed evidence
of the extraction of all chert materials present in the area. The microdebitage could have
been a result of the breakup of chert cobbles as chert was extracted from the ground or
from reduction of cobbles for testing and some production occurring within the quarry,
adjacent to areas of extraction. In an ANOVA test of the counts from each context in the
quarry, the materials were statistically significantly different ($F = 3.37, \text{df} = 4, p = .033$).
A comparison between Ops 374C/1-7 and 374F/1-9, those with elevated counts of
microdebitage, showed these were part of the same population ($F = .787, \text{df} = 1, p = .401$). These comparisons suggest differences in use of the quarry area and increased
probabilities of \textit{in situ} knapping and extraction of lithic production in Ops 374C/1-7 and
374F/1-9.

Table III.6: Table showing descriptive statistics for counts of microartifacts from quarry deposits. These counts are from two liter samples.

<table>
<thead>
<tr>
<th>Context</th>
<th>Average</th>
<th>Range</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>374 A/1-7</td>
<td>231.4</td>
<td>269</td>
<td>411</td>
<td>142</td>
</tr>
<tr>
<td>374 B/1-8</td>
<td>491.6</td>
<td>981</td>
<td>1,021</td>
<td>40</td>
</tr>
<tr>
<td>374 C/1-7</td>
<td>1,099</td>
<td>454</td>
<td>1,326</td>
<td>872</td>
</tr>
<tr>
<td>374 E/1-8</td>
<td>570</td>
<td>548</td>
<td>844</td>
<td>296</td>
</tr>
<tr>
<td>374 F/1-9</td>
<td>2,149</td>
<td>4,725</td>
<td>4,882</td>
<td>157</td>
</tr>
</tbody>
</table>

The most logical explanation for the increased density of lithic materials from
some areas of the quarry is a combination of production and quarrying. With the density
of microdebitage in these areas almost eight times that of the density in a lithic production workshop at Buenavista (Cap 2012), production alone fails to explain such a density of lithic materials. Instead, it is probable that the methods of extraction of \textit{in situ} chert beds contributed to the large density of microdebitage. In Op 374F/1-9 in particular, there was evidence of bedded chert removed from the quarry, which could also cause large amounts of debitage to be produced. As such, it seems most likely that Ops 374C/1-7 and 374F/1-9 were the locations of lithic reduction, as also supported by the macro debitage, and the extraction of \textit{in situ} chert beds, which led to the extremely high numbers of microdebitage in some areas of the quarry.

The analysis of the microdebitage from Callar Creek Quarry indicates variation in quarrying and use across the quarry and supports previous assumptions concerning the production of lithic materials at both adjacent household groups and in structure construction fill. The microdebitage from the construction fill of Callar Creek Quarry 1 supports evidence presented in Chapter 7 and Appendix I that some quarry debitage was used as construction fill. Evidence from off-structure deposits from CCQ-1 and 2 indicate, through comparisons with microartifact densities from other sites, that lithic production occurred in these areas, although it does not indicate specific locations of reduction. These data support the evidence from the attribute analysis of macroartifacts which indicates production of lithic materials in the adjacent household groups. Within the quarry area itself, the microdebitage confirms the variation in use of the area, as discussed in Chapter 6, and also suggests some \textit{in situ} areas of reduction, in Ops 374C/1-7 and 374F/1-9, were present in the quarry.
III.5 Utility of Microartifacts in a Quarry Context

The analysis of materials from Callar Creek Quarry can shed some light on the utility of microartifact analysis in quarry contexts. Microartifact analysis is a time consuming and laborious process and, while useful for identifying activity areas, what is their utility in a quarry context where debitage is ubiquitous? The analysis of the microdebitage from Callar Creek Quarry demonstrates that variation in use of the quarry area can be determined from the microdebitage. Furthermore, the microdebitage has provided additional evidence to support conclusions from the analysis of the macrodebitage about production and the areas in which production occurred.

The downside of microartifact analysis from a quarry context is the sheer quantity of materials. The two liter samples from Callar Creek Quarry produced large amounts of microdebitage that then had to be sorted and analyzed. If issues of production and variation in quarry use were not important to the quarry study, then the labor intensive process of microartifact analysis would have little utility. In this case however, the information about variation throughout the quarry provides a more nuanced prospective on the use of different quarry areas, as well as the potential for some in situ reduction areas.

One caveat which should be considered when thinking about microartifact analysis in quarry areas is the abundance of lithic debitage produced from the lithic extraction process. As suggested in this discussion, methods of removing chert, including breaking chert beds into smaller pieces for extraction, lead to the production of microdebitage which increases the amount of debitage. The presence of this material, and the implications of its presence, should be considered when determining the function
of areas through microartifact analysis. The large quantity of microdebitage identified within the quarry area might seem to be obvious, as it is a quarry and site for lithic reduction, but the analysis of these materials, particularly with attention to differences in the spatial layout of the materials, can provide additional information about extraction and production processes within the quarry.
Appendix IV: Excavations

IV.1 Introduction

Excavations at Callar Creek Quarry focused on the quarry and two adjacent structure groups. This section will introduce and describe the excavation methodologies and the specifics of excavations at CCQ-1, and CCQ-2. Investigations were aimed at determining the use of the quarry, both in terms of the extraction of raw materials and the production of tools, and the timing of construction and use and the function of the surrounding structures. The construction sequence, dating, and the materials recovered from excavations were discussed in Chapter 7.

The naming of excavation units follows the conventions of the Mopan Valley Archaeological Project (MVAP) which shares conventions with the Xunantunich Archaeological Project (XAP) for ease of comparison between projects. General areas are referred to as Operations (Ops). Specific units are Suboperations (Subops), and divisions within those units, levels or layers, are Lots. Operation numbers are assigned by the MVAP direct and are consecutive within the project. Excavations at Callar Creek Quarry utilized four operations: 370, quarry surface collections; 373, on and off-structure excavations at CCQ-2; 374, quarry excavations; and 381, on and off-structure excavations at CCQ-1 (see Table IV.2 for a description of all lots excavated).
All excavations followed standard archaeological conventions. Materials were screened through ¼ inch mesh. Two liter flotation samples were taken from some excavation units and these were subject to flotation and the materials analyzed separately, as discussed in Appendix III.

**IV.2 Callar Creek Quarry 1 Excavations (Operation 381)**

Excavations at Callar Creek Quarry 1, the results of which are discussed in Chapter 7, focused on determining the timing and phases of the structure construction and elucidating the function of the structures. Excavations focused on three of the six structures in the group, as not all structures could feasibly be investigated. Off-structure excavations were performed in locations which were likely to contain large deposits, possibly middens, and indicative of the structure function.

**IV.2.1 Platform Excavations (Platform 1, Structure 4)**

Excavations of Platform 1 and Structure 4 consisted of four subops, Ops 381A/1-15, 381B/1-14, 381C/1-10, and 381D/1-19. These Ops were concentrated on Str. 4 (Ops 381A/1-15, 381B/1-14, 381D/1-19) to determine the number of construction episodes of this structure, and Platform 1 (381C/1-10) to investigate the construction of the platform.

Ops 381A/1-15, 381B/1-14 were adjacent 1 x 2 m units on the west side of Str. 4. Op 381A/1-5 was excavated to bedrock, a depth of 145 cm, in 15 lots. A floor was identified in the eastern portion of the unit at a depth of 40 cm, and the remainder of the unit was then segmented to only a 1 m x 140 cm segment of the original size. Below the floor was a buried A horizon, fill, and an earlier buried A horizon. Op 381B/1-14 identified an interior retaining wall after the first 10 cm of excavation (Figure IV.1, IV.2). All subsequent excavations occurred behind this wall to obtain clean fill for dating of the
construction. 155 cm of fill were excavated, but the fill was not excavated to bedrock as it continued unchanged (see Figure 7.8).

Figure IV.1: Plan view of the retaining wall in Op 381B/1-14
Op 381D/1-19 was placed on the east side of Str. 4 slightly off the center line. The location was chosen to ensure that all construction episodes of the structure were identified. Ops 381A/1-15 and B/1-14 were placed off-center to the extent that they may have missed some of the construction episodes. Op 381D/1-19 was a 2 x 2 m unit excavated to bedrock, a depth of 220 cm. Op 381D/1-19 contained collapse, a floor, ballast, and a buried A horizon which extended to bedrock (Figure IV.3).

The excavations of Str. 4, as revealed in Ops 381A/1-15, 381B/1-14, 381D/1-19 indicate two construction phases. As discussed in Chapter 7, while there is an abundance of Middle Preclassic ceramics, the earliest construction episode probably dates to the Early Classic, with the second construction phase in the Late to Terminal Classic, specifically the Late Classic II.
Op 381C/1-10 was a 1 x 2 m unit located on the east side of Platform 1. It was placed on the edge of the platform to determine construction episodes and dating of the construction of the platform but in the end revealed mostly collapse and wash, as this unit was located down-slope from the rest of the structure. The unit was excavated to sterile
sascab, a depth of 80 cm plus an additional 50 cm test unit, of 50 x 50 cm in size, to ensure the sterility of the matrix (Figure IV.4). As no cultural materials were recovered from this 50 cm test unit, investigations were halted. Unfortunately, Op 381C/1-10 revealed little information about the construction of Platform 1. However, as an Early Classic period structure was built on top of the platform, it must have been constructed either in the Early Classic period or earlier.

Figure IV.4: South profile of Op 381C/1-10 showing the lack of construction phases for Platform 1.

The excavations on Str. 4 and Platform 1 indicate two construction episodes. The first dates to the Early Classic period, although a Middle Preclassic period occupation probably existed in the area, with the second dating to the Late Classic II period.
Excavations at Str. 5, located to the west of CCQ-1 were conducted on the western side of the structure, the part of the structure which appears to have been least affected by post-depositional processes which modified the eastern side of the structure. Investigations at this structure consisted of three Ops, 381F/1-9, 381J/1-5, and 381K/1. These subops are all adjacent and Ops 381J/1-5 and 381K/1 were opened to investigate a burial located in Op 381F/1-9.

Op 381F/1-9 was a 1 x 2 meter unit placed on the edge of Str. 5 to investigate Str. 5’s construction episodes. In Op 381 F/9 bone fragments were identified in the western segment of the unit. The area of the fragments was cleaned and human finger bones were found in the northern side wall at the western end of the unit. Op 381J/1-5, a 1 x 1 m unit, and 381K/1, a 2 x 1 m unit were placed adjacent to Op 381F/1-9 to open an area sufficient to remove the burial. The burial, CCQ Burial 1, was excavated as Op 381J/4. All materials from this lot were screened through window screen to collect any small bones or bone fragments from the burial. The burial was exposed, drawn, and photographed (Figure IV.5).
Excavations demonstrated that the burial was in construction fill, but there appears to have been a cut into the fill, which would have been a pit in which the body was placed. This cut was extremely difficult to see, and was only slightly darker than the surrounding matrix. Ceramics and lithics were identified in the matrix around the bones. All bones were removed from the unit, and wrapped in aluminum foil and labeled by bone and orientation. The skeletal remains were analyzed in 2016 by Carolyn Friewald, MVAP project osteologist. A ceramic vessel, a Dolphin Head Red bowl, dating to the Late Classic period, was placed upside down on top of the cranium (see Chapter 7 for more information on the vessel). Over time, post-depositional processes had led to the presence of the cranial material inside the vessel. The vessel was removed from the unit in one piece, with the cranial materials within it, and taken to the lab to excavate the cranial material in the laboratory. All soil matrix and bone was removed from the bowl.
in the laboratory, using window screen to obtain all materials. Bones were stored for investigation by the project osteologist. The bowl was then cleaned and refit. Burial 1 was placed in a cut into the construction fill of the structure and was in a laid out position oriented roughly north-south with the feet toward the north.

Excavations at Structure 5, consisting of Ops 381F/1-9, 381J/1-5, and 381K/1 were shaped by the discovery of a burial in the fill of Op 381F/1-9. Ops381J/1-5 and 381K/1 were opened to expose and remove the burial. As the burial was located, excavations at Structure 5 did not proceed to bedrock, so a complete understanding of the construction sequence of the structure was not obtained. One fill layer was identified, however, which can be dated through the ceramic materials to the Late Classic II period (see Chapter 7) (Figure IV.6).

![Figure IV.6: South profile of Ops381F/1-9 and 381 J/1-5 showing construction phases and placement of burial within Str. 5.](image-url)
IV.2.3 Off-structure excavations

Off-structure excavations at CCQ-1 were conducted to determine the function of the structures and the activities which were performed at the structure group. Four subops were placed near various structures in CCQ-1; Ops 381E/1-9, 381G/1-4, 381H/1-2, 381I/1-3, and 381GI/1-6.

Op 381E/1-9, a 1 x 1 meter unit excavated to bedrock, was placed to the south of Platform 1. The total depth was 110 centimeters and it was excavated in arbitrary 10 (Op 381 E/1-5) and 20 cm (Op 381 E/6-8) levels. An additional 50 x 50 cm test unit was excavated 20 additional cm into bedrock to confirm that it was in fact bedrock. The materials recovered from Op 381E/1-9 include large numbers of ceramic materials and some lithics, shell, obsidian, and daub.

