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## Prehistoric Life, Labor, and Residence in Southeast Central Texas: Results of Data Recovery at 41HY163, the Zapotec Site, San Marcos, Texas

Jon C. Lohse  
*Center for Archaeological Studies*

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## Prehistoric Life, Labor, and Residence in Southeast Central Texas: Results of Data Recovery at 41HY163, the Zapotec Site, San Marcos, Texas

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# PREHISTORIC LIFE, LABOR, AND RESIDENCE IN SOUTHEAST CENTRAL TEXAS

Results of Data Recovery at 41HY163,  
the Zatopec Site, San Marcos, Texas

*Edited by Jon C. Lohse*



*Archaeological Studies Report No. 18*

Center for Archaeological Studies  
Texas State University-San Marcos

2011

*Prehistoric Life, Labor, and Residence  
in Southeast Central Texas*

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Jon C. Lohse, Principal Investigator*

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*First it must be realized that archaeological significance is a dynamic phenomenon that will change with advances in archaeological method and theory. "Canned" approaches cannot provide useful guidance to an evolving scientific discipline.*

—*Mark L. Raab and Timothy C. Klinger*





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## **ACKNOWLEDGMENTS**

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**D**ata recovery and analyses of archaeological remains from the Zatopec site, 41HY163, represent one of the most substantial investigations into the prehistoric period in Hays County and the City of San Marcos that has been undertaken to date. Successful completion of a project of this magnitude would not have been possible without important contributions from numerous individuals and agencies, and the Principal Investigator extends his most sincere appreciation to the following for their roles in this effort.

The City of San Marcos provided the initial funding for this work and showed consistent interest in the findings throughout all stages of the project. This data recovery effort represents a significant commitment by the City to the development of a better understanding of local history and prehistory, and I deeply appreciate this level of support. Mr. Sabas Avila, P.E., coordinated many of the logistics provided by the City, including site access, mechanical scraping, and site protection, and his contributions are gratefully acknowledged.

Mr. Jon Budd of the Texas Department of Transportation (TxDOT) has been enthusiastic about this work since its beginning and has provided much appreciated consultation and advice at key project intervals. Dr. Scott Pletka (TxDOT) also provided very important support by consenting to pay for the radiocarbon dating associated with this analysis through his agency's budget (with the exception of the dates on human remains, which were paid for by the City). Mr. Budd and Dr. Pletka also helped coordinate this project with the State Historic Preservation Office, and Dr. Pletka freely offered advice regarding the City's obligations under the Native American Graves Protection and Repatriation Act. Dr. Michelle Hamilton (Texas

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## **ACKNOWLEDGMENTS**

State University, Department of Anthropology) likewise provided much useful guidance concerning NAGPRA consultations.

The Scope of Work for this data recovery was compiled at CAS by David Nickels, Carole Leezer, and C. Britt Bousman, although none of these individuals was directly involved in the project once fieldwork got underway. Fieldwork was carried out by Theodore Brooks, Jon C. Lohse (Principal Investigator) R. Zac Selden, Terrie Simmons, Julian Sitters, and David M. Yelacic (who served as Project Archaeologist throughout the duration of this project). Stephanie Sonnier (Texas State University, College of Liberal Arts) was instrumental in managing the accounting on the University's end. Margie Elliott devoted many hours in technical and copy editing and in laying out this complex report; her efforts greatly improved the final outcome. Lastly, a number of researchers elsewhere contributed important analyses to this overall project, and their efforts are greatly appreciated.

Finally, Dr. James F. Garber (Texas State University, Department of Anthropology) deserves much credit for what is known about Zatopec. He directed several field schools at this important site in the 1980s, and many of the results of those field schools greatly enrich the current report.

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## MANAGEMENT SUMMARY

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This report presents the results of archaeological investigations and analyses of the Zatopec site, 41HY163, in Hays County, Texas. Excavations conducted by the Center for Archaeological Studies, Texas State University-San Marcos from August, 2007 to February, 2008, under contract with the City of San Marcos, were required to offset negative impacts to the site as a result of the City's construction of the Wonder World Drive Extension north from Hunter Road to Ranch Road 12. Initially self-funded by the City, the Federal Highway Administration agreed to reimburse the City for some construction costs. Accordingly, archaeological investigations were required under provisions of the Texas Antiquities Code, as well as Section 106 of the National Historic Preservation Act. Excavations and analyses were conducted under Antiquities Permit Number 4569, Jon C. Lohse, Principal Investigator.

The site had previously been excavated in the mid-1980s in a series of field schools by Texas State University-San Marcos, then Southwest Texas State University. The artifact assemblages and findings of those earlier investigations have been integrated into the more recent project and are incorporated in this report. Overall, approximately 75.86 m<sup>3</sup> of earth were excavated by hand, 21.569 m<sup>3</sup> in the current project, and 226,792 artifacts were recovered.

Based on diagnostic artifacts from the site, occupation spanned time periods from the end of the Late Paleoindian through the Archaic and Late Prehistoric and included an ephemeral early Historic (possibly Colonial) component. Intact deposits, which form the basis of the analysis, represent Middle Archaic (0.3 m<sup>3</sup>), Late Archaic 1 (3.6 m<sup>3</sup>), Late Archaic 2 (5.9 m<sup>3</sup>), Austin (4.0 m<sup>3</sup>) and

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## **MANAGEMENT SUMMARY**

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Toyah (2.5 m3) time periods. Following hand excavations, the entire site area was mechanically scraped through cultural layers to ensure that additional intact features were not present. Site deposits and analytical units belonging to these time periods have been delineated using a combination of diagnostic artifacts and technologies, and by radiocarbon dating of charred botanical and bison remains.

Analyses focused on four research domains:

- assessing the residential character of hunter-gatherer aggregation camp sites,
- investigating site formation processes affecting stratigraphic integrity of deposits,
- assessing prey selection and faunal resource exploitation behaviors, and
- reconstructing aspects of technological organization at the site as it changed through time.

Three fundamental premises guided these investigations.

- The record of occupation at the site reflects the process of continual change over short and long spans of time.
- Understanding the site's record requires comparative research, both of temporal site components and also within components during given time periods.
- Factors affecting these changes included both external (environmental, climatic, etc.) and internal (socially negotiated labor roles, individual-level aptitude, participation in task groups by sex or age, etc.) issues, each of which required consideration.

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## **MANAGEMENT SUMMARY**

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The site displayed a strong residential character, and may have contained the remains of patterned features indicating a structure. Other features indicating the site's residential nature included rock-lined hearths, middens of fire-cracked rock, lithic concentrations from tool manufacture, pits presumably used for storage, and three intact human burials that precisely span the transition from Late Archaic 2 to Austin times. Technological data recorded from several artifact classes revealed variable investment in tool manufacture by skill as well as intended function. Indices are presented that indicate a gradual increase in the intensity of tool usage from Late Archaic 1 to Austin times, with a notable increase in Toyah times. Prey-selection data showed relational changes in large-, medium-, and small-bodied animals; as large game (bison) became common, medium- and small-bodied taxa declined. Differences in the relative frequencies of these prey was most pronounced in Toyah times, when bison dominated the classifiable assemblage and small game were present only in trace amounts. Combined, the faunal record and technological data indicate that tool kits were designed over time to accommodate increasing participation in big game hunting and also the demands associated with processing large mammals. Within this context, opportunities for acquiring and expressing skill shifted from earlier periods. Some individuals devoted greater amounts of time to their tool-making tasks while technological approaches to basic tool types became increasingly differentiated.

Based on all findings together, an important hypothesis that is advanced is that, during periods of intense focus on large game hunting, gendered roles in society were transformed in relation to earlier periods, with men's and women's work becoming more sharply delineated and some women's labor becoming increasingly tedious. Two additional hypotheses are that, during these times, some women were alienated from forms of technological knowledge

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## **MANAGEMENT SUMMARY**

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(means of production) but developed their own approaches to manufacturing tools that were well suited to their tasks; and that some men competed with one another on an increasingly individual level, perhaps for prestige. While these fundamental social tensions were undoubtedly present in some form in earlier periods, evidence on which these hypotheses are based is most strongly expressed in the site's Toyah assemblage.

An additional component of this project involved the pedestrian survey and shovel testing of an area alongside the proposed Wonder World Drive so that the City could install a sedimentation/filtration pond. During the course of this effort, a site was recorded containing evidence for Historic period Native American occupation, consisting of chipped stone artifacts, metal implements, including a metal arrow tip, and apparently intact deposits and possibly features. The letter report of this effort and findings is included at the end of this report as Appendix A.

The record of agency review and comment on the overall Zatopec data recovery report is included as Appendix B.

*Prehistoric Life, Labor, and Residence  
in Southeast Central Texas*



## CHAPTER 1

# INTRODUCTION TO THE ZATOPEC SITE AND RESEARCH ISSUES

Jon C. Lohse David M. Yelacic, and Spencer LeDoux

“First it must be realized that archaeological significance is a dynamic phenomenon that will change with advances in archaeological method and theory. ‘Canned’ approaches cannot provide useful guidance to an evolving scientific discipline” (Raab and Klinger 1977:632).

Site 41HY163, the Zatopec site, is an open-air, multi-component prehistoric campsite located along the banks of Purgatory Creek in western Hays County, South-Central Texas (Figure 1-1). Primary dates of occupation span the Late Archaic and extend into the Late Prehistoric era; evidence is even available for an ephemeral Colonial-era presence at the site (Chapter 5). There is solid evidence for earlier occupations, including brief visitations in the Late Paleoindian, and Early and Middle Archaic. However, very few intact deposits representing these periods were encountered, and very little can be said for them beyond describing diagnostic artifacts (Chapter 7).