Ops 381G/1-4 and 381I/1-3 were adjacent 1 x 1 meter units between Platform 1 and Structure 5 due south of Structure 2. Op 381I/1-3 was an expansion to investigate a possible feature identified in Op 381G/1-4, which turned out to be a natural rock formation. Both units were excavated bedrock in arbitrary 10 and 20 cm levels. Ops381G/1-4 and 381I/1-3 contain the possible Preceramic deposit consisting of a paleosol, a dark clayey matrix which contained only lithic materials. See Chapter 6 for further discussion of the Paleosol.

Op 381H/1-2 was located due south of Structure 2, the possible ancestor shrine. Only 20 cm of Op 381H/1-2 were excavated due to time constraints at the end of the field season. Within those 20 cm, excavated in two 10 cm lots, which consisted only of humus, a large number of ceramics and some lithics were identified.
While none of the off-structure excavations uncovered a midden, or other special use deposits. However, the materials recovered from these units are indicative of a household function for these structures, as is further discussed in Chapter 7. Materials included 1,458 lithics, 1,934 ceramics, 34 shells, one piece of groundstone, three pieces of slate, four pieces of daub, one bone (non-human), and three pieces of obsidian.

Excavations at CCQ-1 demonstrated that the group was residential in function and that the occupation at this group was lengthier than that at CCQ-2. The group was first occupied in the Middle Preclassic, with additional construction in the Late to Terminal Classic and some evidence for occupation in the intervening periods.

**IV.3 Callar Creek Quarry 2 Excavations (Operation 373)**

Excavations at Callar Creek Quarry 2 focused on determining the timing and phases of construction of the two structures and off-structure excavations to examine the function of these buildings. All excavation units, one in each of the structures and eight off-structure units, were organized with these goals in mind.

*IV.3.1 Structure 1*

The excavation of Str. 1, the range structure in the north of CCQ-2 focused on obtaining temporal information on the mound construction. Op 373B/1-16 was a 1 x 2 m unit in the top of the mound excavated to bedrock, a depth of 170 cm, in arbitrary 10 and 20 cm levels. Due to the lack of floors or evidence of multiple construction episodes, Structure 1 was constructed in a single construction episode (Figure IV.7). The fill of Str. 1 consisted of materials from the quarry including unutilized chert cobbles, discarded cores, debitage, and other miscellaneous materials. The dating of the mound, based on ceramic analysis, provides a *terminus post quem* of the Late to Terminal Classic,
specifically Late Classic II to Terminal Classic, for the construction of the mounds. A total of 9,735 lithics, 4,392 ceramics, two pieces of obsidian, five shells, and six pieces of groundstone were collected from these investigations.

Figure IV.7: West profile of Op 373B/1-16 showing single construction episode.

IV.3.2 Structure 2

Str. 2, the smaller, more conical mound, had a looters trench in the top. The looters trench, which was roughly circular in shape and about 2.5 x 3 m on the N/S x E/W diameters, was cleaned, photographed, and profiled and a 1 x 1 m unit was placed in the
bottom of the trench. The unit, Op 373A/1-12, was excavated to bedrock, a depth of one meter, in arbitrary 10 cm levels. The excavations and clearing of the looters trench revealed there was a plaster floor, in the walls of the looters trench. No other evidence of floors or construction episodes was evident from the excavations (Figure IV.8). The fill for the structure appears to have been materials from the quarry area (see Chapter 7). These include unused chert cobbles, debitage, and discarded cores and tools. A total of 1,257 lithics, 864 ceramics, and one piece of groundstone were recovered from these excavations.

Both Str. 1 and Str. 2 were constructed in the Late Classic II to Terminal Classic period in single construction events, indicating that this habitation group was rapidly constructed in a single construction episode.
Figure IV.8: East profile of Op 373A/1-12 showing floor and construction episodes.

IV.3.3 Off-structure Excavations

Off-structure excavations at CCQ-2 were focused on determining the function of these structures. As such, a program of test pitting, consisting of eight units of 1 x 1 or 1 x 2 m, were placed around the structure in optimal locations for the recovery of trash deposits, was developed. The placement of units was mostly off the presumed rear of the structures based on the placement of the staircase in Str. 1 and the plaza between the
structures. The size and depth of the various subops is summarized in Table IV.1. All subops were excavated to either bedrock or sterile sascab in arbitrary levels.

While the eight off-structure units did not identify any midden deposits, a quantity of materials, mostly lithic and ceramic, were recovered from excavations. A total of 2,734 lithics, 1,566 ceramics, seven shells, one groundstone piece, and one piece of slate were recovered from these excavations. The analysis of these materials, discussed in Chapter 7, suggests that CCQ-2 functioned as a residential area. The materials recovered from the off-structure deposits, including the frequency, forms, and types of ceramics, are indicative of household occupation rather than any alternative function.

Table IV.1: Summary of the Ops of off-Structure Excavations at CCQ-2

<table>
<thead>
<tr>
<th>Op</th>
<th>Size</th>
<th>Depth</th>
<th>End Material</th>
<th>Types levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>373C/1-3</td>
<td>1 x 1 m</td>
<td>30 cm</td>
<td>Bedrock</td>
<td>10 cm arbitrary</td>
</tr>
<tr>
<td>373D/1-3</td>
<td>1 x 1 m</td>
<td>30 cm</td>
<td>Bedrock</td>
<td>10 cm arbitrary</td>
</tr>
<tr>
<td>373E/1-3</td>
<td>1 x 1 m</td>
<td>30 cm</td>
<td>Bedrock</td>
<td>10 cm arbitrary</td>
</tr>
<tr>
<td>373F/1-6</td>
<td>1 x 2 m</td>
<td>60 cm</td>
<td>Sterile sascab</td>
<td>10 cm arbitrary</td>
</tr>
<tr>
<td>373G/1-5</td>
<td>1 x 1 m</td>
<td>90 cm</td>
<td>Sterile sascab</td>
<td>20 cm arbitrary</td>
</tr>
<tr>
<td>373H/1-5</td>
<td>1 x 1 m</td>
<td>1 m</td>
<td>Sterile sascab</td>
<td>20 cm arbitrary</td>
</tr>
<tr>
<td>373I/1-5</td>
<td>1 x 1 m</td>
<td>70 cm</td>
<td>Sterile sascab</td>
<td>20 cm arbitrary</td>
</tr>
<tr>
<td>373J/1-4</td>
<td>1 x 1 m</td>
<td>120 cm</td>
<td>Bedrock</td>
<td>20 cm arbitrary</td>
</tr>
</tbody>
</table>

IV.4 Summary

Excavations at Callar Creek Quarry were conducted in three areas of the site: the quarry, and habitation groups located to the north and south of the quarry, Callar Creek Quarry 1 and 2. Evidence from the quarry suggests that the area was differentially utilized from the Archaic through the historic period. Occupation at the surrounding habitation groups, specifically CCQ-1 began in the Middle Preclassic period. Occupation at CCQ-2 began in the Late Classic II to Terminal Classic when construction also occurred at CCQ-1. The course of excavations at CCQ was designed to investigate both
the lithic reduction sequence and the temporal span of occupation and use of the area.

Both of these goals were accomplished through excavations.
Table IV.2: Table of excavation unit characteristics.