Zatopec was first excavated by Southwest Texas State University (SWT) in a series of field schools from 1983-1987 (Garber 1987). Those excavations recovered dense accumulations of prehistoric artifacts from repeated occupations, and recorded several features indicating the residential nature of the site. Zatopec became the focus of additional archaeological investigation in 2002 when the City of San Marcos (city) began planning the extension of Wonder World Drive from Hopkins Road around the northwest side of San Marcos to join with Ranch Road 12. Although initially self-funded by the city, the project will be reimbursed by the Federal Highway Administration (FHWA), with the Texas Department of Transportation (TxDOT) providing a pass-through for

funding, on the basis of commuter usage once the roadway is completed. The Texas DOT is responsible for Section 106 oversight according to FHWA, and has played a central role in consultations to determine what kinds of efforts were to be carried out in conjunction with the city's required excavations.

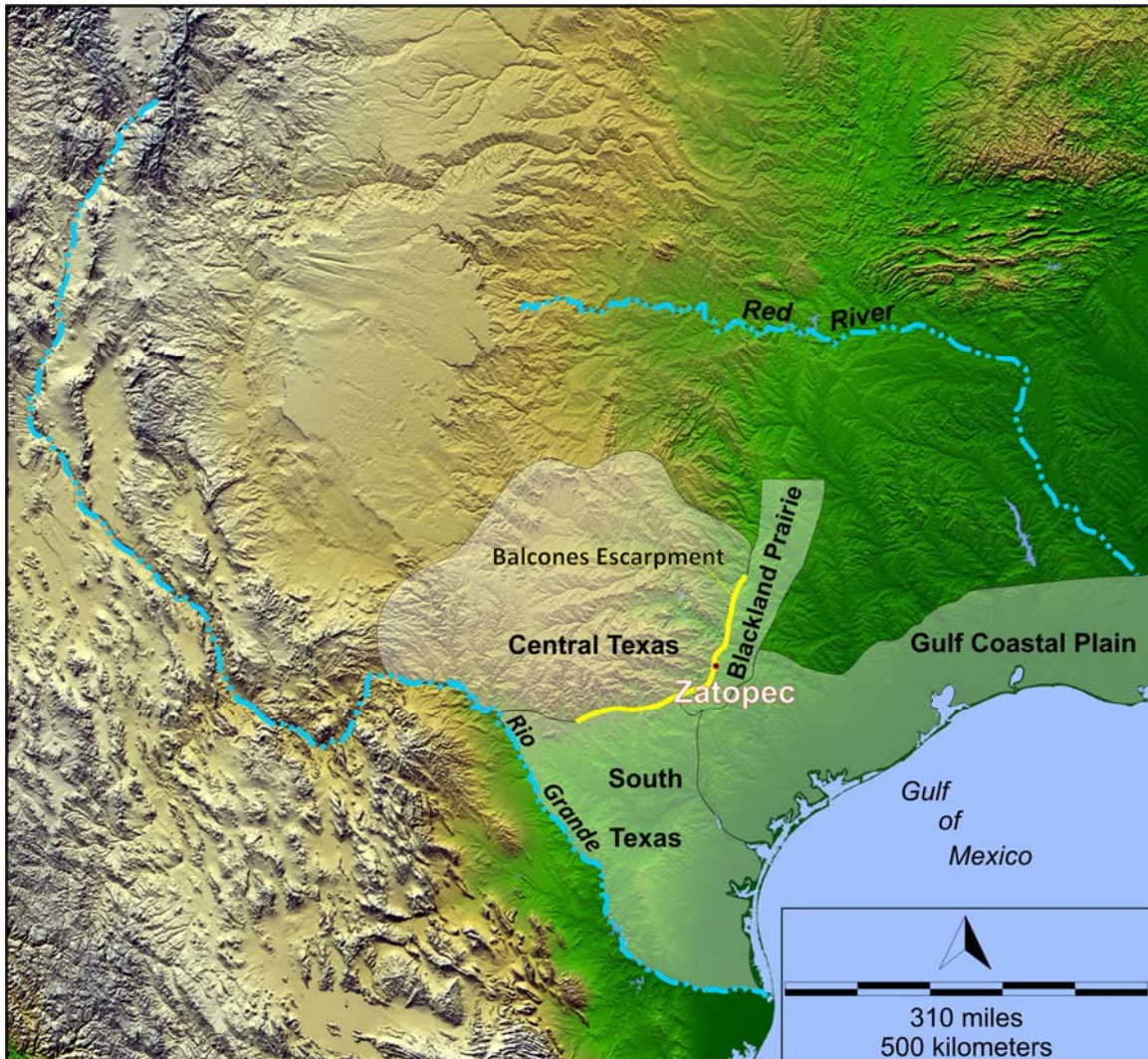


Figure 1-1. Location of Zatopec, on the face of the Balcones Escarpment, in south-east Central Texas, near interface with Gulf Coastal Plain and South Texas regions.

Zatopec was resurveyed (Karbula et al. 2003) during a preliminary environmental impact statement (EIS) conducted for that project. The survey determined that intact deposits were present within the area of potential effects (APE) for the proposed roadway extension. It was furthermore determined that the site retained the potential to yield

meaningful information concerning the region's prehistoric record. In accordance with Section 106, the city contracted with Center for Archaeological Studies at Texas State University-San Marcos (CAS) in 2007 to conduct data recovery at Zatopec in order to mitigate the effects of the proposed transportation extension (CAS 2007). Data recovery was conducted between August, 2007 and February, 2008 under Texas Antiquities Permit Number 4569, given to Dr. Jon C. Lohse.

Over the course of the SWT field schools and the CAS data recovery project, at least 203 m<sup>2</sup> were carefully hand-excavated to varying depths; CAS cross-sectioned another 5 m<sup>2</sup> in areas determined to be possible features (Chapter 5). Finally, the entire accessible site area was mechanically scraped with a Grad-all to identify additional features in unexcavated areas. All together, this represents a highly intensive level of effort, and the resultant record provides a great deal of information about the cultural practices of site inhabitants from the Late Archaic to Late Prehistoric periods. This report provides a primary account of the CAS excavations, summarizes results of the SWT field schools (also reported briefly in Garber 1987), and presents the results of the integrated analysis of artifact assemblages from the SWT field school and CAS excavations. As such, the available record from Zatopec offers one of the most robust and complete records of Late Archaic-to-Late Prehistoric prehistoric occupation at a single site in the South-Central Texas region.

The report is organized into several chapters. In the remainder of Chapter 1, research issues that were deemed significant prior to the CAS excavations and that have come to light as analyses have progressed are discussed. The view of the site as a residential camp is unchanged from the 1983-1987 excavations. However, specific

interpretations of site features and of the organization and implementation of important activities over the history of occupation have been revised. Although the understanding of the site as a residential camp provides the overarching framework for analyses that follow, attention is called to the fact that this category of site, “residential camp,” is poorly understood by archaeologists. Consequently, attention is given to developing implications for a site to be “residential” in terms of social behavior, technological adaptation, and subsistence responses. Not all Native American residential camps were alike, and differences hold meaning for how we, both archaeologists and the interested public, understand the changing nature of the region’s rich prehistoric record.

Chapter 2 presents important background information about the site’s setting, environment, and the geologic history of the landform in which the deposits were encountered. Additionally, previous investigations are reviewed. Finally, the chapter presents the regional cultural chronology in order to contextualize the current findings. The collective view of the San Marcos area cultural chronology is undergoing revision at a rapid rate, and many of the findings of this project have implications for that topic.

Chapter 3 discusses excavation and analysis methods used for the current project. Because this report integrates findings from two different excavation programs, the nomenclature used to record archaeological proveniences is not always the same from one part of the site to another. Furthermore, over the course of laboratory analysis, it became increasingly clear that many layers of deposit in certain parts of the site were mixed, with associated cultural materials displaced and moved out of their original contexts (Chapter 4). Effort was subsequently devoted to identifying intact areas of the site that could be assigned to a particular time period; these deposits are referred to as

Analytical Units (AUs). Chapter 3 discusses the diverse provenience data and defines the AUs that provided the basis for artifact analysis, and upon which the reconstruction of the site's occupation history and important behavioral changes are based.

The second part of the report, Chapters 4 through 10, presents the results of different analyses. These include sediments and stratigraphy (Chapter 4), features and chronology (Chapter 5), ceramic artifacts (Chapter 6), much of the lithic assemblage (Chapter 7), human remains (Chapter 8), fauna (Chapter 9), and archaeobotanical remains (Chapter 10). How each line of evidence contributes to the overall understanding of the site is strongly conditioned by variable preservation, sampling, and recovery rates and strategies. For example, perishable artifacts are virtually absent, and consist solely of a miniscule sample of archaeobotanical remains from food-getting. Additionally, no sustained effort was made to recover lithic artifacts that could slip through the ¼" screens used by both the SWT field schools and the CAS excavations. Nevertheless, together these chapters present a relatively comprehensive understanding of many of the aspects of prehistoric life at Zatopec.

The final part of the report, Chapters 11 and 12, discusses some of the major themes that have emerged through excavations and analysis of the site's remains. Zatopec was an open-air residential campsite to which prehistoric and early Historic occupants returned time and time again over a period of time spanning as much as 7000 years. Consequently, the site's components are complexly ordered and not always separable in excavation or analysis. Nevertheless, some important trends are observed not only in temporally diagnostic artifacts, but also in the different activities associated with the ever-present task of ensuring a stable food supply while at the same time socializing

infants and adolescents into knowledgeable, contributing members of a social group. In the presentation of data, emphasis is placed on (1) contextually controlled materials that (2) can be compared from one time period to another. Based on these analyses, Chapter 11 discusses what is understood of the site's temporal and behavioral components; virtually of the data referenced in this chapter is previously presented. Chapter 12 offers some final discussions and conclusions for the site. It is hoped that these conclusions, as outcomes of an analysis program designed specifically to address often-overlooked aspects of South-Central Texas prehistoric cultures, will contribute meaningfully not only to the greater understanding of prehistory in the San Marcos area, but also to future studies in the region and elsewhere.