<table>
<thead>
<tr>
<th>Op</th>
<th>Dimensions</th>
<th>Depth</th>
<th>Location</th>
<th>Context</th>
<th>Artifacts</th>
<th>Chronological Attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>370A/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370B/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>370C/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>370D/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>370E/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>370F/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late Preclassic</td>
</tr>
<tr>
<td>370G/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>Late Classic II</td>
</tr>
<tr>
<td>370H/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370I/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370J/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370K/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370L/1</td>
<td>n/a</td>
<td>N/A</td>
<td>opportunistic find</td>
<td>quarry</td>
<td>biface</td>
<td>None</td>
</tr>
<tr>
<td>370M/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370N/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>1 m d</td>
<td></td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>-----------------------------</td>
<td>--------</td>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>370O/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370P/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370Q/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370R/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370S/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370T/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370U/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370V/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370W/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370X/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370Y/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370Z/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AA/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AB/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AC/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>Code</td>
<td>Depth</td>
<td>Origin</td>
<td>Method</td>
<td>Quarry</td>
<td>Lithics</td>
<td>Notes</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>---------</td>
<td>----------------</td>
</tr>
<tr>
<td>370AD/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AE/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AF/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AG/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AH/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AI/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AJ/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AK/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AL/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AM/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>370AN/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AO/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AP/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AQ/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>370AR/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>Code</td>
<td>Depth</td>
<td>Location</td>
<td>Technique</td>
<td>Source</td>
<td>Materials</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
<td>----------</td>
<td>-----------</td>
<td>--------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>370AS/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AT/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AU/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AV/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AW/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AX/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370AY/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>370AZ/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BA/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BB/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BC/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BD/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BE/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BF/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BG/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>Reference</td>
<td>Depth</td>
<td>Location</td>
<td>Method</td>
<td>Feature</td>
<td>Feature Details</td>
<td>Find</td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>----------</td>
<td>--------</td>
<td>---------</td>
<td>----------------</td>
<td>------</td>
</tr>
<tr>
<td>370BH/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BI/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BJ/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BK/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BL/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BM/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BN/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BO/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BP/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BQ/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BR/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BS/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>370BT/1</td>
<td>1 m d</td>
<td>N/A</td>
<td>surface collection, quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>373A/1</td>
<td>2.5 x 3 m</td>
<td>circle</td>
<td>cleanup of looters trench</td>
<td>looters trench S shaped group</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373A/2</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>below looters</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal</td>
</tr>
<tr>
<td>Site Number</td>
<td>Dimensions</td>
<td>Trench Depth</td>
<td>Trench Location</td>
<td>Fill</td>
<td>Artifacts</td>
<td>Time Period</td>
</tr>
<tr>
<td>-------------</td>
<td>------------</td>
<td>--------------</td>
<td>----------------</td>
<td>------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>373A/3</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>below looters</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373A/4</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>below looters</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373A/5</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>below looters</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373A/6</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>below looters</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373A/7</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>below looters</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373A/8</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>below looters</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373A/9</td>
<td>1 x 1</td>
<td>to bedrock</td>
<td>below looters</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373A/10</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>below looters</td>
<td>fill</td>
<td>bedrock, ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373A/11</td>
<td>1 x 1</td>
<td>30 cm</td>
<td>below looters</td>
<td>fill</td>
<td>bedrock, thought was plaster</td>
<td>None</td>
</tr>
<tr>
<td>373A/12</td>
<td>2.5 x 3 m circle</td>
<td>wall fall -</td>
<td>looters trench S</td>
<td>wall fall</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373B/1</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373B/2</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373B/3</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late Classic II</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>-------</td>
<td>-------------------------------------------</td>
<td>------</td>
<td>------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>373B/4</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late Classic II</td>
</tr>
<tr>
<td>373B/5</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373B/6</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373B/7</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373B/8</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Terminal Classic</td>
</tr>
<tr>
<td>373B/9</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373B/10</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373B/11</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373B/12</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>Code</td>
<td>Size</td>
<td>Depth</td>
<td>Notes</td>
<td>Finds</td>
<td>Culture</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
<td>-------</td>
<td>--------------------------------------------</td>
<td>----------------</td>
<td>-----------------------</td>
<td></td>
</tr>
<tr>
<td>373B/13</td>
<td>1 x 2</td>
<td>n/a</td>
<td>on top of larger mound of SW L shaped group</td>
<td>wall fall from storm</td>
<td>ceramics, lithics</td>
<td>Late Classic II</td>
</tr>
<tr>
<td>373B/14</td>
<td>1 x 2</td>
<td>20 cm</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373/15</td>
<td>1 x 2</td>
<td>20 cm- to bedrock</td>
<td>on top of larger mound of SW L shaped group</td>
<td>fill</td>
<td>ceramics, lithics</td>
<td>None</td>
</tr>
<tr>
<td>373B/16</td>
<td>1 x 2</td>
<td>n/a</td>
<td>on top of larger mound of SW L shaped group</td>
<td>clean up - wall fall</td>
<td>N/A</td>
<td>None</td>
</tr>
<tr>
<td>373C/1</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>off mound - CCQ 2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late Classic I</td>
</tr>
<tr>
<td>373C/2</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>off mound - CCQ 2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373C/3</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>off mound - CCQ 2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>373D/1</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>off mound - CCQ 2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373D/2</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>off mound - CCQ 2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373D/3</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>off mound - CCQ 2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Classic</td>
</tr>
<tr>
<td>373E/1</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>off mound - CCQ 2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373E/2</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>off mound - CCQ 2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373E/3</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>off mound - CCQ 2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373F/1</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>off mound - CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373F/2</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>off mound - CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373F/3</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>off mound - CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Classic</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>-------</td>
<td>-------------------</td>
<td>-------</td>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>373F/4</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>off mound - CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373F/5</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>off mound - CCQ-2</td>
<td>sascab</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>373F/6</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>off mound - CCQ-2</td>
<td>sascab</td>
<td>lithics, ceramics</td>
<td>Late Classic I</td>
</tr>
<tr>
<td>373G/1</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposit - CCQ -2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373G/2</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposit - CCQ -2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>373G/3</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposit - CCQ -2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373G/4</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposit - CCQ -2</td>
<td>sascab</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>373G/5</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>off mound deposit - CCQ -2</td>
<td>sascab</td>
<td>none</td>
<td>None</td>
</tr>
<tr>
<td>373H/1</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposits - CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373H/2</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposits - CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373H/3</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposits - CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>373H/4</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposits - CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>373H/5</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposits - CCQ-2</td>
<td>sascab</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>373I/1</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposits - CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373I/2</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposits</td>
<td>sascab</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>Site</td>
<td>Area</td>
<td>Depth</td>
<td>Context</td>
<td>Trench</td>
<td>Materials</td>
<td>Age</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>---------</td>
<td>--------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>373I/3</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposits - CCQ-2</td>
<td>sascab</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>373I/4</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>off mound deposits - CCQ-2</td>
<td>sascab</td>
<td>sterile</td>
<td>None</td>
</tr>
<tr>
<td>373I/5</td>
<td>40 x 40 cm</td>
<td>10 cm</td>
<td>off mound deposits - CCQ-2</td>
<td>sascab</td>
<td>sterile</td>
<td>None</td>
</tr>
<tr>
<td>373J/1</td>
<td>1 x 1 m</td>
<td>20 cm</td>
<td>off mound deposits CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>373J/2</td>
<td>1 x 1 m</td>
<td>20 cm</td>
<td>off mound deposits CCQ-2</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Mixed</td>
</tr>
<tr>
<td>373J/3</td>
<td>1 x 1 m</td>
<td>20 cm</td>
<td>off mound deposits CCQ-2</td>
<td>sascab</td>
<td>none</td>
<td>None</td>
</tr>
<tr>
<td>373J/4</td>
<td>1 x 1 m</td>
<td>20 cm</td>
<td>off mound deposits CCQ-2</td>
<td>sascab</td>
<td>none</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374A/1</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374A/2</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374A/3</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late Classic 1</td>
</tr>
<tr>
<td>374A/4</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374A/5</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374A/6</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>374A/7</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>374B/1</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374B/2</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374B/3</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>374B/4</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>374B/5</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374B/6</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374B/7</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374B/8</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>374C/1</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374C/2</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374C/3</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late Classic I</td>
</tr>
<tr>
<td>374C/4</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>374C/5</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374C/6</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374C/7</td>
<td>1 x 2</td>
<td>to bedrock</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374D/1</td>
<td>1 x 2</td>
<td>stratigraphic layer - humus</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374D/2</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374D/3</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>374D/4</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374D/5</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374D/6</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374D/7</td>
<td>1 x 2</td>
<td>to rock layer could not pass under without</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>Area</td>
<td>Orientation</td>
<td>Depth</td>
<td>Context</td>
<td>Tools</td>
<td>Horizon</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>-------</td>
<td>---------</td>
<td>---------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>374D/8</td>
<td>1 x 2</td>
<td>removal</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>374D/9</td>
<td>1 x 2</td>
<td>under chert layers - about 20 cm to bedrock</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics</td>
<td>None</td>
</tr>
<tr>
<td>374D/10</td>
<td>1 x 5</td>
<td>cleanup</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374E/1</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>possible debitage mound</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>374E/2</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>possible debitage mound</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374E/3</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>possible debitage mound</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>374E/4</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>possible debitage mound</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>374E/5</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>possible debitage mound</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374E/6</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>possible debitage mound</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>374E/7</td>
<td>1 x 2</td>
<td>to bedrock - less 10 cm</td>
<td>possible debitage mound</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374E/8</td>
<td>1 x 2</td>
<td>wallfall</td>
<td>possible debitage mound</td>
<td>quarry</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374F/1</td>
<td>1 x 3</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, few ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374F/2</td>
<td>1 x 3</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, few ceramics</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>374F/3</td>
<td>1 x 3</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, few ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>374F/4</td>
<td>1 x 3</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, few ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374F/5</td>
<td>1 x 3</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, few ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374F/6</td>
<td>1 x 3</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, few ceramics</td>
<td>Late Classic</td>
</tr>
<tr>
<td>374F/7</td>
<td>1 x 3</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, few ceramics</td>
<td>None</td>
</tr>
<tr>
<td>374F/8</td>
<td>1 x 3</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, few ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>374F/9</td>
<td>1 x 3</td>
<td>10 cm</td>
<td>quarry</td>
<td>quarry</td>
<td>lithics, few ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381A/1</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>CCQ - 1 on mound</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381A/2</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>CCQ - 1 on mound</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381A/3</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>CCQ - 1 on mound</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381A/4</td>
<td>1 x 140 cm</td>
<td>to floor</td>
<td>CCQ - 1 on mound</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381A/5</td>
<td>1 x 140 cm</td>
<td>remove floor</td>
<td>CCQ - 1 on mound</td>
<td>floor</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381A/6</td>
<td>1 x 140 cm</td>
<td>remove floor</td>
<td>CCQ - 1 on mound</td>
<td>floor</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381A/7</td>
<td>1 x 140 cm</td>
<td>10 cm</td>
<td>CCQ - 1 on mound</td>
<td>fill</td>
<td>lithics, ceramics</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381A/8</td>
<td>1 x 60 cm</td>
<td>10 cm</td>
<td>CCQ - 1 on mound</td>
<td>fill (?)</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381A/9</td>
<td>1 x 140 cm</td>
<td>15 cm</td>
<td>CCQ - 1 on mound</td>
<td>fill</td>
<td>lithics, ceramics</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381A/10</td>
<td>1 x 140 cm</td>
<td>10 cm</td>
<td>CCQ - 1 on mound</td>
<td>fill</td>
<td>lithics, ceramics</td>
<td>Middle</td>
</tr>
<tr>
<td>Site</td>
<td>Location</td>
<td>Dimensions</td>
<td>Depth</td>
<td>Context</td>
<td>Finds</td>
<td>Chronology</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>-------------</td>
<td>-------</td>
<td>---------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>381A/11</td>
<td>1 x 140 cm</td>
<td>10 cm</td>
<td>fill</td>
<td>CCQ - 1 on mound</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381A/12</td>
<td>1 x 140 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ - 1 on mound</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381A/13</td>
<td>1 x 140 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ - 1 on mound</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381A/14</td>
<td>1 x 140 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ - 1 on mound</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381A/15</td>
<td>1 x 140 cm</td>
<td>15 cm</td>
<td>buried A horizon</td>
<td>CCQ - 1 on mound</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381B/1</td>
<td>1 x 2 m</td>
<td>10 cm</td>
<td>humus</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381B/2</td>
<td>1 x 80 cm</td>
<td>10 cm</td>
<td>collapse</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381B/3</td>
<td>1 x 80 cm</td>
<td>10 cm</td>
<td>collapse</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381B/4</td>
<td>1 x 80 cm</td>
<td>10 cm</td>
<td>fill</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381B/5</td>
<td>1 x 80 cm</td>
<td>10 cm</td>
<td>fill</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381B/6</td>
<td>1 x 80 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381B/7</td>
<td>1 x 80 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381B/8</td>
<td>1 x 80 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Early Classic</td>
</tr>
<tr>
<td>381B/9</td>
<td>1 x 80 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Preclassic</td>
</tr>
<tr>
<td>381B/10</td>
<td>1 x 80 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381B/11</td>
<td>1 x 80 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Early Classic</td>
</tr>
<tr>
<td>381B/12</td>
<td>1 x 80 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>Early Classic</td>
</tr>
<tr>
<td>381B/13</td>
<td>1 x 80 cm</td>
<td>15 cm</td>
<td>fill</td>
<td>CCQ-1 on mound</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>Reference</td>
<td>Size</td>
<td>Depth</td>
<td>Context</td>
<td>Sediment Type</td>
<td>Material</td>
<td>Time Period</td>
</tr>
<tr>
<td>-----------</td>
<td>------</td>
<td>-------</td>
<td>---------</td>
<td>---------------</td>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td>381B/14</td>
<td>1 x 80 cm</td>
<td>15 cm</td>
<td>CCQ-1 on mound</td>
<td>fill</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381C/1</td>
<td>1 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposits</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381C/2</td>
<td>1 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposits</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381C/3</td>
<td>1 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposits</td>
<td>erosion, collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381C/4</td>
<td>1 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposits</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381C/5</td>
<td>1 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposits</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381C/6</td>
<td>1 x 80 cm</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposits</td>
<td>sascab</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381C/7</td>
<td>1 x 120 cm</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposits</td>
<td>sascab</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381C/8</td>
<td>1 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposits</td>
<td>sascab</td>
<td>few</td>
<td>None</td>
</tr>
<tr>
<td>381C/9</td>
<td>1 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposits</td>
<td>sascab</td>
<td>none</td>
<td>None</td>
</tr>
<tr>
<td>381C/10</td>
<td>1 m x 50 cm</td>
<td>80 cm</td>
<td>CCQ-1 off mound deposits</td>
<td>sascab</td>
<td>3 ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381D/1</td>
<td>2 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposit</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381D/2</td>
<td>2 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposit</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381D/3</td>
<td>2 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposit</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381D/4</td>
<td>2 x 2 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposit</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381D/5</td>
<td>2 x 1 m</td>
<td>10 cm</td>
<td>CCQ-1 off mound deposit</td>
<td>fill</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>Site</td>
<td>Size</td>
<td>Depth</td>
<td>Type</td>
<td>Description</td>
<td>Layer</td>
<td>Age</td>
</tr>
<tr>
<td>-------</td>
<td>---------------</td>
<td>-------</td>
<td>---------------</td>
<td>------------------------------</td>
<td>------------</td>
<td>---------------</td>
</tr>
<tr>
<td>381D/6</td>
<td>2 x 1 m</td>
<td>10 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>fill</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381D/7</td>
<td>2 x 1 m</td>
<td>10 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>fill</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381D/8</td>
<td>2 x 1 m</td>
<td>10 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>fill</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381D/9</td>
<td>2 x 1 m</td>
<td>10 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>fill</td>
<td>None</td>
</tr>
<tr>
<td>381D/10</td>
<td>2 x 1 m</td>
<td>floor removal</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>floor</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381D/11</td>
<td>2 x 1 m</td>
<td>ballast removal</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>ballast</td>
<td>Preclassic</td>
</tr>
<tr>
<td>381D/12</td>
<td>2 x 1 m</td>
<td>10 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>buried A horizon</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381D/13</td>
<td>2 x 1 m</td>
<td>10 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>buried A horizon</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381D/14</td>
<td>2 x 1 m</td>
<td>15 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>buried A horizon</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381D/15</td>
<td>2 x 1 m</td>
<td>10 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>buried A horizon</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381D/16</td>
<td>2 x 1 m</td>
<td>15 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>buried A horizon</td>
<td>Preclassic</td>
</tr>
<tr>
<td>381D/17</td>
<td>2 x 1 m</td>
<td>15 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>buried A horizon</td>
<td>None</td>
</tr>
<tr>
<td>381D/18</td>
<td>2 x 1 m</td>
<td>15 cm</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>buried A horizon</td>
<td>Preclassic</td>
</tr>
<tr>
<td>381D/19</td>
<td>2 x 1 m</td>
<td>to bedrock</td>
<td>deposit</td>
<td>CCQ -1 on mound deposit</td>
<td>buried A horizon</td>
<td>None</td>
</tr>
<tr>
<td>381E/1</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>CCQ-1 off mound</td>
<td>deposit</td>
<td>humus</td>
<td>Late/Terminal Classic</td>
</tr>
</tbody>
</table>

473
<table>
<thead>
<tr>
<th>Site</th>
<th>Area</th>
<th>Section</th>
<th>Size</th>
<th>Description</th>
<th>Material</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>381E/2</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>CCQ-1 off mound</td>
<td>off mound deposits</td>
<td>lithics, ceramics</td>
<td>Classic</td>
</tr>
<tr>
<td>381E/3</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>CCQ-1 off mound</td>
<td>off mound deposits</td>
<td>lithics, ceramics</td>
<td>Mixed</td>
</tr>
<tr>
<td>381E/4</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>CCQ-1 off mound</td>
<td>off mound deposits</td>
<td>lithics, ceramics</td>
<td>Mixed</td>
</tr>
<tr>
<td>381E/5</td>
<td>1 x 1</td>
<td>10 cm</td>
<td>CCQ-1 off mound</td>
<td>off mound deposits</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381E/6</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>CCQ-1 off mound</td>
<td>off mound deposits</td>
<td>lithics, ceramics</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381E/7</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>CCQ-1 off mound</td>
<td>off mound deposits</td>
<td>lithics, ceramics</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381E/8</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>CCQ-1 off mound</td>
<td>off mound deposits</td>
<td>lithics, ceramics</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381E/9</td>
<td>1 x 1</td>
<td>20 cm</td>
<td>CCQ-1 off mound</td>
<td>off mound deposits</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381F/1</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>testing of possible structure w of CCQ-1</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381F/2</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>testing of possible structure w of CCQ-1</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381F/3</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>testing of possible structure w of CCQ-1</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Early Classic</td>
</tr>
<tr>
<td>381F/4</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>testing of possible structure w of CCQ-1</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381F/5</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>testing of possible fill</td>
<td>lithics, ceramics</td>
<td></td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>Site Code</td>
<td>Unit Size</td>
<td>Unit Depth</td>
<td>Feature Description</td>
<td>Fill Type</td>
<td>Artifacts</td>
<td>Period</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>------------</td>
<td>---------------------</td>
<td>-----------</td>
<td>-----------</td>
<td>--------</td>
</tr>
<tr>
<td>381F/6</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>testing of possible structure w of CCQ-1</td>
<td>fill</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381F/7</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>testing of possible structure w of CCQ-1</td>
<td>fill</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381F/8</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>testing of possible structure w of CCQ-1</td>
<td>fill</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381F/9</td>
<td>1 x 2</td>
<td>10 cm</td>
<td>testing of possible structure w of CCQ-1</td>
<td>fill</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381G/1</td>
<td>1 x 1 m</td>
<td>10 cm</td>
<td>off mound deposits ccq-1</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381G/2</td>
<td>1 x 1 m</td>
<td>to change in matrix</td>
<td>off mound deposits ccq-1</td>
<td>off mound deposit</td>
<td>lithics, ceramics</td>
<td>Mixed</td>
</tr>
<tr>
<td>381G/3</td>
<td>1 x 1 m</td>
<td>10 cm</td>
<td>off mound deposits ccq-1</td>
<td>off mound deposit</td>
<td>lithics, ceramics</td>
<td>Mixed</td>
</tr>
<tr>
<td>381G/4</td>
<td>1 x 1 m</td>
<td>10 cm</td>
<td>off mound deposits ccq-1</td>
<td>off mound deposit</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381I/1</td>
<td>1 x 1 m</td>
<td>remove humus</td>
<td>investigate possible feature in 381G</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Mixed</td>
</tr>
<tr>
<td>381I/2</td>
<td>1 x 1 m</td>
<td>to reach possible feature</td>
<td>investigate possible feature in 381G</td>
<td>off mound deposit</td>
<td>lithics, ceramics</td>
<td>Mixed</td>
</tr>
<tr>
<td>381I/3</td>
<td>1 x 1 m</td>
<td>to reach level of 381 G/4</td>
<td>investigate possible feature in 381G</td>
<td>off mound deposit</td>
<td>lithics, ceramics</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>381GI/1</td>
<td>1 x 2 m</td>
<td>remove non feature to level of 381 G/4 and I/3</td>
<td>off mound deposits ccq-1</td>
<td>off mound deposit</td>
<td>lithics, ceramics</td>
<td>Middle Preclassic</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>---------------------------------------------</td>
<td>---------------------------</td>
<td>-------------------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>381GI/2</td>
<td>1 x 2 m</td>
<td>15 cm</td>
<td>off mound deposits ccq-1</td>
<td>off mound deposit</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381GI/3</td>
<td>1 x 2 m</td>
<td>15 cm</td>
<td>off mound deposits ccq-1</td>
<td>off mound deposit</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381GI/4</td>
<td>1 x 70 cm</td>
<td>15 cm</td>
<td>off mound deposits ccq-1</td>
<td>paleosol</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381GI/5</td>
<td>1 x 70 cm</td>
<td>15 cm</td>
<td>off mound deposits ccq-1</td>
<td>paleosol</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381GI/6</td>
<td>1 x 70 cm</td>
<td>15 cm</td>
<td>off mound deposits ccq-1</td>
<td>paleosol</td>
<td>lithics, ceramics</td>
<td>None</td>
</tr>
<tr>
<td>381H/1</td>
<td>1 x 1 m</td>
<td>10 cm</td>
<td>off mound deposits at CCQ-1</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Mixed</td>
</tr>
<tr>
<td>381H/2</td>
<td>1 x 1 m</td>
<td>to change in matrix</td>
<td>off mound deposits at CCQ-1</td>
<td>off mound deposit</td>
<td>lithics, ceramics</td>
<td>Mixed</td>
</tr>
<tr>
<td>381J/1</td>
<td>1 x 1 m</td>
<td>to humus</td>
<td>to reach burial in 381 F/9</td>
<td>humus</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381J/2</td>
<td>1 x 1 m</td>
<td>to level below chert cobbles - change in matrix</td>
<td>to reach burial in 381 F/9</td>
<td>collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381J/3</td>
<td>1 x 1 m</td>
<td>to burial</td>
<td>to reach burial in 381 F/9</td>
<td>fill</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381J/4</td>
<td>2 x 2 m</td>
<td>burial cleanup</td>
<td>to extract burial</td>
<td>burial</td>
<td>lithics, ceramics, bone</td>
<td>Late/Terminal Classic</td>
</tr>
<tr>
<td>381J/5</td>
<td>2 x 2 m</td>
<td>burial</td>
<td>to extract any</td>
<td>burial</td>
<td>lithics, ceramics,</td>
<td>None</td>
</tr>
<tr>
<td>cleanup after</td>
<td>remaining burial pieces/bones</td>
<td>bone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------</td>
<td>---------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>381K/1</td>
<td>1 x 2 m</td>
<td>to reach burial</td>
<td>to reach burial</td>
<td>fill, collapse</td>
<td>lithics, ceramics</td>
<td>Late/Terminal Classic</td>
</tr>
</tbody>
</table>
Appendix V: Radiocarbon Results

V.1 Introduction

Radiocarbon samples from the households adjacent to Callar Creek Quarry were collected when possible, a total of 15 samples. Eight samples were submitted for testing to the Beta Analytic Radiocarbon laboratory in Miami for standard AMS radiocarbon dating. The samples chosen derived from contexts which might provide information concerning the construction phases of Callar Creek Quarry 1 and 2, with six samples from Callar Creek Quarry 1 and two from Callar Creek Quarry 2. Prior to the radiocarbon analysis, all samples exported from Belize (a total of 13 samples) were analyzed by Rebecca Friedel, the MVAP Paleobotanist, at the University of Texas San Antonio. The results of these analyses are discussed below.

V.2 Radiocarbon Samples

As per MVAP conventions, each radiocarbon sample receives a carbon number. These identifiers, along with the provenience information, are used to identify the carbon sample after excavation. Beta Analytic assigned an additional identifier for processed samples, reported in the Table V.3. Of the 15 samples recovered from Callar Creek Quarry, all come from the household groups. Three derive from CCQ-2 fill contexts with
one sample from off-structure deposits at CCQ-2 (Table V.1). The remaining 11 samples all derive from CCQ-1 fill contexts.

<table>
<thead>
<tr>
<th>Provenience</th>
<th>Context</th>
<th>Analyzed (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>373B/11</td>
<td>Bottom of lot in fill</td>
<td>Y</td>
</tr>
<tr>
<td>373B/11</td>
<td>Bottom of lot in fill</td>
<td>Y</td>
</tr>
<tr>
<td>373B/11</td>
<td>Bottom of lot in fill</td>
<td>N</td>
</tr>
<tr>
<td>373H/3</td>
<td>Off structure deposits</td>
<td>N</td>
</tr>
<tr>
<td>381A/2</td>
<td>Fill</td>
<td>Y</td>
</tr>
<tr>
<td>381A/12</td>
<td>Fill – bottom of lot</td>
<td>Y</td>
</tr>
<tr>
<td>381C/5</td>
<td>Fill – darker area with roots</td>
<td>Y</td>
</tr>
<tr>
<td>381D/10</td>
<td>Fill</td>
<td>N</td>
</tr>
<tr>
<td>381D/11</td>
<td>Fill</td>
<td>Y</td>
</tr>
<tr>
<td>381D/13</td>
<td>Fill</td>
<td>N</td>
</tr>
<tr>
<td>381D/13</td>
<td>Fill</td>
<td>Y</td>
</tr>
<tr>
<td>381D/17</td>
<td>Fill</td>
<td>Y</td>
</tr>
<tr>
<td>381J/4</td>
<td>Fill</td>
<td>N</td>
</tr>
<tr>
<td>381F/9</td>
<td>Fill</td>
<td>N</td>
</tr>
</tbody>
</table>

V.3 Paleobotanical Analysis

Of the 13 samples analyzed by Rebecca Friedel, the majority were hardwoods (n = 4) or pine (n = 3). The remainder were unidentifiable either due to the small size of the carbon fragments (n = 4) or the lack of organic material within the sample. See Table V.2 for the list of identified samples. The prevalence of hardwoods and pines is unsurprising given that these trees occur locally.
Table V.2: Paleobotanical Analysis of 13 Carbon Samples from Callar Creek Quarry (Performed by R. Friedel).

<table>
<thead>
<tr>
<th>Carbon #</th>
<th>Provenience</th>
<th>Weight (g)</th>
<th>Count</th>
<th>Taxonomic ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-632</td>
<td>Op 373B/11</td>
<td>1.3</td>
<td>1</td>
<td>Hardwood</td>
</tr>
<tr>
<td>C-634</td>
<td>Op 373B/11</td>
<td>16.0</td>
<td>1</td>
<td>Unidentifiable</td>
</tr>
<tr>
<td>C-673</td>
<td>Op 381A/2</td>
<td>6.3</td>
<td></td>
<td>Hardwood</td>
</tr>
<tr>
<td>C-681</td>
<td>Op 381A/12</td>
<td>.7</td>
<td>1</td>
<td>Pine</td>
</tr>
<tr>
<td>C-691</td>
<td>Op 381C/5</td>
<td>.7</td>
<td></td>
<td>Hardwood</td>
</tr>
<tr>
<td>C-692</td>
<td>Op 373H/3</td>
<td>1.3</td>
<td>6</td>
<td>N/A</td>
</tr>
<tr>
<td>C-697</td>
<td>Op 381D/11</td>
<td>4.1</td>
<td>1</td>
<td>Hardwood</td>
</tr>
<tr>
<td>C-700</td>
<td>Op 381D/13</td>
<td>5.3</td>
<td>1</td>
<td>Unidentifiable</td>
</tr>
<tr>
<td>C-701</td>
<td>Op 381D/13</td>
<td>3.5</td>
<td></td>
<td>Pine</td>
</tr>
<tr>
<td>C-702</td>
<td>Op 381D/17</td>
<td>2.7</td>
<td>1</td>
<td>Pine</td>
</tr>
<tr>
<td>C-704</td>
<td>Op 381J/4</td>
<td>.4</td>
<td></td>
<td>Unidentifiable</td>
</tr>
<tr>
<td>C-705</td>
<td>Op 381F/9</td>
<td>.9</td>
<td>1</td>
<td>Unidentifiable</td>
</tr>
<tr>
<td>C-696</td>
<td>Op 381D/10</td>
<td>4.9</td>
<td>4</td>
<td>N/A</td>
</tr>
</tbody>
</table>

V.4 Radiocarbon results

Analysis at the Beta Analytic laboratory resulted in dates for seven of the eight samples. One sample (C-691) did not result in a chronometric date as it was contaminated with modern carbon (see Table V.3). The results of the other samples are presented below (Table V.3) and will be discussed by household group.

Table V.3: Radiocarbon dates and 2-sigma calibrations

<table>
<thead>
<tr>
<th>BETA</th>
<th>Provenience</th>
<th>(MATERIAL): PRETREATMENT</th>
<th>CONVENTIONAL AGE</th>
<th>2 SIGMA CALIBRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>40276 1</td>
<td>C-702 Op 381D/17</td>
<td>(charred material): acid/alkali/acid</td>
<td>2740 +/- 30 BP</td>
<td>Cal BC 970 to 960 (Cal BP 2920 to 2910) and Cal BC 930 to 820 (Cal BP 2880 to 2770)</td>
</tr>
<tr>
<td>40276 0</td>
<td>C-701 Op 381/13</td>
<td>(charred material): acid/alkali/acid</td>
<td>1830 +/- 30 BP</td>
<td>Cal AD 90 to 100 (Cal BP 1860 to 1850) and Cal AD 125 to 250 (Cal BP 1825 to 1700)</td>
</tr>
<tr>
<td>40275 9</td>
<td>C-697 Op 381D/11</td>
<td>(charred material): acid/alkali/acid</td>
<td>1580 +/- 30 BP</td>
<td>Cal AD 405 to 550 (Cal BP 1545 to 1400)</td>
</tr>
</tbody>
</table>
V.4.1 Callar Creek Quarry 1 Radiocarbon Samples

C-673 Op 381A/2

Sample C-673 was recovered from the construction fill of the latest construction stage of Str. 4 from CCQ-1. This sample was chosen for processing as it was stratified with other samples, which could provide information about the multiple construction phases of this structure. The two-sigma calibrated date for the sample, A.D. 770 – 900 or A.D. 925 – 945 (Figure V.1), a Late/Terminal Classic date, fits in well with the Late Classic II or Terminal Classic dates of the most recent construction phase, based on ceramic chronologies (see Chapter 5).
Figure V.1: Calibration curve for sample C-673.