#### **RESEARCH DOMAINS FOR DATA RECOVERY AT ZATOPEC**

In preparing for mitigation, CAS outlined what were felt to be important issues that could be profitably addressed by additional excavation and analysis of existing collections (CAS 2007). Results of the SWT field schools strongly conditioned how the site was perceived, and contributed significantly to the formation of these research questions. Earlier excavations (Garber 1987) had identified a number of discrete features and areas at Zatopec representing initial core reduction, tool finishing, cooking, butchering, and domestic activity (Figure 1-2). Diagnostic artifacts indicated minor occupations in the Early and Middle Archaic, abundant Late and Transitional Archaic deposits, and some occupation extending into the Late Prehistoric (Garber 1987:19). A series of features that were identified as post holes was documented in the main part of the site and these were believed to date to the Transitional Archaic. These intrusive dark

stains were interpreted as the outlines of an oval structure measuring approximately 8-by-6 m (Garber 1987:27). Because prehistoric domestic structures are exceedingly rare in Central Texas, this particular find was seen as extremely important (CAS 2007:19).

FIGURE 1-2. REDACTED

Figure 1-2. Zatopec site map showing SWT units and on-site activity areas interpreted from different features and artifact evidence.

Following Garber's (1987) discussion, CAS (2007) outlined four objectives for the City-sponsored mitigation: (1) examining site formation processes and feature integrity; (2) investigating the spatial organization of hunter-gatherer sites; (3) reconstructing, to the degree possible, past environments and patterns in resource exploitation; and (4) understanding how the technological systems of tool production were organized through time. Based on the results of excavation and analysis of both the SWT and CAS assemblages, however, some modification of these research objectives has been warranted. Plant remains were poorly preserved (Chapter 10), limiting possible conclusions about the paleoenvironment or ancient diet choices. Additionally, the site was found to be largely (though not entirely) deflated, with less-than-ideal sediment build-up by other than cultural processes, as well as disturbed in places by extensive rodent burrowing (Chapters 4, 5). These factors undermine at least some feature interpretations, constraining possible conclusions about the kinds and patterning of activities carried out here. Additionally, CAS recovered evidence for a wide and complex range of behaviors that are arguably correlated with residential camps, offering greater contributions to the collective understanding of local and regional prehistory.

In spite of these adjustments to the research design, each of the four original objectives is essentially intact, and informs the other lines of inquiry at a fundamental level. In addition to changes in how some questions were approached, the unanticipated recovery of three human burials contributed substantially to how the site is understood.

The original research domains are modified as follows:



- (1) Modeling site formation and geologic landform accretion processes that contribute to (or undermine) the integrity of features and contexts, and that influence sediment depositional patterns associated with peaks or lacunae in the occupation record.
- (2) Investigating the character (spatial and behavioral) of residential camp sites like Zatopec, sometimes also referred to as **aggregation sites** (Conkey 1980), in terms of the activities and social processes that occurred in them.
- (3) Reconstructing prey-choice and resource exploitation behaviors, and noting how these changed over time based on taxonomically identified zooarchaeological remains and some macrobotanical and microbotanical evidence.
- (4) Examining how hunter-gatherer technological systems were organized according to many factors including divisions of labor by age, sex, and task group. Such divisions have been identified in nearly all contemporary societies (Binford 1980; Brown 1970; Burton et al. 1977; Dahlberg 1981; Hayden 1981; Hill et al. 1987; Hurtado et al. 1985; Lee and DeVore 1968; Murdock 1937, 1949; and others) and are reasonably assumed to have existed in prehistoric times as well (Sassaman 1992; Waguespeck 2005). An important aspect of this question includes recognizing production that was unevenly organized or carried out by individuals who display clearly different levels of skill, grading potentially into specialized production.

### ***Causes of Culture Change***

A central premise shaping this research is that the foragers that occupied Zatopec throughout its history were considerably more complex in terms of their internal *and* external social relationships than researchers and analysts historically presume for

hunters and gatherers. Throughout the analyses reported here, explanations for patterns in the site's artifact record that favor individual-level decision making, those representing members of social groups who occupied the site, are pursued at least as often as those focusing on exogenous causes of culture change: climate, environmental change, resource availability, and so on. Not that these external forces are considered unimportant, but it is our view that sufficient attention is rarely given to how the prehistoric and early Historic record of Central Texas was also shaped by *internal* group dynamics. Throughout these analyses, we consider how people of the same social unit, most likely forager bands consisting of multiple nuclear families, had different personal identities; levels of aptitude, skill, or ability; motivations for behavior; and other significant, if situational, temporary, or seasonal cleavage planes along which to define themselves apart from others with whom they also shared many important common bonds. In this sense, the current project adopts a social archaeology approach to understanding regional prehistory in south-Central Texas in that it seeks to explain variation including down to the level of individual people, and focuses on lived experiences and how these changed over time (Journal of Social Archaeology 2001). This focus complements traditional explanations invoking external factors to which these peoples responded.

Below, each of the revised four research domains is discussed in detail. Specific linkages are made with categories of data that are used to address these issues. Some domains are better suited to the social archaeology approach just described than others, and many topics remain unresolved. Yet it is anticipated that the manner in which they are treated here will allow future archaeological work to build on these ideas in ways that advance the collective understanding of the past.

## **RESEARCH DOMAIN 1: SITE FORMATION AND LANDFORM ACCRETION**

The initial research domain for investigations at Zatopec is establishing the spatial and temporal context and integrity of features at the site by modeling or analyzing geologic landform accretion and site formation processes. Geologic landform accretion, also geomorphic history, and site formation processes are often included as geoarchaeology, which is the integration of earth sciences' concepts and methodology with archaeology. Accurate interpretations of patterns and processes require an interdisciplinary approach and provide the "ultimate context" (Goldberg and Macphail 2006) for recovered artifacts, which result in a solid foundation upon which cultural inferences can be made.

Through geomorphic mapping, the observation, analysis, and illustration of features on the earth's surface, and investigations of sedimentary features, or the examination of sediments and soils, a regional description of the dynamic landscape can be compiled; this is known as geomorphic history (Hugget 2007). Geomorphic history serves as a baseline for determining what processes were involved with deposition of natural and cultural deposits. Studies of site formation processes incorporate local geomorphic history and investigate patterns and processes associated exclusively with the deposits, natural and cultural, present at the archaeological site. Site formation begins with the deposition of cultural material, which is immediately subjected to distribution by cultural and natural processes (Schiffer 1983). Understanding an archaeological site in terms of site formation processes involves defining what factors affected the distribution of artifacts, determining the degree to which artifacts were disturbed, and considering the effect of these processes on researchers' ability to use contextualized data to support

interpretations about past events and behaviors that may be represented by a site's material content.

At Zatopec, interpretations of geomorphic histories and site formation processes seek to establish context in which artifacts can be used to identify and analyze cultural characteristics. Having an end goal of establishing context, investigations are aligned by questions including:

1. what is the site's location in terms of regional and local geomorphology?
2. what is the site's context in terms of litho- and pedostratigraphy?
3. how might regional and local geomorphic histories affect natural and cultural deposits, and how can these patterns and processes be identified in the stratigraphy?
4. to what degree have cultural deposits been disturbed by cultural and natural processes?
5. how do the above factors affect depositional integrity and site interpretation?

Methods employed to address topics of geomorphic history and site formation processes are divided into two arenas: 1) field, and 2) laboratory methodologies. Field methodology includes all geomorphic and stratigraphic studies that take place in the field, and laboratory methods are the analysis of the collected samples and synthesis of all data.

### ***Methodologies***

A preliminary investigation of regional geology, representing the parent material for sediment and a constituent of topography, provides a necessary base for conducting basic geomorphic and stratigraphic research. Additionally, a review of topographic maps

and previous archaeological and geoarchaeological work in the region is useful for defining a site's location on the landscape, determining what methods might be necessary to address research objectives, and understanding the context of the site in terms of identified landforms and depositional units. Once in the field, observation through pedestrian reconnaissance supplements studies of regional geology, topography, and previous investigations while precisely placing the site in the context of the local landscape. Pedestrian reconnaissance at Zatopec involved generalized geomorphic mapping and searching for naturally exposed profile exposures along Purgatory Creek. Often times, useful stratigraphies may also be found in cutbanks and/or road cuts. Profile exposures allow for a synthesis of the stratigraphy in the vicinity of the site.

An integration of litho- and pedostratigraphies for investigating site formation comprises the on-site part of field methodologies. *Lithostratigraphic* units are unaltered bodies of sediment that are discernable in terms of texture and/or structure from overlying and underlying strata. *Pedostratigraphic* units are discernable bodies of sediment that have been altered by pedogenesis, or soil formation. Lithostratigraphy offers insight into depositional processes and origin of sediment, while pedostratigraphy characterizes post-depositional processes. An integrated description of the stratigraphies reveals information pertaining to the nature, distribution, and disturbance of natural and cultural deposits, and is obtained through observation and examination of sediment granulometrics (e.g., composition, texture, sorting, particle shape, structure, color, etc.). Field descriptions can be accurate, but often require confirmation through laboratory analyses of samples (samples are collected to confirm or deny hypotheses formed in the field). Bulk sediment samples provide enough matrix to supplement field granulometric

examinations with laboratory analyses. As additional lines of evidence are often better, samples for magnetic susceptibility and micromorphology may also be collected.

Methods employed in the laboratory include analysis of samples collected in the field and synthesis of all data. Samples collected at Zatopec include bulk sediment, magnetic susceptibility, and micromorphology; however, samples for micromorphology were not found to be useful in terms of contributing additional lines of evidence to landform aggradation and site formation hypotheses and are not presented in the summary of the site's formation history and geomorphology (Chapter 4).

As previously defined, bulk sediment samples provide enough matrix to supplement field assessments of texture, carbonate content, and percent coarse grain fragments with laboratory analyses. Results of these analyses indicate characteristics of depositional and post-depositional processes affecting the formation of landform and site.

In the laboratory, accurate proportions of sand, silt, and clay can be measured through a series of drying, sieving, and hydrating. Results of this analysis indicate how sediments were deposited and provide descriptive statistics which can be compared with strata in the same profile and across the site. Soil calcium carbonate content is measured through an elaborate series of reduction techniques. The result, like texture, provides descriptive statistics that can be compared within the profile and across the site. Calcium carbonate content in soils can indicate soil formation processes and, in some cases, temporal limitations, but at Zatopec, calcium carbonate content serves to illustrate the integrity of stratigraphy.

At Zatopec, investigations of geomorphic history and site formation processes were performed by geoarchaeologist, Dr. Charles Frederick, and are presented in Chapter

4. Interpretations are based on the observation and analyses of four profiles, A-D, exposed by test unit excavations (Figure 1-3). Columns were collected from each profile in 5 cm increments and analyzed for different kinds of data pertaining to the character of the site's deposits. For each profile, calcium carbonate content (CCE) was measured as a percentage, magnetic susceptibility values were recorded, and texture was calculated by percentage of clast size (gravel, sand, silt, and clay). For two profiles (C and D), fire-cracked rock (FCR) and debitage that were collected in each of the samples was counted and/or weighed. Composition determines the mineralogy of the sediment and is indicative of origin. Texture defines the physical characteristics of grains composing the sediment and indicates depositional environment. Sorting is a measure of sand, silt, and clay proportions composing the sediment and also provides information about the nature of the deposit. Structure is a description of deposition, and color is described using a Munsell Color Chart and can indicate weathering characteristics and age (Goldberg and Macphail 2006). Together, these data are useful for indicating "peaks" in cultural materials, disruptions in depositional continuity, and possible sources and processes for sedimentation. Finally, the mean particle size and degree of sorting for each profile was recorded to assess the comparability of site-wide deposits. Results were evaluated against other regional models of alluvial build-up throughout the Holocene from Central Texas.

The geoarchaeological analysis indicates that most sediments at Zatopec had been deposited on the site by the Middle Holocene, and that virtually all of the upper deposits had been formed as a result of cultural activity and natural disturbances (e.g., pedoturbation). Given these findings, it is important to note that parts of the site were found to contain relatively intact deposits that showed little or no signs of disturbance.

FIGURE 1-3. REDACTED

Figure 1-3. Location of the four profiles, A-D, examined to study site depositional history and processes.

While Zatopec is not an ideal case for clearly stratified deposits and easily isolable cultural components, intact deposits were present in some places. These deposits were carefully defined using multiple lines of temporal data to form the basis of interpretations concerning the site's history (Chapters 5, 6, 7, 9, 10).



## **RESEARCH DOMAIN 2: THE CHARACTER OF RESIDENTIAL SITES**

Zatopec was identified as a residential camp site from the outset based on Garber's (1987) recognition of possible postholes and the interpretation of these as the remains of a domestic structure (see discussion of features in Chapter 5). The subsequent mitigation project was designed in part to recover evidence needed to confirm this interpretation. Unfortunately, the CAS excavations failed to recover unambiguous evidence supporting the presence of a structure; many intrusive discolorations that were encountered were found to be rodent burrows, while others did not conform to the expected spatial pattern based on Garber's (1987) circular features (see Chapter 5). Important, however, is the fact that these CAS findings do not refute the earlier interpretation of a structure; that conclusion is simply not sustained based on the CAS excavations (see Chapter 5 for a discussion of all features recorded at Zatopec).

Based on the nature and abundance of material remains and the presence of human burials, it is clear that Zatopec was a residential site. Given the initial questions guiding the data recovery, this project proved an excellent opportunity to examine the kinds of social processes and activities that distinguish some kinds of residential camps from others. From background data informing the current analysis, it is clear that not all residential camp sites were the same. It is furthermore clear that archaeologists working in Texas have not yet defined the full range of variability for residential sites. Based on these facts, an important objective of the current analysis is expanding the analysis of different kinds of residential sites. In this case, we focus specifically on what makes sites "residential" in character, and consider different kinds of decisions that were made concerning where, how often, for how long, and by whom sites were occupied.

Nominally, residential sites are the localities of stay-overs by social groups of different sizes for spans of time ranging from one or two nights to several weeks or months (Tomka and Perttula 1997:4-11). Based on combinations between varying lengths of stay and the size of the group, as well as what kinds of activities they were pursuing from that particular locale, many different kinds of residential sites can be envisioned. Binford (1980:9) defines *residential bases*, the kind of residential site that most closely approximates Zatopec, as “the hub of subsistence activities, the locus out of which foraging parties originate and where most processing, manufacturing, and maintenance activities take place.” According to Thomas (1985:238), these sites share basic commonalities such as domestic dwellings, site furniture, specialized utilitarian structures and outdoor work spaces, service centers, diversified tool fabrication and repair, child rearing, diversified food consumption, and so on. Yet, the amount of time devoted to each of these activities, as well as the people who carried them out and which tool kit(s) are used, all depend quite strongly on external factors having to do with patterns of temporary occupation, mobility, and labor organization for carrying out important tasks.

***Residential Mobility: “Simple” Subsistence Versus Aggregation***

Residential mobility based on the seasonal availability of important food resources is well documented among contemporary hunter-gatherer societies (Binford 1980; Gamble and Boismier 1991; Kelly 1995; Lee and Daly 1999; Lee and DeVore 1968), and is also firmly entrenched in hunter-gatherer archaeology. Because mobile hunter gatherers rarely employ technologies for creating or storing food surpluses, as available foodstuffs are depleted from near a site area, residential camps are relocated

elsewhere. However, residential mobility was not only conducted in relation to shifting resource availability; equally important is what Lee (1979) calls the cycle of aggregation/dispersion. This cycle describes the periodic aggregation of several smaller groups (microbands, nuclear groups, households, etc.) into larger groupings (macrobands) for certain periods over different times of the year. Aggregations are scheduled, like virtually all hunter gatherer activities, with seasonal resource considerations in mind, but they occur for many other reasons as well that are of considerable importance for understanding hunter gatherer societies.

Aggregations have been noted among many contemporary hunter-gatherers (Binford 1980; Gould 1969; Lee 1976, 1979; Steward 1938; Wilmsen 1973; see Binford 2001) and are commonly used to understand prehistoric hunter-gatherers as well (e.g., Conkey 1980, 1991; Meltzer 2004; Robinson et al. 2009; Shott 2004; Wadley 1989; Wilmsen 1974; Yellen 1976). The primary reason for aggregation processes involves the relationship between seasonal availability of food resources and social group size (Tomka and Perttula 1997; Tomka et al. 1997). While variations exist according to latitude, climate, and other factors, the general pattern for hunter gatherer aggregations is for large groups to fission into small microbands during lean seasons and re-aggregating during periods when food availability is greater (Hurtado and Hill 1990:264). Although essentially a subsistence-based cycle, the pattern influences nearly all other aspects of hunter-gatherer culture. Hurtado and Hill (1990:293) argue that “Because seasonality influences the food supply, and this in turn constrains many other aspects of economic and social life, simple changes in rainfall and temperature patterns can result in an almost

endless array of subsequent ramifications that may ultimately influence work patterns, marriage, social structure, and ritual cycles.”

Residential mobility and the aggregation/dispersion cycle shape site residential characteristics in many ways, including whether camps are occupied by micro- or macro-bands, how long sites are occupied, and how habitation factors into resource extraction that takes place away from camp. As such, considerable variation is seen in residential sites where bands aggregate depending on the length and season of stay, the frequency and interval of visits, the number of people involved, and the kinds and intensity of activities that were carried out. In terms of regional patterns that would have included Zatopec, understanding these factors and how they changed over time is a fundamental task for archaeologists dealing with large residential camps. Clearly, when considering the kinds of other social activities mentioned by Hurtado and Hill (1990), the definitions offered by Binford (1980) and Thomas (1985) barely scratch the surface of variation in hunter-gatherer residential camps. For example, previous attention to differences between residential sites in Texas focuses on chronological trends (Prewitt 1981), documenting environmental adaptations (Collins 1995; Weir 1976), or the ever-present need for a reliable food supply (Tomka and Perttula 1997). Often overlooked in favor of questions of chronology, settlement, and subsistence is the fullest possible range of behaviors that occurred on residential sites where bands aggregated, what kinds of remains these behaviors might leave in the material record, and how those remains might be used in the study of internally diverse social groups.