C-681 Op 381A/12

Sample C-681 was recovered from the construction fill of the early construction stage of Str. 4. As it is stratified with C-673, these two samples provide evidence of the dating of the various construction stages. The two-sigma calibrated date, B.C. 1225 to 1045 provides a *terminus post quem* for the materials used in construction, and the early age of that date suggests an organic sediment present in the fill materials utilized (Figure V.2).

Figure V.2: Calibration curve for C-681 Op 381A/12.
C-691 Op 381C/5

The sample comes from the Platform 1 construction phase, and was the best possibility for obtaining a date for the construction of this platform. Unfortunately, the sample contained large amounts of modern carbon and so did not result in a date. The sample was removed from an area which was darker in color than the rest of the sediment in the unit and which contained many roots, indicating that this sample probably came from a modern tree.

C-697 Op 381D/11

The sample comes from the earliest construction stage of Str. 4 providing a terminus post quem for the building construction to a calibrated. A.D. 405 – 550 (Figure V.3).

![Figure V.3: Calibration curve for C-697 Op 381D/11.](image)

C-701 Op 381D/13

C-701, from construction fills of Str. 4, provides a terminus post quem, of calibrated A.D. 90 - 100 or A.D. 125 - 250, in the Protoclassic or Early Classic Periods.
These dates fit well with the presence of Protoclassic and Early Classic ceramics in these early construction phases, as discussed in Chapter 5 (Figure V.4).

C-702 Op 381D/17

C-702 comes from the lowest levels of the construction fill of Str. 4. The calibrated dates of B.C. 970 - 960 or B.C. 930 - 820, provide a *terminus post quem* for the construction of the earliest stage of the structure in the Preclassic. The dates from Op 381 D/13 suggest that the structure was in fact constructed later than indicated by this sample (Figure V.5).
Summary

The radiocarbon dates from CCQ-1 support the ceramic chronology for the construction of Str. 4. Dates from the last construction phase point to a Late Classic II or Terminal Classic period construction episode, while the *terminus post quem* for the earliest construction phase is in the Early Classic period. These samples provide a chronometric check for the ceramic chronology, and reveal similar patterns.

V.4.2 *Callar Creek Quarry 2 Radiocarbon Samples*

C-632 Op 373B/11

Carbon recovered from construction fill contexts of Callar Creek Quarry 2 Structure 1. Although the presence of the sample within the construction fill does not provide a firm date for the construction of the structure, the sample can provide a *terminus post quem* for when the materials utilized were deposited as fill. Results for C-632 show a calibrate 2-sigma date of A.D. 420-575, in the Early Classic period (Figure V.6).
C-634 Op 373B/11

As with Sample C-634, from Op 373 B/11, this sample was recovered from construction fill, providing only a *terminus post quem* for building construction. The calibrated dates place this sample between AD 90 to 100 and AD 125 to 250 (Figure V.7), in the Protoclassic or Early Classic period.
Summary

The materials from Callar Creek Quarry 2 confirm that Structure 2 could not have been constructed prior to the Early Classic period. This fits in with relative dates from the construction fill, which indicate a Late/Terminal Classic period date for mound construction. As they are from construction fill, these samples provide us with little additional information about the construction of Callar Creek Quarry 2.

V.5 Conclusions

The radiocarbon samples collected from Callar Creek Quarry 1 and 2 provide chronometric dates for the construction of these structures. In both cases, the chronometric dates, fit well with the ceramic chronologies, as described in Chapter 5. For Callar Creek Quarry 1, the earliest construction phase dates to the Early Classic period, with a Late Classic II or Terminal Classic period expansion, and at Callar Creek Quarry 2, the terminus post quem, is in the Early Classic period, although ceramic evidence points to a Late Classic II or Terminal Classic construction. Some of the materials from Callar Creek Quarry 1 point to a much earlier occupation. While these data cannot be directly linked with a construction phase, it is not unlikely that early occupation occurred, as discussed in Chapters 4 and 5.
References Cited

Abbott, David R.

Abbot, Lawrence E. Jr.
2004  An Assessment of Lithic Extraction Technology at a Metavolcanic Quarry in the Slate Belt of South Carolina. SAA Paper Presented at the 69th Annual Meeting in Montreal, Ontario, Canada.

Abramiuk, Marc A. and William P. Meurer

Abrams, Elliot M.

Adams, R. E. W.

Ahler, Stanley A.

Ahrens, Corrie

Aimers, James J.

Aimers, James J. and Elizabeth Graham

Alchian, Armen A. and William R. Allen

Alden, John R.

Aldenderfer, Mark

Algaze, Guillermo

Allard, Pierre, Françoise Bostyn, François Gillghy, Jacek Lech, ed.

Alonzo, Juan A.
Amick, Daniel S.

Andrefsky, William Jr.


Andresen, John M.

Andrews, Anthony P.

Andrews, Anthony P. and Shirley B. Mock


Andrews, Bradford


Andrews, Bradford W., Timothy M. Murtha Jr., and Barry Scheetz

Andrieu, Chloé


Andrieu, Chloé y Alejandra Roche

Andrieu, Chloé, Edna Rodas, and Luis Luin

Aoyama, Kazuo


2006  Political and socioeconomic implications of Classic Maya lithic artifacts from the Main Plaza of Aguateca, Guatemala. Journal de la société des américanistes 92(1).


Appadurai, Arjun

Ardren, Traci
2015  *Social Identity in the Classic Maya Northern Lowlands: Gender, Age, Memory, and Place*. University of Texas Press, Austin.

Ardren, Traci (ed.)
2002  *Ancient Maya Women*. Altamira Press, Walnut Creek.

Arnold, Dean E.

Ashton, Nick and Mark White

Ashmore, Wendy

Audouze, Francois


Ausel, Erica L.
Awe, Jaime J.

Babel, Jerzy

Baivin, Nicole

Ball, Joseph W.

Ball, Joseph and Jennifer Taschek


Bamforth, Douglas B.


Bar Yosef, Ofer


Barba, L., J. Blancas, L. R. Manzanilla, A. Ortiz, D. Barca, G. M. Crisci, D. Miriello, and A. Pecci

Barham, L.S.

Barkai, Ron and Avi Gopher

Barkai, Ran, Avi Gopher, and Philip C LaPorta

Barrett, Jason W.


Barrett, Jason W., Harry J. Shafer, and Thomas R. Hester

Barut, Sibul

Baumler, Mark F.

Baumler, Mark F. and Leslie B David

Bayman, James M.

Beadury-Corbett, Marilyn and Sharisse McCafferty

Beadury-Corbett, Marilyn, Scott E. Simmons, and David B. Tucker

Beck, Charlotte and Jones, George T.  

Becker, Marshal Joseph  


Behm, Jeffery A.  

Benitez, Alexander Villa  
2006  *Late Classic and Epiclassic Obsidian Procurement and Consumption in the Southeastern Toluca Valley, Central Highland Mexico*. Unpublished PhD Dissertation University of Texas, Austin. UMI, Ann Arbor.

Berdan, Frances F.  


Biette, Amilcare and Stefano Grimaldi  
Bill, Cassandra R.

Binford, Lewis R.


Black, Stephen L.

Black, Stephen L. and Charles K. Suhler

Blackman, M. James, Gil J. Stein, and Pamela B. Vandiver

Blackmore, Chelsea

Blair, Daniel A. and Richard E. Terry

Blanton, Richard E.

Bleed, Peter.

Bloxam, Elizabeth

Boeda, Eric

Bolender, Douglas J.

Bostyn, Françoise, Francois Gillgny, Adrienne Lo Carmine

Boucher, Sylviane and Lucía Quiñones


Braswell, Geoffrey E. and Michael D. Glascock


Braswell, Geoffrey E., Cassandra R. Bill, and Christian M. Prager

Braswell, Jennifer B.


Brennan, Michael L., Eleanor M. King, Leslie C. Shaw, Stanley L. Walling, Fred Valdez Jr.  

Breton, A.  

Bronowicki, Jaroslaw and Miroslaw Masojc  

Brooks, Ian P. and Ken J. Donnign  

Brown, David O. Meredith L. Dreiss, and Richard E. Hughes  

Brown, James A., Richard A. Werber, and Howard D. Winters  

Brown, James A. and John E. Kelly  

Brumfiel, Elizabeth M.  


Brumfiel, Elizabeth M. (ed)

Brumfiel, Elizabeth M. and Deborah L. Nichols

Brumfiel, Elizabeth M. and Timothy K. Earle

Buge, David E.

Burger, Richard L.

Burke, Adrian L.

Butler, Brian M. and Ernest E. May, eds.

Byers, David A., Craig Picka, and Jack H. Ray

Callaghan, Michael G.
Callahan, Errett  

Cantarutti, Gabriel E.  

Canuto, Marcello A. and Jason Yaeger, ed.  

Cap, Bernadette  


Cap, Bernadette, Rachel A. Horowitz, Jason Yaeger, and Mark C. Eli  
2015  From Quarry to Household: The Economics of Limestone Bifaces among the Classic Maya of Buenavista del Cayo, Belize. Paper Presented at the 80th Annual Society for American Archaeology Meetings, San Francisco, CA.
Cap, Bernadette, Meaghan Peuramaki-Brown, and Jason Yaeger

Capote, Marta, Susana Consuegra, Pedra Diaz del Rio, and Xavier Terradas, ed.

Carballo, David M.


2005 *State Political Authority and Obsidian Craft Production at the Moon Pyramid, Teotihuacan, Mexico.* Unpublished PhD dissertation UCLA. UMI, Ann Arbor.

Carr, Christopher.

Carr, Philip J.


Carr, Philip J. and Andrew P. Bradbury

Carr, Philip J. and Brad Koldehoff

Carr, Philip J., Andrew P. Bradbury, and Sarah E. Price

Carrasco Vargas, Ramon, Veronica A. Vazquez Lopez, and Simon Martin

Chapman, Thomas J.

Chapman, Thomas, Catherine Sword and M. Kathryn Brown

Charlton, Thomas H.


Charlton, Thomas H. and Deborah L. Nicholas

Charlton, Thomas H. and Michael W. Spence
Chase, Arlen F.

Chase, Arlen F. and Diane Z. Chase


Chase, Arlene F. and James F. Garber

Chase, Arlen F. Diane Z. Chase, Jaime J. Awe, John F. Weishampel, Gyles Iannone, Holley Moyes, Jason Yaeger, Kathryn Brown, Ramesh L. Shrestha, William E. Carter, and Juan Fernandez Diaz

Chase, Diane Z.

Chase, Diane Z. and Arlen F. Chase (eds.)

Chase, Diane Z. and Arlen F. Chase

Cheal, David

Chiarulli, Beverly A.

Childe, V. Gordon

Chinchilla Mazariegos, Oswaldo

Christie, Jessica Joyce (ed.)

Church, M. C.

Ciudad Ruiz, Andrés

Ciudad Ruiz, Andrés, María Josefa Iglesias Ponce de León, Jesús Adánez Pavón, Alfonso Lacadena y Jorge E. Chocón
2003 La entidad política de Machaquila, Poptún, en el Clásico Tardío y Terminal: Informe de la temporada 2003.

Clark, John E.


1979  A Specialized Obsidian Quarry at Otumba, Mexico; Implications for the Study of Mesoamerican Obsidian Technology and Trade. Lithic Technology 8(3): 46-49.

1978  Contemporary Obsidian Use at Pachuca, Hidalgo, Mexico. Lithic Technology 7(3): 44.

Clark, John E. and Douglas Donne Bryant

Clark, John E. and Arlene Coleman

Clark, John E. and William J. Parry

Clark, John E. and James C. Woods

Clarkson, Chris.
2013 Measuring Core Reduction using 3D Flake Scar Density: A Test Case of Changing Core Reduction at Klasies River Mouth, South Africa. *Journal of Archaeological Science* 40: 4348-4357.


Close, Angela, E.
2006 *Finding the People who Flaked the Stone at English Camp (San Juan Island).* University of Utah Press, Salt Lake City.

Cobb, Charles C.


Cobean, Robert H.
2002 *Un mundo de obsidiana: minería y comercio de un vidrio volcánico en le México antiguo.* Instituto Nacional de Antropología e Historia, Mexico.
Cobos, Rafael and Terance L. Winemiller  

Collins, Michael B. and Jason M. Fenwick  

Conlon, James M. and Terry G. Powis  

Connell, Samuel V.  

2000  *Were they Well Connected? An Exploration of Ancient Maya Regional Integration from the Middle Level Perspective of Chaa Creek, Belize*. Unpublished PhD dissertation, University of California Los Angeles.

Cook, Duncan E., Brigitte Kovacevich, Timothy Beach, and Ronald Bishop  

Cooney, Gabriel  


Cooper, H. Kory  

Cornec, Jean H.  
2004  Geology Map of Belize.
Coronel, Eric G., Scott Hutson, Aline Magnoni, Chris Balzotti, Austin Ulmer, Richard E. Terry

Cortes, Hernan

Cortes-Rincon, Marisol, Sarah Boudreaux, and Erik Marinkovich

Costin, Cathy L.