Clearly, subsistence-related activities are among the most important scheduling priorities for hunter-gatherers. However, they are not the only important considerations

that condition(ed) residential site characteristics. Concerning non-subsistence aspects of residential sites where multiple microbands come together, Margaret Conkey (1980:610) notes that “The motives for forming such (large seasonal) groups, have over and over again been shown to be social as well as economic.” An example of one such motive is extending social networks. Damas (1969:52; cited in Conkey 1980:610) observes that at autumn Eskimo gatherings, “economic activities were virtually at a standstill” as individuals and families focused on establishing and maintaining important social relationships. This was accomplished by exchanging marriage partners and sharing food, in addition to exchanging goods that were not otherwise available. Richard Lee (1979) also notes that ritual events help integrate nuclear microbands into seasonal macrobands. Lee (1979) defines trance-dance curing and men’s initiations as common events at larger seasonal sites of the Kalahari !Kung San. In central Australia, Merwyn Meggitt (1962) refers to the macroband phase of Walbiri settlement as the “ceremonial season,” and describes initiation and other rituals that are performed at such occasions (cited in Cashdan 1989:34). On the basis of these accounts, archaeologists, too, should consider the non-subsistence aspects of the aggregation/dispersion cycle.

Conkey (1980, 1991) was among the first archaeologists to systematically examine residential aggregation involving the integration of multiple microbands and where social, economic, and ritual activities would have been carried out. Her studies, with others, provide an important comparative framework for understanding archaeological remains of sites like Zatopec. According to Conkey (1980:612), aggregation sites are places where “affiliated groups and individuals come together... The occasions for concentration may be ecologically or ritually/socially prompted, and

there must be processes that effect the integration and allow the aggregation to take place... Many different persons may move in and out of the aggregated group, so that although group size remains relatively constant group composition varies radically.” Importantly, she defines some traits that can be expected of aggregation sites. These are (1) larger group size than found at short-term camps; (2) seasonal occupation, perhaps repeated, corresponding with available nearby resources; (3) patterning in where activities were carried out; (4) maintenance of some site features; (5) a greater total diversity or range of activities than seen at short-term camps or resource extraction locales, including some that do not occur at these other kinds of sites; (6) ecological factors that may prompt, contribute to, or facilitate aggregation, such as a resource-rich setting or an attractive locale; and (7) the integration of regional peoples (Conkey 1980:612). She subsequently (1991) has discussed how these sites are ideal contexts for identifying gendered roles, specifically those involving female work and socialization, as well as social roles based on differences in age. As will be seen, Zatopec contains evidence for many of these traits.

To the lists compiled by Conkey (1980, 1991), Hurtado and Hill (1990), and others, another aspect characteristic of aggregation sites involves labor pooling, the scheduling of certain tasks during aggregation cycles to correspond with the presence of several individuals closely related in age, sex, and/or aptitude and who comprise discrete task groups. Pooling labor is made possible during periods or settings of seasonal resource abundance, where adequate foodstuffs are available in sufficient quantities to free up individuals’ time so that they may pursue other tasks. Lee (1979) notes that the amount of labor expended by any single individual may increase under these conditions,

meaning that the internal logic of labor organization found in aggregation sites can not be understood in strictly effort-minimizing terms. Nevertheless, Conkey (1980:610) notes that labor pooling in these circumstances contributes to, or is associated with increases in resource variety, quantity, and reliability. An outcome of food stability is the significant easing of scheduling requirements for repairing tool kits, restocking hunting and trapping gear, and other productive tasks. In other words, food stability allows replenishing or replacing equipment and gearing up for future excursions to occur at a leisurely pace. Aggregation sites differ markedly in this regard from short-term camps or extraction sites where time or material shortages often preclude extensive reworking of tools beyond what is necessary to minimize the risk of equipment failure at the next encounter (e.g., Bleed 1986; Bousman 1993; Kelly 1988). In the current analysis, we relate this specifically to technological innovation and/or evidence for inefficient use of materials that indicates practice, skill acquisition, or learning. This may be especially true for curated or formal tool technologies (Binford 1979; see below and Chapter 7) that involve high labor costs to fashion and maintain.

Based on abundant ethnographic and historical data, as well as the interpretation of archaeological remains, aggregation represents an important counterpart to “only” food-getting in determining the settlement-mobility patterns for hunter gatherers. Many of the activities that take place during aggregation periods are decidedly “social” in nature, potentially including ritual ceremonies; food, partner, and information exchange; integration of multiple group identities; labor pooling by temporary (seasonal) task groups; and negotiated social roles by age, sex, and gender. Other activities are more strictly technological, such as tool manufacture and refurbishment. Yet, since these, too,

take place under conditions of pooled expertise they commonly involve socialization of younger or less adept individuals, meaning that even the most technological activities seen in aggregation sites carry major non-utilitarian, non-subsistence implications.

### *Archaeological Evidence for Zatopec as an Aggregation Site*

According to Conkey (1980, 1991), at least eight characteristics or traits define aggregation sites. These include (1) larger group size than found at short-term camps; (2) seasonal occupation corresponding with available resources; (3) spatial patterning of some activities; (4) maintenance of site features; (5) greater diversity of activities than seen at short-term camps or resource extraction locales; (6) ecological factors, such as a resource-rich setting, that contribute to aggregation; (7) the integration of regional peoples; and (8) openly expressed identities according to age, sex, and gender. Following Lee (1979), to this list we add (9) organizing labor in ways that concentrate certain resource extraction (seen as specialization), facilitate other important social activities such as learning and enculturation, or that appear as “inefficient.”

Unfortunately, many of these traits can apply to almost any kind of residential site, potentially reducing the utility of the aggregation concept as a way to single out the kinds of social behaviors described for them. Furthermore, aggregation cycles are rarely addressed by archaeologists in Texas, and an inventory of possible aggregation sites, rather than merely residential camps, is lacking. Nevertheless, while acknowledging difficulty in operationalizing aggregation in reconstructions of regional hunter gatherer adaptations and cultural practices, we believe that meaningful distinctions can, and should be made among residential camps in ways that can be correlated with specific



archaeological evidence. Distinguishing between different kinds of residential camps would allow archaeologists to model seasonal settlement mobility patterns and associated oscillations in regional aggregation/dispersion cycles that were specific to different archaeological cultures, or to recognize prehistoric hunter-gatherer “central places” in ways that help delimit territorial ranges. Moreover, correlating these patterns across large areas could help recognize important events including cultural displacement or in-migrations, or understand responses to severe climatic or environmental changes. Of course, by using models of social formation and adaptation based on aggregation patterns, archaeologists can begin addressing some ephemeral or intangible aspects of hunter gatherer societies, such as behavioral variation by age, sex, or gender.

Distinguishing aggregation sites from other residential camps involves not only identifying specific archaeological criteria that correspond with the nine traits discussed above, but also compiling a regional inventory of candidates for aggregation locales that can be compared against one another, and against residential camps that do not meet sufficient criteria to be recognized as true macroband aggregation sites. In terms of material correlates, issues of group size (Trait 1) and the diversity of activities (Trait 5) that are carried out can be addressed by examining the quantity of artifacts and features present (these must be controlled for the length of archaeological periods and the size of excavated samples for meaningful comparison, see Chapter 3), and the ranges of behaviors they represent. Feature maintenance (Trait 4) can be seen in how some site furniture, such as hearths, storage pits, or even burial locations, are reused from one visitation to the next. Spatial patterning (Trait 3) refers to how transient activities are located in and around more permanent fixtures that structure site layout from one

visitation to the next. Spatial patterning and feature maintenance are closely related, and can be used to argue for cultural continuity of occupation. (The ability to recognize spatial patterning, or features for that matter, necessarily depends on site preservation and geoarchaeological contextual integrity, which are not great at Zatopec.) Seasonality of occupation (Trait 2) and resource richness (Trait 6) are more difficult to reconstruct from the archaeological record, necessarily relying on organic, including faunal preservation and archaeologists' ability to reconstruct ancient environments. At Zatopec, this is not possible for most contexts or time periods. However, some faunal and microbotanical data indicate late-summer to fall occupation for some time periods (Chapters 9, 10), and attempts were made to reconstruct faunal resource diversity (also called richness) for different time periods and compare these to other regional assemblages (Chapter 9). Integrating regional peoples (Trait 7) is an important aspect of aggregation sites, and could be seen in the presence of symbolically significant artifact styles. These include not only different point types, but may also include carved bone pendants, shell gorges and disks, and carved and painted pebbles. In open camp sites like Zatopec, organic remains including clothing, footwear, and possible hair ornaments are rarely preserved, leaving archaeologists reliant on non-perishable remains.

Defining material correlates for the final trait identified above, labor organization resulting in technological variation that can be identified as innovative, inefficient, specialized, or distinctly age- or gender-based, is a complicated task. In this analysis, we identify technological organization as a separate research domain (see below). In order to avoid building circular arguments about site use, interpretations about aggregation at Zatopec do not rely on data regarding technological variation. Although technological

organization is discussed in considerably more detail below, here we summarize some possible material correlates for labor organization (Trait 9) that can arguably be associated with aggregation sites. Archaeologists can seek evidence for different forms of labor organization in several ways. One includes labor pooling and increased cooperation among task groups, resulting in eased scheduling concerns. A relaxed schedule allows tool makers to invest time experimenting with new technologies and, importantly, to train novice tool makers. The former activity appears as well made but hard-to-define or classify tool forms, while the latter is recognized as evidence of some individuals first acquiring or developing their skills in important crafts. The Zatopec assemblage was evaluated for evidence such as learning, innovation, and occupational specialization as small components of the larger question of how occupants at the site organized their technological activities.

### ***Cautionary Notes and Concluding Thoughts on Aggregation***

On the basis of Traits 1-7 alone, a case can be made that Zatopec indeed represents a prehistoric aggregation site. The merits for this interpretation are discussed in greater detail in Chapters 11 and 12. However, it is acknowledged that, in the absence of written documentation to the contrary, there is no clear archaeological standard of evidence for establishing that a site was an aggregation site. Instead, we outline the aggregation issue, consider its implications for Zatopec, and recommend that it be pursued in the analyses of other possible aggregation sites. It is appropriate to note that Zatopec is viewed as a *kind* of aggregation locale, somewhat reduced in scale in relation to other such sites, and that this label best applies to the site only for some time periods.