Costin, Cathy L. and Melissa B. Hagstrum
1995 Standardization, Labor Investment, Skill and the Organization of Ceramic Production in Late Prehispanic Highland Peru. *American Antiquity* 60(4): 619-639

Cotteral, Brian and Johan Kamminga
Cowan, Frank L.  
*American Antiquity* 64(4): 593-607.

Cowgill, George L.  

Crabtree, Don E.  

Crabtree, Don and B. Robert Butler  
*Tebiwa* 7(1):1-16.

Cutright, Roybn E.  

D'Altroy, Terrance N. and Timothy K. Earle  

Dahlin, Bruce H.  
2009  Ahead of its time: the remarkable Early Classic Maya Economy of Chunchucmil.  


Dahlin, Bruce H. and Traci Ardren  

Dahlin, Bruce H., Marjukka Bastamow, Timothy Beach, Zachary X. Hruby, Scott R. Hutson, and Daniel Mazeau  


Daras, Veronique 1999 *Tecnologicas prehispanicas de la obsidiana: Los centros de produccion de la region de zinaparo-Prieto, Michoacan*. Centre Francais de etudes mexicaines et centroamericanes, Mexico.


de Lucia, Kristin

de Montmollin, Olivier


Deal, Michael
1998 *Pottery Ethnoarchaeology in the Central Maya Highlands*. University of Utah Press, Salt Lake City.


Deal, Michael and Brian Hayden

Degryse, Patrick, Ebru Torun, Markku Corremans, Tom Heldal, Elizabeth G. Bloxam, and Marc Waelkens

Delage, Christophe, ed.

Delage, Christophe

Delagnes, Anne
Delu, Antonia M.

Delvendahl, Kai
2010 Las sedes del poder: Evidencia arqueologica e iconografica de los conjuntos palaciegos. Mayas del clasico tardio. Universidad autonoma de yucatan, Merida.

Demarest, Arthur A.


Demarest, Arthur A., Chloé Andrieu, Paola Torres, Mélanie Forné, Tomás Barrientos and Marc Wolf

Devio, Jessica

Diaz del Castillo, Bernal

Dibble, Harold L.


Dibble, Harold L, Utsav A. Schurmsn, Radu P. Iovita, and Michael V. McLaughlin

Dillehay, Tom D.

Dixon, C. G.
1956 Geology of Southern British Honduras with Notes on Adjacent Areas. Printed by the Authority of his Excellency the Governor. Belize.

Dobosi, Viola T.

Dockall, John E.
1994 Oval Biface Celt Variability During the Maya Late Preclassic. Lithic Technology 19(1): 52-68.

Dockall, John E. and Harry J. Shafer

Doelman, Trudy


Doelman, Trudy, Robin Torrence, Nikolay Kluyev, Igor Sleptsov, and Vladimir Popov

Dolores Soto de Arechalaleta, Dolores
Dorsey, George A.  

Douglass, Matthew J.  

Douglass, Matthew J., Simon J. Holdaway, Patricia C. Fanning, and Justin I. Shiner  

Doyle, James A.  

Dowling, Patrick J.  

Drake, Eric, Charles R. Cobb, and Brian M. Butler  

Driver, W. David and James F. Garber  

Druart, Chloe  

Duff, A. I.  

Dunnell, Robert C. and Julie K. Stein  
Dunning, Nicholas

Duran, Diego

Dye, David H.


Earle, Timothy K. and Jonathon E. Ericson (eds.)

Earle, Timothy K.


Eaton, Jack D.

Eekhout, Peter  

Eerkens, Jelmer W., Kevin J. Vaughn, Moises Linares-Grados, Christina A. Conlee, Katharina Schreiber, Michael D. Glascock, Nicholas Tripcevich.  

Ek, Jerald D.  

Elson, Christina M.  

Emerson, Thomas E., Kenneth B. Farnsworth, Sarah U. Wisseman, and Randall E. Hughes  

Emery, Kitty F. and Kazuo Aoyama  

Emery, Kitty F. and Antonia E. Foias  

Eppich, Keith and David Freidel  

Ericson, Jonathan E.  

Ericson, Jonathon E. and Timothy K. Earle  
Ericson, Jonathan E. and Barbara A. Purdy, eds.

Erikson, Berit Valentin

Escobedo, Héctor L.

Evans, Susan Toby


Evans, Susan Toby and Joanne Pillsbury (eds.)

Farrell, Pat, Timothy Beach, Bruce Dahlin

Faulkner, Patrick

Fedick, Scott
Feinman, Gary M.

Feinman, Gary, Richard Blanton and Stephen Waleushi

Feinman, Gary M. and Christopher P. Garraty

Feinman, Gary M. and Linda M. Nicholas (eds.)

Feldman, Lawrence H.

Ferring, C. Reid

Ferris, Jennifer M. and William Andrefsky Jr.

Findlow, Frank J. and Marisa Bolognese

Flad, Rowan K. and Zachary X. Hruby
Fladmark, K. R.

Flenniken, J. Jeffery

Flenniken, J. Jeffrey and Ervan G. Garrison

Flenniken, J. Jeffery and Kenneth G. Hirth

Flexner, James L. and Colleen L. Morgan

Flores, Giovanni

Flores, Rosa María

Foias, Antonia E.


Foias, Antonia E. and Ronald L. Bishop

Foias, Antonia E. and Kitty F. Emery

Foias, Antonia, Christina T. Halperin, Ellen Spensley Moriarty, and Jeanette Castellanos

Folan, William J.

Ford, Anabel


Ford, Anabel and Kirsten Olson

Ford, Anabel, Fred Stross, Frank Asaro, and Helen V. Michel.

Fowler, William R., Jr.


Fox, John W, Dwight T. Wallace, and Kenneth C. Brown

Franklin, Jay D., Maureen A. Hays, Sarah C. Sherwood, and Lucinda M. Langston

Freidel, David A.
1979 Culture Areas and Interaction Spheres: Contrasting Approaches to the Emergence of Civilization in the Maya Lowlands. American Antiquity 44: 36-54.

Freidel, David A., Marilyn A. Masson, and Michelle Rich

Freidel, David A., Kathryn Reese-Taylor, and David Mora-Marín
Freidel, David A. and Jeremy A. Sabloff
1984 *Cozumel: Late Maya Settlement Patterns*. Academic Press, Orlando.

Frieman, Catherine

Frison, George C.

Fry, Robert E.


Fry, Robert E. and Scott C. Cox

Furley, Peter A.

Furley, P. A. and A. J. Crosbie

Galup, Sheila M.

Garber, James F. (ed.)
Garber, James F., M. Kathryn Brown, Jaime J. Awe, and Christopher H. Hartman
2004a Middle Formative Prehistory of the Central Belize Valley: An Examination of
Architecture, Material Culture, and Sociopolitical Change at Blackman Eddy. In
_Ancient Maya of the Belize Valley: Half a Century of Archaeological Research._

Garber, James F., M. Kathryn Brown, Christopher J. Hart, F. Kent Reilly III, and Lauren
A. Sullivan
2004b Archaeological Investigations at Blackman Eddy. In _Ancient Maya of the Belize

Garcia-Barcena, Joaquin
1974 Las Minas de obsidiana de la sierra de las navajas, hidalgo, Mexico. _Actas del XLI
Congreso Internacional de Americanistas._ Volumen 1. 369-377.

Garraty, Christopher P.

2009 Evaluating the Distributional Approach to Inferring Marketplace Exchange: A
Test Case from the Mexican Gulf Lowlands. _Latin American Antiquity_ 20(1):
157-174.

Garraty, Christopher P. and Barbara L. Stark (eds.)
2010 _Archaeological Approaches to Market Exchange in Ancient Societies._ University
Press of Colorado, Boulder.

Gaxiola Gonzalez, Margarita
2005 Rancho la Canada: Una unidad de producción de instrumentos de obsidiana en
Huapalcalco, Hidalgo. In _Reflexiones sobre la industria líti ca._ Leticia Gonzalez
Arratia and Lorena Mirambell, eds., pp 181-203. INAH Colección científica, Mexico.

Gaxiola G., Margarita and Jorge Guevara H.
1989 Un conjunto habitacional en Huapalcalco, Hidalgo, especializado en la talla de
obsidiana. In _La obsidiana en Mesoamérica._ Margarita Gaxiola G. and John E.
Clark, eds., pp 227-242. Instituto nacional de arqueología e historia, Mexico.

Gaxiola G., Margarita and John E. Clark, eds.
1989 _La obsidiana en Mesoamérica._ Instituto nacional de arqueología e historia,
Mexico.
Gaxiola Gonzalez, Margarita and Fred Nelson

Gibson, Eric C.

Gifford, James C.


Glascock, Michael D.

Goldstein, Paul S.


Golitko, Mark and Gary M. Feinman

Gonzalez Cruz, Arnoldo and Martha Cuevas Garcia
1998 *Canto versus canto: manufactura de artefactos líticos en Chiapa de Corzo, Chiapas*. Colección Científica, INAH, San Cristóbal de las Casas

Goodyear, Albert C. and Tommy Charles
http://scholarcommons.sc.edu/archanth_books/187
Gould, Richard A.

Graeber, David.
2011 Debt: The First 5,000 Years. Melville House, Brooklyn.


Graham, Elizabeth


Gramly, R.M.


Grimaldi, Stephano and Christina Lemorini

Guderjan, Thomas H.

Gyarmati, Janos
Hagstrum, Melissa B.

Haley, Bryan, Bernadette Cap, and Jason Yaeger

Hall, Christopher T. and Mary Lou Larson (eds.)
2004 *Aggregate Analysis in Chipped Stone*. The University of Utah Press, Salt Lake City.

Halperin, Christina T.

Halperin, Christina T. and Antonia E. Foias

Halperin, Rhoda H.

Hammond, Norman

Hammond, Norman, Arnold Aspinall, Stuart Feather, John Hazelden, Trevor Gazard, and Stuart Agnell

Hare, Timothy S.
Hare, Timothy S., Masson, Marilyn A.,
2010 Pottery Assemblage Variation at Mayapán Residences. Society for American Archaeology Meetings, St. Louis, April 15.

Harrell, James A. and Per Stonemyr

Harrison, Peter D. and E. Wyllys Andrews

Hatch, James W. and Patricia E. Miller

Hauk, Richard

Haviland, William A.

Haviland, William A. and Hattula Moholy-Nagy

Hay, Conran A.

Hayden, Brian and Aubrey Cannon

Hayden, Brian and Michael Deal
Healan, Dan


1997 Pre Hispanic Quarrying in the Ucareo-Zinapecuaro Obsidian Source Area. *Ancient Mesoamerica* 8: 77-100.


Healy, Paul R., Kitty Emery, and Lori E. Wright

Healy, Paul F., Bobbi Hohmann, and Terry G. Powis

Hearth, Nicholas F.

Hearth, Nicholas F. and Scott L. Fedick

Hegman, Jon B. and Jon C. Lohse

Heindel, Theresa
2010 *A Lithic Deposit found in the East Plaza of the Late Classic Maya site of Buenavista, Belize and its effect on Stone Tool Production in Ancient Maya Marketplaces*. Unpublished Senior Thesis, University of Wisconsin, Madison.

Heindel, Theresa, Bernadette Cap, and Jason Yaeger

Heldal, Tom

Helmke, Christophe and Jaime Awe

Helms, Mary W.
1993  *Craft and the Kingly Ideal: Art, Trade, and Power*. University of Texas, Austin.

Hendon, Julia A.

Henry, Donald
1995  The Influence of Mobility Levels on Levallois Point Production, Late Levantine Mousterian. In *The Definition and Interpretation of Levallois Technology*. Harold
Hernandez Xoloctzi, Efraiim

Hester, Thomas R.


Hester, Thomas R., ed.

Hester, Thomas R. and Harry J. Shafer


Hester, Thomas R., Jack D. Eaton, and Harry J. Shafer, eds.

Hintzman, Marc W.
Hirth, Kenneth G.


Hirth, Kenneth G., ed.


Hirth, Kenneth G. and Bradford Andrews, eds.

Hirth, Kenneth G., Bradford Andrews, J. Jeffery Flenniken

Hirth, Kenneth and J. Jeffery Flenniken
2002 Core Blade Technology in Mesoamerican Prehistory. In Pathways to Prismatic Blades: A Study in Mesoamerican Obsidian Core Blade Technology. Kenneth

Hirth, Kenneth G. and Joanne Pillsbury

Hiscock, Peter

Hiscock, Peter and Val Attenbrow.

Holdaway, Simon, Matthew Douglass, and Rebecca Phillips

Holmes, William H.


Horowitz, Rachel A.
2014 Ongoing Investigations at Callar Creek Quarry. In Mopan Valley Archaeological Project: Results of the 2013 Season, Jason Yaeger, ed. Manuscript on file with the Belize Institute of Archaeology, Belmopan, Belize.


Horowitz, Rachel A. and Grant S. McCall

Horowitz, Rachel A., Bernadette Cap, Mark C. Eli, and Jason Yaeger

Houk, Brett A.

Houk, Brett A. and Gregory Zaro

Hruby, Zachary X.

Hull, Kathleen L.

Hutson, Scott


Inomata, Takeshi and Stephen D. Houston (eds.)


Inomata, Takeshi and Laura R. Stiver

Inomata, Takeshi and Daniela Triadan

Inomata, Takeshi, Daniela Triadan, Erick Ponciano, Estela Pinto, Richard E. Terry, Markus Eberl

Iovita, Radu and Shannon McPherron

Isaza Aizparua, Ilean Isel

Ives, David J.

1975 *The Crescent Hills Prehistoric Quarrying Area.* Museum Brief No. 22 University of Mississippi, Cambridge.
Jackson, Sarah E.  
2013  *Politics of the Maya Court: Hierarchy and Change in the Late Classic Period.* University of Oklahoma Press, Norman.

James, Charles D. III  

Jamison, T. R.  

Janusek, John W.  

Jelinek, Arthur J.  

Jelinek, Arthur J.  

Jenney, W. P.  

Jennings, Justin, Felix Palacios, Nicholas Tripcevich, and Willy Yepez Alvarez  

Jeske, Robert J. and Katherine M. Sterner-Miller  
2015  Microwear Analysis of Bipolar Tools from the Crescent Bay hunt Club Site. *Lithic Technology*
Johnson, Jay K.


1981 *Yellow Creek Archaeological Project* Volume 2. Tennessee Valley Authority Publications in Anthropology Number 28.


Jones, Christopher


Jones, George T., Lisa M. Fontes, Rachel A. Horowitz, Charlotte Beck, and David G. Bailey


Joyce, Rosemary A., Julia A. Hendon, and Jeanne Lopiparo

Justice, Noel D.


Kamp, Kathryn A., John Whittaker, Rafael Guerra, Kimberly McLean, Peter Brands, Jose V. Guerra Awe

Kaneko, Akira
2003  *Artefacts Liticos de Yaxchilan.* Colección Científica, Serie Arqueología Instituto Nacional de Antropología e historia.

Karlin, C. and M. Julien

Karimali, Evangelia

Keatinge, Richard W. and Kent C. Day

Keeley, Lawrence H.

Kelany, Adel, Mohamed Negem, Adel Tohami, and Tom Heldal
Keller, Angela H.


Kelly, John E.


Kelly, Robert L.

Kelly, Robert L. and Todd, L.

Kelsay, Richalene G.
1985 A Late Classic Lithic Finishing Station at Buenavista Belize Paper Presented at the 50th Annual Meeting of the Society for American Archaeology, Denver.

Kerley, Janet M.
Kestle, Caleb

2008 Limestone Quarrying and Household Organization at Chan, Belize. Paper Presented at the 2008 Society for American Archaeology Meetings, Vancouver, CA.

Kidder, A.V.


Kidder, A.V., Jesse D. Jennings, Edwin M. Shook

King, Adam and Jennifer A. Freer

King, Eleanor M.


King, Eleanor and Leslie Shaw


Knudson, Kelly J.

Koetje, Todd and Linda T. Grimm

Kolata, Alan L.

Koldehoff, Brad

Kopytoff, Igor

Kovacevich, Brigitte


Kovacevich, Brigitte, Tomás Barrientos, Arthur Demarest, Michael Callaghan, Cassandra Bill, Erin Sears y Lucía Morán

Kovacevich, Brigitte and Michael G. Callaghan

Kuhn, Steven L.


Kurjack, Edward B.

Kurnick, Sarah J.

Kurnik, Sarah and Sebastian Salgado-Flores

Kwoka, Joshua J.

Kyle, Carolyn E.

Lamb, Lara

Laporte, Juan Pedro, Heidy Quezada, Jennifer Braswell y María Elena Ruiz Aguilar


Larson, Mary Lou

Latchford, Carl
Law, Wallace Boone


Lawton, Corey

LeCount, Lisa J.


LeCount, Lisa J. and Jason Yaeger (eds.)

LeCount, Lisa J. and Jason Yaeger

LeCount, Lisa J., Jason Yaeger, Richard M. Leventhal, and Wendy Ashmore

Lee, Thomas A.

Lentz, David, Sally Woods, Angela Hood, and Marcus Murph

Lesure, R.

Lerner, Harry J.

Leventhal, Richard M, Wendy Ashmore, Lisa J. LeCount, and Jason Yaeger

Leventhal, R. M. and W. Ashmore

Levine, Marc N. and David M. Carballo (eds.)

Levine, Marc N.
Lewenstein, Suzanne M.


Lewis, Brandon S.

Lin, Sam C. H. Matthew J. Douglass, Simon J. Holdaway, Bruce Floyd

Lin, Sam C., Cornel M. Pop, Harold L. Dibble, Will Archer, Dawit Desta, Marcel Weiss, and Shannon P. McPherron

Lohse, Jon C.


Lohse, Jon C. Jaime Awe, Cameron Griffith, Robert M. Rosenswig, Fred Valdez Jr.
Lohse, Jon C. and Nancy Gonlin

Lohse, Jon C. and Fred Valdez, Jr.

Lohse, Jon C. and Fred Valdez, Jr., (eds.)
2004 Ancient Maya Commoners. University of Texas Press, Austin.

Lollet, Helene, Anne Hauzeur, Jacek Lech

Lopez Aguilar, Fernando, Rosalba Nieto Calleja, Robert H. Cobean

Lopez Aguilar, Fernando and Rosalba nieto Callejo

López Olivares, Nora María

Lothrop, Jonathan C.

Lucero, Lisa J.

Luedtke, Barbara E.
Lurie, Rochelle

Mackey, Carol J. and A. M. Ulana Klymushun

Mackie, Euan W.

Maler, Teobert

Mallory, John K.

Manahan, T. Kam, Traci Ardren, and Alejandra Alonso Olvera

Mandeville, M. D.

Mandeville, M. D. and J. Jeffrey Flenniken

Mandujano Alvarez, Carlos and Sandra Elizalde Rodarte
Mann, Michael

Mannine, Mikael A. and Kjel Knutsson

Manzanilla, Linda R.

Manzanilla, Linda and Luis Barba

Marceaux, Shawn and David H. Dye

Marcus, Joyce


Marks, Anthony E. and Kathryn Monigal
1995 Modeling the Production of Elongated Blanks from the Early Levantine Mousterian at Rosh Ein Mor. In The Definition and Interpretation of Levallois

Marks, Anthony E., Jeff Shokler, and Joao Zilhao

Martin, Simon


Martin, Simon and Nikolai Grube

Marwick, Ben
2008 What Attributes are Important for the measurement of Assemblage Reduction Intensity? Results from an Experimental Stone Artefact Assemblage with Relevance to the Hoabinhian of mainland Southeast Asia. Journal of Archaeological Science 34: 1189-1200.

Marwick, Ben and Alex Makcay, eds.

Masson, Marilyn A.


Masson, Marilyn A. and David A. Freidel
Masson, Marilyn A. and David A. Freidel (eds.)
2002 Ancient Maya Political Economies. AltaMira Press, Walnut Creek.

Masson, Marilyn A. and Carlos Peraza Lope

Masson, Marilyn A., Peraza Lope, C. Hare, T.S.,


Mayer, Enrique


McAnany, Patricia A.


McDonald, Mary M. A.  

McEnroe, John  
2010  *Architecture of Minoan Crete: Constructing Identity in the Aegean Bronze Age*. University of Texas Press, Austin.

McGovern, James O.  

McKillop, Heather  

2005  In *Search of Maya Sea Traders*. Texas A and M. University Press, College Station.


1991  *Wild Cane Cay: An Insular Classic Period to Postclassic Period Maya Trading Station*. University of California Santa Barbara, University Microfilm International, Ann Arbor.

McPherron, Shannon P.  


McSwain, Rebecca  
Meadows, Richard K.


Mehrer, Mark W.

Mejía, Héctor E.


Mejía, Héctor E., Lilian A. Corzo y Marco Antonio Urbina

Meierhoff, James, Mark Golitko, and James D. Morris

Melcher, C. L. and D. W. Zimmerman

Mercer, H. C.

Meyers, Mauren S.
Michaels, George H.  


Michaels, Joseph W.  
1989  La composición de elementos mayores contra la composición de elementos traza den la reconstrucción de sistemas de yacimientos de obsidiana. In *La obsidiana en Mesoamerica.* Margarita Gaxiola G. and John E. Clark, eds., pp 40-49. Instituto nacional de arqueología e historia, Mexico.


Miller, David  

Miller, Mary  

Minc, Leah D.  


Mitchell, Douglas R. and Michael S. Foster  

Mitchell, Peter J.  
Mitchum, Beverly

Moholy-Nagy, Hattula


Monoghan, William G., Daniel R Hayes, S. I. Dworkin and Eric Voigt

Montet-White, Anta

Moore, Jerry D.


Morehart, Christopher T. and Kristin De Lucia
Moriarty, Matthew D.  

Morris, Craig  

Morris, Craig, R. Alan Covey, and Pat Stein  

Morris, Craig and Donald E. Thompson  

Morrow, Toby A.  

Morse, Dan F. and Phyllis A. Morse  


Moseley, Michael E.  

Muller, Jon  


Murakami, Tatsuya


Murata, Satoru

Murra, John V.


Murra, John V. and Craig Morris

Nelson, Fred W.

Nelson, Margaret C.

Nelson, Zachary N.
2000 *Analysis of an Obsidian Workshop at Hacienda Metepec, Teotihuacan, Mexico, AD 700-800.* MA. Thesis, Bingham Young University.
Neivens, Mary and David Libbey

Netting, Robert McC., Richard R. Wilk, and Eric J. Arnold (eds.)

Newlander, Khori S.

Nielsen, A. E.,

Odell, George H.


Ogburn, Dennis E.


Ohnuma, Katsuhiko

Oland, Maxine
Ortiz, Sutti (ed.)

Paling, Jason S. R.

Palka, Joel W.


Papadopoulos, J. K. and G. Urton

Paris, Elizabeth H.

Parker, Bradley J. and Jason R. Kennedy

Parry, William J.

2001 *Production and Exchange of Obsidian tools in Late Aztec City States.* *Ancient Mesoamerica* 12: 101-111.

Parry, William J. and Robert L. Kelly  

Pastrana, Alejandro  

1998  *La explotación Azteca de la obsidiana en la Sierra de las Navajas*. Colección Científica. INAH, Mexico.

Pastrana, Alejandro and Silvia Dominguez  

Pastrana, Alejandro, Silvia Dominguez, and Osvaldo Sterpone  

Pastrana, Alejandro and Kenneth G. Hirth  

Paton, Robert  

Patterson, Thomas C.  

Patton, Mark  
Pauketat, Timothy R.

Peacock, David and Valerie Maxfield

Pearson, George A.

Pendergast, David

Peregrine, Peter N.

Peuromaki-Brown, Meaghan M.


Perles, Catherine

Petraglia, Michael, Philip La Porta and K Paddayya

Phillips, W. A.
Pillsbury, Joanne and Banks L. Leonard

Plattner, Stuart (ed.)

Plattner, Stuart


Plunket, Patricia, and Gabriela Uruñuela


Plunket, Patricia, Gabriela Uruñuela, Michael Glascock, and Hector Neff

Pohl, Mary Deland

Polanyi, Karl


Potter, Daniel R.
Powis, Terry G.

Puleston, D. E.

Purdy, Barbara A.


Purdy, Barbara A. and H. K. Brooks

Quezada, Heidy

Quezada, Heidy, Jorge E. Chocón, Mario Vásquez y Juan Pedro Laporte

Raczek, Teresa P.

Railey, Jim A. and Eric J. Gonzalez
Ramos, Carmen E., Julio A. Roldán, José Samuel Suasnávar y Juan Pedro Laporte

Rathje, William L.


Rathje, William L. and Jeremy A. Sabloff

Rattray, Evelyn

Reith, Joseph C.

Reents-Budet, Dorie


Reents-Budet, Dorie, Ronald L. Bishop, Jennifer T. Taschek, and Joseph W. Ball
Reents-Budet, Dorie, Ronald L. Bishop, and Barbara Macleod

Reina, E. Ruben and Robert M. Hill II

Renfrew, Colin

Rice, Prudence M.


Richards, Colin, Karina Croucher, Tike Paoa, Tamsin Parish, Enrique Tucki M. and Kate Welham

Rick, John W.

Ricketson, Edith Balyes

Robin, Cynthia (ed.)

Robin, Cynthia


Robin, Cynthia, Andrew Wyatt, James Meierhoff, and Caleb Kestle

Robin, Cynthia, James Meierhoff, Caleb Kestle, Chelsea Blackmore, Laura J. Kosakowsky, and Anna C. Novotny

Robin, Cynthia, James Meierhoff, and Laura J. Kosakowsky

Robin, Cynthia, Jason Yaeger, and Wendy Ashmore

Robin, Cynthia, Laura Kosakowsky, Angela Keller, and James Meierhoff

Robins, Gay

Rochette, Erick T.

Roddick, Andrew and Elizabeth Klarich

Roemer, Erwin

Romney, D. H., ed.