Clearly, other sites in Central Texas are better candidates for representing the largest of macroband aggregation locales, such as those located in prime settings near large springs on the eastern face of the Balcones Escarpment located in New Braunfels, San Marcos, Austin, and farther north. Consequently, we conclude that, in cases where evidence is present but not overwhelming, aggregation should be used as a framework for qualitatively comparing differences among large residential camp sites.

An additional factor for consideration is how site use changed over time. Since aggregation is fundamentally related to subsistence as well as other “social” factors, major changes in subsistence practices and regimes should result in changes in how sites were visited. Aggregation sites for one time period may not have been used in the same way in earlier or later periods. At Zatopec, using radiocarbon (Chapter 5) as well as technological evidence from stone tool assemblages (Chapter 7), we see significant differences in terms of how the site was used and how frequently it was visited from the Late Archaic 2 and Austin times to Toyah times (see Chapter 2 for cultural chronology and Chapter 3 for how these temporal intervals are defined at Zatopec). If Zatopec was an aggregation locale of moderate size in Late Archaic 2 and Austin times, and we think it was, we cannot presently say that maintained this status in Toyah times. However, we identify this particular issue, the fundamentally different ways in which some sites were used and how often they were visited, as one in need of additional research.

### **RESEARCH DOMAIN 3: PREY-CHOICE AND RESOURCE EXPLOITATION**

Analyses at Zatopec focus on a series of questions involving the social organizations and technological behaviors of the site’s prehistoric occupants, and how

these changed over time. Broadly, analyses are concerned with elucidating the “residential” character of a site that was serially occupied by internally diverse social groups (Domain 2), and with understanding what this meant for technological behaviors, divisions of labor, task scheduling, learning and skill transmission, possible specialized undertakings, and efforts by some individuals to pursue status gains over others (Domain 4). Both are considered within a geoarchaeological understanding of the site’s depositional history and stratigraphic integrity (Domain 1). Choices about which food resources to exploit under what conditions are closely related to these issues, particularly for hunter-gatherer societies for whom residential and logistical mobility in search of food was ever-present. Reconstructing these choices comprises the third research domain.

### ***Resource Exploitation and Food Sharing***

The primary objective of this research domain is not simply to reconstruct a species inventory for animals found at Zatopec. Rather, the goal also includes recognizing how, or whether certain foods that were exploited over different periods of time served as social commodities used to build or maintain social networks, contribute to individual and/or group identities, or that were associated with particular technological requirements for their exploitation. This approach requires (1) accurately identifying taxa present by time at Zatopec, (2) considering how these taxa were involved in important social relationships among and between site occupants, and (3) correlating these results with those of the technological analysis. In the present analysis, this means considering evidence for different patterns not only in hunting, but also for food sharing. Examining food sharing over time at Zatopec raises important methodological issues for recognizing

the distribution of elements, not just at the site but also at other sites to help present the Zatopec data in a regional perspective.

Recent studies (Gurven and Hill 2009; also Binford 1978; Enloe 2004; Kaplan and Hill 1985; Kelly 1995; Wenzel et al. 2000; and others) examine the complexity of factors that motivate hunters to share food, protein in particular, other than merely providing sustenance. Among the many conclusions from this body of work is that advantages gained by higher-than-average hunting success, and the apportioning out of those results, can take several forms. Successful hunting, particularly of large animals associated with higher risks and requiring extended forays at distance from residential camps (these are called logistical forays; Binford 1980), has been repeatedly shown to be positively associated with status gains (Hawkes 1991; Hawkes et al. 2001; Wiessner 1996), success in mating competition (Kaplan and Hill 1985), better offspring survivorship (Hill and Hurtado 1996), higher biological fitness (Smith 2004), and other social advantages (see Gurven and Hill 2009). Each of these potential benefits is in addition to meeting basic dietary needs, and can be described as serving individual interests at the expense of overall group well-being. In this way, they represent “inegalitarian” (cf. Flanagan 1989) motivations for the preferential or uneven sharing of food resources.

Informed by this work, one working hypothesis addressed in Research Domain 3 is that many of the prehistoric choices that shaped the Zatopec faunal assemblage were driven as much by desires or attempts by individuals to achieve or gain status or advantage over others, even if acting on behalf of offspring, pair-bonds, or other immediate family members, as they were to reinforce egalitarian social bonds and ties or

to simply obtain sufficient food supplies. Because these rationales for sharing are not mutually exclusive (Gurven and Hill 2009), archaeological models of prey-choice behavior over time that accommodate multiple motivations for food sharing are likely to be more accurate and to provide better, more comprehensive explanations of past behavior. As discussed below (and in Chapter 9), reconstructing food-sharing practices at Zatopec is difficult. Yet correlating which anatomical elements from what key species are strongly represented on site versus those found missing in high frequencies reveals to some degree which choice portions were returned to camp versus being consumed off-site, perhaps at the location of the kill, and how these patterns shifted over time with focused reliance on particularly important species.

### ***Technological and Residential Implications of a Big Game Focus***

A second hypothesis for this research domain is that, due to the benefits that come with successful exploitation of large mammals, defined at Zatopec specifically as bison, periods during which large game hunting was particularly important were likely to be characterized by notable shifts in other food choices, as well as in technological production, the scheduling and pooling of labor, and the negotiation of age and gender roles. In order to evaluate this hypothesis, an effort was made to defining periods of bison abundance for Zatopec and the surrounding region. Previous such studies are problematic in that they too heavily depend on the recovery of bison in what are often poorly resolved or poorly dated strata in open-air sites, similar to Zatopec. To address this problem, the current project included a concerted effort to directly date bison remains recovered from excavations. The result is two kinds of data on bison presence and abundance at Zatopec:

one based on archaeological association in excavated strata and the other on directly dated bison remains (Chapter 9, and also discussed in Chapter 5). These findings provide an important temporal context for understanding other activities not only involving tool manufacture but also related to food-getting. This hypothesis by no means indicates a belief that bison were the most important food resource available to prehistoric inhabitants at Zatopec, only that periods of oscillating focus on big game had important implications for other food-related activities. This inquiry could theoretically be structured in the same way but using any other subsistence resource that fluctuated in availability over time.

In this regard, prey-choice and resource exploitation (Research Domain 3) offer complementary lines of evidence that can support conclusions drawn from technological analyses (Research Domain 4) showing how certain individuals engaged in tasks that were inefficient in terms of the time involved or raw material wasted, were specific to a particular task group, or that demonstrated increasing amounts of skill that set those individuals apart from others. As with technological production (Lohse 2010, n.d.; see below), it is unlikely that meaningful differences between individual hunters' skill could be accurately assessed except between the very worst and the very best, even by members of these forager groups (see Hill and Kintigh 2009; Koster 2010). Still, the benefits beyond simple provisioning associated with successful large game hunting are cross-culturally consistent and reliable enough that archaeologists can extend this relationship into the past and consider how such benefits may have been realized in prehistoric contexts. When viewed in conjunction with technological tasks associated with bison exploitation that were themselves demanding and carried high rates of failure (see



Research Domain 4, below), a view emerges in which some individuals may have enjoyed opportunities to achieve, at least temporarily, social status gains over others through excelled performance of high-risk, high-reward tasks. In the context of residential camps like Zatopec, it is impossible to identify individuals' success rates over different time periods and in so doing to evaluate hunters against one another. But it is possible to consider, from different perspectives, relationships between logistical hunters of large game and the rest of the social group, including those who hunted and gathered small- and medium-sized prey that would have been available nearby.

Changes in resource exploitation may bring about increases in logistical forays to obtain non-local food stuffs in relation to or that occurred independent of residential mobility, providing evidence for larger shifts in settlement mobility in terms of length and frequency of site occupation. Additionally, changes in the availability of key species may have resulted in new schemes of labor organization involving hunting strategies, new technological approaches to ensure food-getting, or new patterns of food sharing. Any of these could have either leveled uneven access to important resources or emphasized and reinforced status gains by individuals better able to exploit those resources. These kinds of shifts have implications for how small or medium-sized bands sustained themselves at temporary residential camps like Zatopec.

Testing each of these possibilities involves analyzing faunal records for evidence of changes in the availability of key resources over time and considering possible implications for those changes. (At Zatopec, archaeobotanical evidence is not well enough preserved to be used to address this research domain.) For example, differentiated food acquisition reflecting increases or decreases in diet breadth might be associated with

new gender- or age-based task divisions, and made necessary by shifts in settlement mobility or environmental change. Additionally, preferential access to a high-fat or high-protein diet by some individuals may reflect new or exacerbated inequalities among hunter-gatherers. However, a special note is warranted concerning the use of certain faunal taxa, specifically bison, in this analysis. Archaeologists in Central Texas and the larger Southern Plains have long focused on bison as a key subsistence resource (Baugh 1986; Collins 2004; Creel 1990, 1991; Dillehay 1974; Huebner 1991; Lynott 1979; Prewitt 1981b; see Mauldin et al. 2010). One unintentional result of this analytical focus has been an unbalanced emphasis on primarily “male” activities (big-game, logistical hunting) to group subsistence and technologically-related activities. The current analysis of Zatopec fauna focuses on bison, but also considers the importance of bison in relation to other resources.