Root, Matthew J.


Rosen, Arlene M.

Rosen, Steven A.

Rosenswig, Robert M.

Rosenswig, Robert M., Deborah M. Pearsall, Marilyn A. Masson, Brendon J. Culleton, and Douglas J. Kennett

Rovner, Irwin

Rovner, Irwin and Suzanne M. Lewenstein
1997  Maya Stone tools of Dzibichaltun, Yucatan and Becan and Chicanna, Campeche. Middle American Research Institute Publication 65 Tulane University, New Orleans.

Sabloff, Jeremy A.


Sabloff, Jeremy A. and William L. Rathje

Sabloff, J. A. and R. E. Smith

Sahlins, Marshall

Sahagun, Bernardino de

Salazar, Diego, Cesar Borie, and Camilia Onate

Salomon, Frank

Santley, Robert S.


Santley, Robert S. Janet M. Kerley and Thomas P. Barnett


Santeford, Laurence Ghu.


Santone, Leonore


Sassaman, Kenneth E.

1994   Changing Strategies of Biface Production in the south Carolina Coastal Plain. In *The Organization of North American Prehistoric Chipped Stone Tool*

Saunders, Nicholas J.

Scarborough, Vernon L. and John E. Clark (eds.)

Scarborough, Vernon L. and Fred Valdez, Jr.


Scarre, Chris

Schlanger, Nathan

Schortman, Edward M. and Patricia A. Urban
Schroeder, R.

Schultze, Carol A.

Sellet, Frederic.


Semenov, S. A.

Shackley, Steven M.

Shafer, Harry J.


Shafer, Harry J. and Thomas R. Hester

Shafer, Byron E.


Sharer, Robert J. and Loa P. Traxler


Shaw, Leslie C.


Shaw, Leslie C. and Eleanor M. King


Sheets, Payson D.


Sheets, Payson, Christine Dixon, David Lentz, Rachel Egan, Alexandria Halmbacher, Venicia Slotten, Rocío Herrera, and Celine Lamb


Sheets, Payson D. and Guy R. Muto


Sheets, Payson and Scott Simmons


Sherrat, A. and S. Sherrat


Shimada, Izumi


Shott, Michael J.


Shott, Michael J. and Margaret C. Nelson.


Shott, Michael J. and Eric C. Olsen

2015  Scale of Production at Prehistoric Quarries: A Pilot Study in Extending the 'Analytical Core Unit' Concept. *Lithic Technology*

Shott, Michael J. and Kathryn J. Weedman


Shults, Sara C.

Sidrys, Raymond

Sidrys, R., J. Andersen, and D. Marcucci

Siegel, Peter E. and Peter G. Roe

Sieveking, G. de G. and M. H. Newcomber, ed.

Sievert, April K.

Silver, Morris

Singer, C. A.

Sinopoli, Carla M.

Smallwood, Ashley M. and Albert C. Goodyear
2009  Reworked Clovis Biface Distal Fragments from the Topper Site, 38AL23: Implications for Clovis Technological Organization in the Central Savannah River Region. *CRP* 26: 118-120.

Smith, Adam
Smith, A. Ledyard and A. V. Kidder

Smith, Michael E.


Smyth, Michael P.


Soffer, Olga

Solberger, J. B. and Thomas R. Hester

Soles, Jeffery S.

Sorensen, Lasse

Speal, C. Scott


Spence, Michael W.


Spence, Michael W, J. Kimberlin, and G. Harbottle.

Spence, Michael W. and Jeffery Parsons

Spielmann, Katherine A.

Stadel, Christoph
Stanier, Peter

Stanish, Charles


Stanish, Charles, Edmundo de la Vega, Michael Moseley, Patrick Ryan Williams, Cecilia Chávez J., Benjamin Vining, Karl LaFavre

Stark, Barbara L. and Christopher P. Garraty

Stark, Barbara L. and Alanna Ossa

Stein, Gil J.

Stemp, W. James and Jaime Awe

Stemp, W. James, Jaime J. Awe, and Christophe G. B. Helmke
Stemp, W. James, Jaime J. Awe, Keith M. Prufer, and Christophe G. B. Helmke

Stemp, W. James, Christophe Helmke, and Jaime Awe

Stemp, W. James, Gabriel D. Wrobel, Jaime J. Awe, and Kelly Payeur

Stemp, W. James, Gabriel D. Wrobel, Jessica Haley, and Jaime J. Awe

Stocker, T. L. and R. H. Cobean

Stockton, Trent C.

Stoltman, James B.
1978 *Lithic Artifacts from a Complex Society: The Chipped Stone Tools of Becan, Campeche, Mexico*. Occasional Papers Number 2, Middle American Research Institute, Tulane University, New Orleans.

Stoltman, James B., Jeffery A. Behm, Harris A. Palmer

Stone, Andrea and Marc Zender

Storemyr, Per, Elizabeth Bloxam, Tom Heldal, and Adel Kelany
Storey, G. R.

Straight, Kirk D.


Straus, Lawrence G.

Sullivan, Alan P. III and Kenneth C. Rozen

Sullivan, Kristin S.

2006 Specialized Production of San Martin Orange Ware at Teotihuacan, Mexico. Latin American Antiquity 17(1): 23-53.

Sunahara, Kay Sachiko

Suyuc Ley, Edgar

Tacon, Paul S. C.
2004 Ochre, Clay, Stone, and Art: The Symbolic Importance of Minerals as Life-Force among Aboriginal People of North and Central Australia. In The Cultural

Taschek, Jennifer T. and Joseph W. Ball


1986 Guerra: A Late Classic Suburban Paraje of Buenavista del Cayo, Belize. Paper Presented at the 51st Meeting of the Society for American Archaeology Meeting, New Orleans, LA.

Taube, Karl A.

Taube, Karl A., Zachary X. Hruby, and Luis A. Romero

Teather, Anne

Teltser, Patrice A.

Terry, Richard E., Daniel A. Blair, and Eric G. Coronel

Thacker, Paul T., Joel Hardison, and Carolyn Conklin
Thompson, Marc

Titmus, Gene L. and James C. Woods

Topic, John R.


Topping, Peter


Topping, Peter and Mark Lynott

Torrence, R.


Torres, Carlos Rolando y Juan Pedro Laporte

Tourtellot, Gair, Francisco Estrada Belli, John J. Rose and Normand Hammond

Tourtellot, Gair, Jeremy A. Sabloff, and Kelli Carmean

Towner, Ronald H.

Tozzer, Alfred M.

Trachman, Rissa M.

Traxler, Loa P.

Triadan, Daniela
Tripcevich, Nicholas

Tripcevich, Nicholas and Daniel A. Contreras

2011 Quarrying Evidence at the Quispisisa Obsidian Source, Ayacucho, Peru. Latin American Antiquity 22(1); 121-136.

Tripcevich, Nicholas and Kevin J. Vaughn, eds.

Turnbaugh, W. A., S. P. Turbaugh, and T. H. Keifer

Urbana, Marco Antonio

Urban, Patricia A., Edward M. Schortman, and Marne T. Ausec

Uzendoski, Michael A.

Valdez, Fred Jr.

and John E. Clark, eds., pp 81-88. Instituto nacional de arqueologia e historia, Mexico.

Van Buren, Mary

Van der Leeuw, S. E.

van Gijn, Annelou

Van Peer, Philip

VandenBosch, Jon C.

VandenBosch, Jon C., Lisa J. LeCount, and Jason Yaeger

Vaughn, Kevin J., Hendrick van Gijseghem, Verity H. Whalen, Jelmer Eerkens, and Moises Linares Grados

Vehik, Susan C., ed.
Vogt, James R., Christopher C. Graham, Michael D. Glascock, and Robert H. Cobean
1989 Determinación de elementos traza de yacimientos de obsidiana en Mesoamérica
por análisis de activación neutrórica. In La obsidiana en Mesoamérica. Margarita
Gaxiola G. and John E. Clark, eds., pp 27-37. Instituto nacional de arqueología e
historia, Mexico.

Voorhies, Barbara (ed.)
1989 Ancient Trade and Tribute: Economies of the Soconusco Region of Mesoamerica.
University of Utah Press, Salt Lake City.

Wailes, Bernard
1996 V. Gordon Childe and the Relations of Production. Craft Specialization and Social
University Museum Monograph Number 93. The University Museum of
Archaeology and Anthropology, University of Pennsylvania, Philadelphia.

Waltars, Gary Rex
Margarita Gaxiola G. and John E. Clark, eds., pp 253-262. Instituto nacional de
arqueología e historia, Mexico.

Ward, Drew T.
2013 Investigations of a Ground Stone Tool Workshop at Pacbitun, Belize.

Watts, Joshua and Alanna Ossa
2016 Exchange Network Topologies and Agent Based Modeling: Economies of the

Weber, Max
Malden.

Webster, David
2001 Spatial Dimensions of Maya Courtly Life; Problems and Issues. In Royal Courts
of the Ancient Maya Volume 1: Theory, Comparison, and Synthesis, Takeshi

Archaeological Assessment. Diane Z. Chase and Arlen F. Chase, eds., pp 135-
156. University of Oklahoma, Norman.

Webster, David, Nancy Gonlin, and Payson Sheets
1997 Copan and Ceren: Two Perspectives on Ancient Mesoamerican Households.
Ancient Mesoamerica 8: 43-61.
Webster, David and Takeshi Inomata

Weedman, Kathryn J.


Weeks, John M.

Weigand, Phil C.

Weigand, Phil C. and Michael W. Spence
1989 The Obsidian Mining Complex at La Joya, Jalisco. In *La obsidiana en Mesoamerica*. Margarita Gaxiola G. and John E. Clark, eds., pp 205-211. Instituto nacional de arqueologia e historia, Mexico.

1982 The Obsidian Mining Complex at La Joya, Jalisco. In *Mining and Mining Technology in Ancient Mesoamerica: Special Issue of Anthropology* 6(1 and 2): 175-188. Phil C. Weigand and Gretchen Gwynne, eds.

Weisberber, G.

Wells, E. Christian

Wells, E. Christian and Karla L. Davis-Salazar


Wells, E. Christian and Patricia A. McAnany (eds.)


Wiessner, Polly


Whittaker, John C.


Whittaker, John C. Kathryn A. Kamp, Anabel Ford. Rafael Guerra, Peter Brands, Jose Guerra, Kim McLean, Alex Woods, Melissa Badillo, Jennifer Thornton, and Zerifeh Eiley


Widmer, Randolph J. and Rebecca Storey


Wilk, Richard R. (ed.)


Wilk, Richard R. and Wendy Ashmore (eds.)


Wilk, Richard R. and Lisa C. Cligget

Will, Manuel, John E. Parkington, Andrew W. Kandel, Nicholas J. Conard
2013 Coastal adaptations and the Middle Stone Age lithic assemblages from Hoedjiespunt 1 in the Western Cape, South Africa. *Journal of Human Evolution* 64(6): 518-537.

Willey, Gordon R.


Willey, Gordon R., William R. Bullard, Jr., John B. Class and James C. Gifford

Wyatt, Andrew R.


Yacobaccio, Hugo D., Patricia S. Escola, Marisa Lazzari, and Fernando X. Pereyra

Yaeger, Jason


Yaeger, Jason, M. Kathryn Brown, and Bernadette Cap

Yaeger, Jason, M. Kathryn Brown, Bernadette Cap, Christophe Helmke, Christie Kokel Rodriguez, and Sylvia Batty
2014  *Into the Watery Underworld: Elite Burials at Buenavista del Cayo.* Paper Presented at the 5th Annual South Central Conference on Mesoamerica, New Orleans, LA.

Yaeger, Jason, M. Kathryn Brown, Christophe Helmke, Marc Zender, Bernadette Cap, Christie Kokel Rodriguez, and Sylvia Batty

Yaeger, Jason, Bernadette Cap, Meaghan Peuramaki-Brown

Yaeger, Jason, Minettte C. Church, Richard M. Leventhal, and Jennifer Dornan

Yaeger, Jason and Samuel V. Connell

Yaeger, Jason, Meaghan Peuramaki-Brown, and Bernadette Cap

Yaeger, Jason, Meaghan Peuramaki-Brown, Christina Dykstra, Sarah Kurnick, and Sebastian Salgado-Flores
Yaeger, Jason and Cynthia Robin

Yaeger, Jason, Jason M. Whittaker, Tiffany M. Lindley, and M. Kathryn Brown

Yoffee, N.

Zhai, Shaodong
Biography

Rachel A. Horowitz was born in Boston, MA and grew up in Olean, NY, a small town south of Buffalo. She graduated from Hamilton College, in Clinton, NY, in 2009 with a major in Archaeology and a minor in Hispanic Studies. She then moved to New Orleans, LA to attend Tulane University, beginning the Anthropology Ph.D. program in Fall 2009. She has conducted archaeological fieldwork in western Belize since 2011 and has also performed fieldwork in eastern Nevada, Virginia, Yucatan, Mexico, and Namibia and analyzed archaeological lithic collections from elsewhere in the southeastern United States and Guatemala.