### ***Methodological Approaches: Local and Regional Comparisons***

In pursuing this research, analysis of Zatopec fauna is focused on two related questions: (1) patterns in food sharing among site occupants, and (2) changes in hunting strategies over time that reflect shifting availability of certain key resources (e.g., bison). Addressing these questions requires comparative research at two scales. One of these is local, and considers changes in the animal portion of diet-related behavior at Zatopec over time. The other scale is regional, and involves comparing the Zatopec assemblage to others in Central Texas. This comparison contextualizes faunal exploitation at Zatopec in relation to other sites occupied during the same time periods to present a larger view of food-getting strategies by Central Texas hunter-gatherers. This scale of analysis is helpful

for identifying periods during which some prey, such as bison, may have been pursued disproportionately over others, and corrects for possible biases in how regional patterns are understood as a result of site-specific practices or differential preservation. Important to each analysis is change through time and controlling for sample size (see Chapter 3 for how Analytical Units are defined). Poor preservation is an issue for all time periods represented at Zatopec, but especially earlier ones. Particular questions for each scale of consideration are discussed below, and both rely on a detailed taxonomic description of all fauna recovered from the site, including discussion of bone condition and possible modification (Chapter 9).

### *Local Scale*

Patterns of faunal consumption at Zatopec can contribute to an understanding of relationships among prehistoric occupants of the site by helping address patterns of resource sharing over time in relation to contributions to diet. Choices about which prey to pursue, as well as how differently valued portions are shared among people who hunt near the camp versus those pursuing large game can be assessed in the zooarchaeological record. Anticipating regional patterns, site data show that, as bison became more important in the Late Prehistoric, both medium- and small-body game became proportionally less well represented at Zatopec. Based on this evidence alone, it appears that big game hunting at the site came at the expense of other targeted prey, resulting in a scenario wherein the potential for status competition among big game hunters likewise increased. Important implications must also be considered for the effect of this marked shift in localized hunting strategy on intra-group social relations and labor roles with

respect to food procurement and processing (discussed in Research Domain 4, below). Within this context it is not possible to ascribe hunting success to any individual hunter at Zatopec. However, it remains possible to reconstruct some patterns of food resource allocation that took place at the camp and that represent relationships between logistical hunters and the rest of their social units.

With the relationship between successful hunting and some kinds of social benefits in mind, the Zatopec assemblage was assessed for evidence of uneven meat consumption. This first involves looking at what anatomical parts are present at the site and that provide general evidence for on-site sharing, versus which elements are absent. Second, analyses consider the nutritional (fat) value of each part in order to rank the nutritional quality of parts that were consumed (shared) on-site versus those consumed off-site. Since patterns of sharing between nuclear units at the site is not possible at Zatopec as it is at other, more pristinely preserved contexts (e.g., Enloe 2004), this analysis focused on uneven consumption between individuals directly responsible for hunting and those at camp with whom butchered remains would have been shared. John Speth (1990) argues that some hunters that pursue prey away from camp will often consume portions of the kill with the highest nutritional values at the kill site, and bring back lower-ranked portions. He suggests that, in order to evaluate nutritional equity in sharing, one needs to know (1) who gets each part of the carcass, (2) the fat content of each part, (3) the physiological condition of who gets fat-rich parts versus those who get lean parts. Because small- and medium-bodied prey can be hunted in relative proximity to the camp, including distances within which females hunt, assessing the unequal consumption of meat based on portion representation *within* a residential assemblage

addresses inequality between some men, those who participate in logistical, off-site hunting, and all others who remain at camp, including many (or most) women, and other males too young, old, or unskilled to participate in logistical forays.

Admittedly, factor 3, the physiological condition of site occupants, can not be known from available data. Yet factors 1 and 2, consumers of carcass parts and the fat value of each part, can be at least partially reconstructed. In the current analysis, this is accomplished by rank-ordering anatomical parts in terms of their nutritional value and statistically demonstrating the representation of each part in relation to the rest of the faunal assemblage for each time period (AU). In this analysis, rank-ordering elements by nutritional value (presented as a utility index; see Chapter 9) involved classifying them as high, medium, or low, following methods employed by Binford (1978) and Metcalf and Jones (1988). Within each time period, the frequency of each body part for bison is calculated to recognize possible shifts in meat-sharing behavior. These are compared with comparable data for antelope and deer, both classified as medium-sized. While data are limited by small sample size, they indeed show that as bison utility increases slightly in Toyah times, deer/antelope utility noticeably decreases. This comparison, which seems to indicate that deer/antelope are consumed in increasingly unequal ways when bison are more widely shared, allows analysts to suggest possible changes in meat-sharing behavior that occurred in relation to other animals during periods of increased bison frequency.

### *Regional Scale*

Following initial identification and description and consideration of local-scale patterns, the faunal assemblage at Zatopec is described in relation to others from the

region by measures such as assemblage diversity and richness. This includes utilizing the body-size data derived in the consideration of local patterns, as well species data as an indication of prey choice. Assemblage percentage by body size was first standardized by sample size and then compared with some other regional assemblages that have been reported in a level of detail sufficient for comparison with Zatopec. To the degree possible, this comparison follows the time periods identified at Zatopec, although common time periods are not defined the same way at all sites. Questions considered at this level of comparison include: How does bison availability change during each time period? During times of greater bison density (when overall representation increases), does bison consumption become more important to overall group diet than other prey choices? That is, during periods of bison increase, did other game become *less* important or were they relied upon as heavily as in previous periods?

An example of a pattern that could emerge from this comparison that would help address how labor was organized is a strong reliance on logistically-organized large-game hunting versus reliance on medium- and small-bodied animals for particular time periods. Highly diverse (in terms of body size) regional assemblages could be argued to be a measure of equitable contributions from many different kinds of individuals, such as those who engage in dangerous logistical hunting *as well as* those who remain closer to the camp, to group diets. In terms of bison availability in the region, earlier studies proposed periods of presence and absence for bison in parts of the Southern High Plains (Dillehay 1974). A recent evaluation of 141 components from 77 Late Archaic and Late Prehistoric sites from Central and South Texas (Mauldin et al. 2010), however, together with proxy data for paleoenvironmental and climate change, concludes that bison were

always present (at least over these time intervals), but that their frequency became more erratic in the Terminal Late Prehistoric (Toyah) period as temperatures warmed and rainfall became increasingly patchy. Other models have been proposed as well, with the accuracy of their reconstructions depending on how bison data are considered and placed into temporal categories (Figure 1-4). All studies agree, however, that bison became significantly more common in archaeological assemblages dating to the Toyah interval than in previous times. As a result, the dramatic increase of bison remains on Toyah sites does not seem to reflect a “new” focus on this resource as an important food (or economic; see Creel 1991) resource, but rather a marked shift toward logistically organized hunting strategies that focused on bison herds that were wandering ever farther afield in search of viable rangelands. The present analysis considers whether this pattern can be seen at Zatopec as well.

Regional assemblages were assessed for richness, or the diversity of species represented, and for evenness, or how evenly each species present was represented in the assemblage. Some changes are noted over time, with Archaic assemblages generally appearing more diverse and evenly distributed than earlier and later periods. However, important differences by site are also evident that must be taken into consideration when drawing conclusions about regional patterns of faunal exploitation.

### ***Conclusions***

This analysis looks at how faunal exploitation and consumption at Zatopec changed over time while also considering trends across the region. From a regional

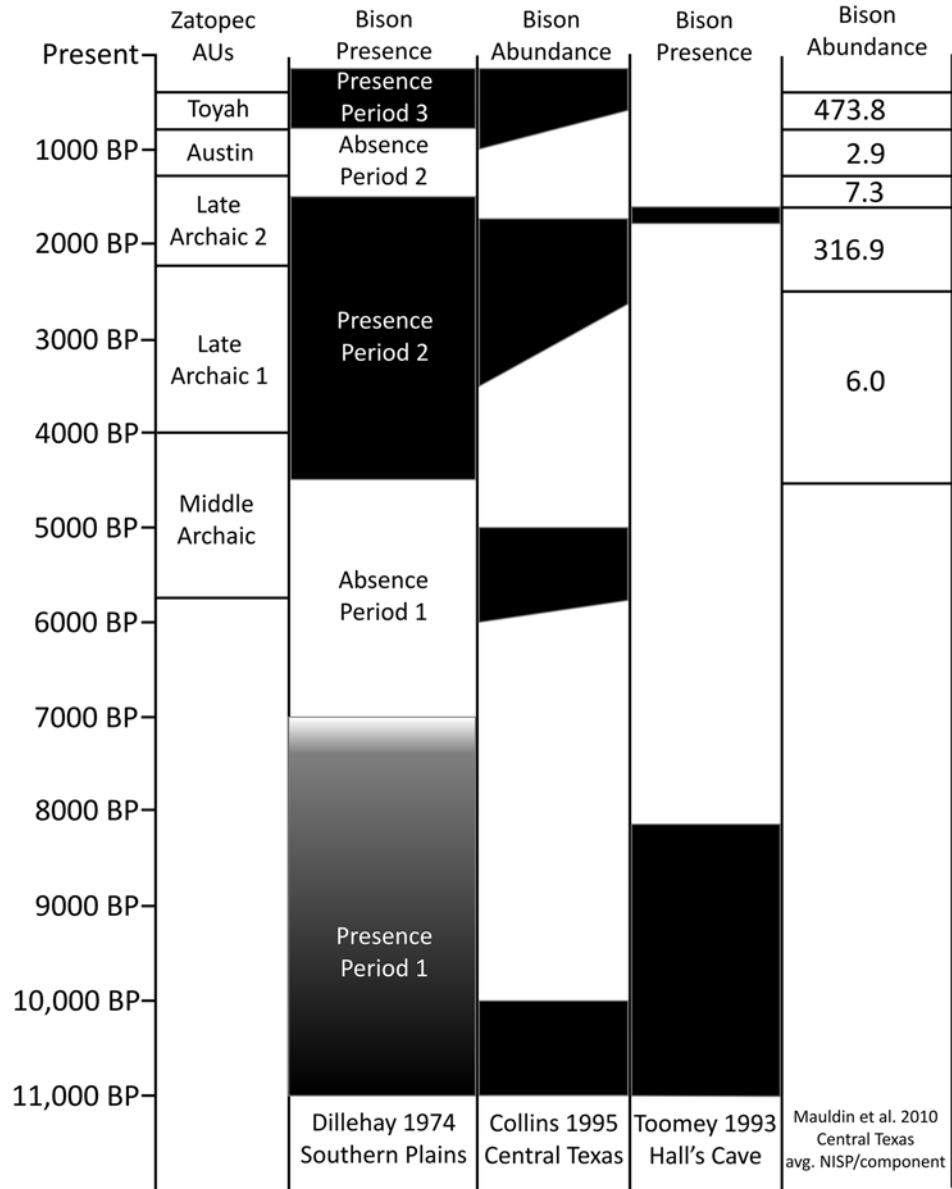


Figure 1-4. Models of bison abundance or presence by time for Central Texas. Presence or abundance depends on how bison data were collected and placed into time periods. Data from Zatopec are compiled and compared with these trends.

perspective, it is important to identify periods in the cultural chronology during which certain game, particularly bison, were both abundant (absolute abundance) and proportionately more important than other available game (relative abundance). This assessment help analysts understand the role that large-game hunting may have had on regional technological assemblages, the scheduling and tasking of labor for regional



hunter-gatherer societies at Zatopec and nearby sites, periods of change for labor-related gender roles, and possible scenarios for increasing competition between big game hunters. From a local perspective, it is important to consider how bison was shared among site occupants in relation to other game in terms of nutritional value, as well as the amount of time spent exploiting those additional resources. Using deer and antelope for a comparison of meat-sharing activities, some changes are indeed evident. Comparing frequency trends for these two classes against the occurrence of small game (not ranked by utility index) allows analysts to reconstruct important changes in behavior concerning the focused economic exploitation of particular prey, bison. In and of themselves, these data illustrate important shifts in economic (subsistence-related) activities and relationships between site inhabitants. However, they provide the most interpretive value of changing social relations expressed through resource exploitation behaviors when considered together with time-dependent technological data from Zatopec.

#### **RESEARCH DOMAIN 4: ORGANIZATION OF HUNTER-GATHERER TECHNOLOGIES**

Analyses of Zatopec's lithic assemblage include a very general assessment of risk-management behavior, as described in the Scope of Work (CAS 2007:26). However, effort is also given to understanding the technological contributions of different kinds of socially conditioned individuals to the archaeological record (Brumfiel 1991; Ortner 1984). An important assumption guiding this approach is that individuals who can be categorized by age, sex, role, expertise, and so forth are likely to have been socialized in such a way that strongly shapes or even determines much of their behavior (Ingold 1990).

Technological organization at Zatopec is addressed from multiple perspectives. Some perspectives can be characterized as “processual” in that they interpret assemblage patterning in relation to larger decisions about settlement mobility, the perceived riskiness of certain undertakings, and different strategies for resource exploitation. Most of this focus involves describing and comparing time-specific assemblages against each other in order to characterize circumstances to which hunters or tool makers were responding. Little interpretation is given to intra-assemblage variation that might be related to individual-level performances. Other approaches consider specifically how different kinds of individuals pursued certain tasks in common with or apart from other, similar individuals during the same and also different time periods in ways that introduce important technological variation into site-level assemblages. These approaches allow analysts to suggest changes in how labor roles were negotiated or defined over time, including not only those relating to age and skill or membership in a task group, but also by biological sex and perhaps even socially ascribed gender.

In our view, these approaches are complementary in that they provide different explanations for assemblage variation. On one hand, processual analyses address some external forces possibly resulting in technological change over time. On the other hand, focusing on individual-level behavior describes how parts of a time-controlled assemblage might vary from other parts of the overall tool kit for that same period. This analysis can also be used to define historical contexts for large-scale changes in labor roles between different kinds of individuals over time.

Lewis Binford (1965) perhaps anticipated a focus on intra-assemblage variation (although never followed it up) when he noted that culture was not uniform, but was

participated in differentially by people acting under different circumstances: “Within any one cultural system, the degree to which the participants share the same ideational basis should vary with the degree of cultural complexity of the system as a whole... a measure of cultural complexity is considered to be the degree of internal structural differentiation and functional specificity of the participating subsystems” (Binford 1965:205). One implication of this statement for hunter-gatherer technological variation is that not everyone in past societies performed the same kinds of tasks at the same level of efficiency regardless of distinctions by age, sex, or experience. A corollary to this point is that researchers can learn something of how these kinds of differences were conceived and expressed in ancient societies by studying the remains of their material technologies (Dobres 1995; Dobres and Hoffman 1994).

Analysis of technological organization is by far the most labor-intensive research domain undertaken for this project. In our view, this is where much if not most of the behavioral variability that defined different task groups, cultural adaptations, and individual identities is to be found. Individual-level behavior, and its resultant cultural variation, is often incorrectly characterized as an unworthy objective for “scientific” archaeological study (e.g., Owens 2008:80). However, it is fact that variation in technological performance by individuals pursuing any of a number of objectives, at different levels of aptitude, comprises much of what archaeologists see as assemblage-level patterning. Moreover, as discussed below, decisions made by individuals acting in response to shared or unique objectives, circumstances, and aptitudes have significant effects on group-level adaptations. In this way, this focus is an essential complement to traditional, “normative” approaches to hunter-gatherer technologies.

## **Processual Approaches: Logistical vs. Residential Moves and Expedient vs. Maintainable, Curated Tool Design**

Archaeologists understand that hunter-gatherer technological practices are integral parts of, or are “embedded” in larger systems of settlement mobility in response to environmental factors, and reflect requirements for exploiting certain resources, including the riskiness of some undertakings compared with others (here, risk is in terms of the costs, or what is lost when failing to acquire or procure a desired prey or resource). Some of these approaches are described here as they guide the present analysis.

Lewis Binford (1980) describes two idealized hunter-gatherer mobility strategies that have implications for technological variability. These strategies, termed *forager* and *collector*, focus on the spatial distribution of subsistence and other necessary resources and represent ends of a continuum; all hunter-gatherer adaptations represent some combination of these. They are defined by the frequency of two kinds of movements (or mobility), residential and logistical. Residential movements involve the relocation of bands from one camp to another. Logistical movements start from residential camps but are undertaken only by task-specialized groups in search of specific resources not found nearby. Binford (1980:10; original emphasis) notes that “logistically organized task groups are generally small and composed of skilled and knowledgeable individuals. They are not groups out “searching” for any resource encountered; they are task groups seeking to procure *specific resources* in specific contexts.” Because logistical task groups are made up of skilled and knowledgeable individuals, identifying the logistical components of larger economic processes is particularly important in the present analysis.

Forager adaptations involve mostly-intact bands moving from one plentiful resource area, or patch, to another. Because most resources utilized by these kinds of forager are found near camp sites, this adaptation is fairly generalized, with minimal differentiation between task groups and relatively homogenous tool kits. As resources necessary for sustaining forager bands are depleted, the group moves to a nearby patch. This happens relatively frequently, since predominantly nearby resources are exploited. Consequently, another aspect of forager patterns is that residential moves are frequent with respect to logistical movements. Collectors, in contrast, make relatively few residential moves. However, special-purpose logistical moves involving specialized task groups are common and allow the band to occupy a particular patch for longer periods of time. These two organizational strategies, foraging and collecting, are characterized by the relative importance of these two kinds of mobility: foragers occupy their residential camps for shorter periods and move them often, but occupy rich patches that do not require being supplemented with resources that are only available far away. Collectors occupy sites longer and make relatively fewer residential moves, but commonly send out task groups on logistical forays.

Important parts of this model for the present analysis are (1) discerning the kinds of tools used for logistical activities from those used in and around residential camps and (2) using these tool kits to model larger patterns of resource exploitation, including defining task groups such as those potentially comprising specialized producers. Tools that are often carried from camp to camp, made for use over extended (logistical) forays, or otherwise intended for prolonged use life are called *curated* (or formal) tools. In contrast, those intended for relatively short use lives are called *expedient* tools. Over the

past several decades there has been much discussion concerning important distinctions between curated and expedient tools.

Binford (1973) was among the first archaeologists to identify distinctions in how tools were viewed. Using ethnographic data, he defined curated tools as those kept for a long period of time and transported from site to site. These tools tend to have greater time invested in their production and, as a result, carry greater stylistic variation and meaning (style in this case refers to morphological variation specific to cultural groups). Binford contrasted curated tools with expedient technologies, in which tools are produced and discarded at the locus of use. Expedient tools typically lack diagnostic markers and have a low time investment. Binford (1977) later noted that expediency and curation are not discrete categories but were tool-use strategies that fall along a continuum; we define this as a continuum of potential versus realized utility (see below). Binford (1977) suggested several ways of assessing whether expediency or curation was emphasized in a site's assemblage. Markers of expedient strategies include an inverse relationship between exhausted and fractured tools and complete tools; a direct relationship between the number of tools and the debitage from tool production; and a direct relationship between the frequency of the tool and the frequency of its need. Curated technologies will have a random relationship between fractured and complete tools, a random relationship between tool frequency and debitage, and an inverse relationship in the frequency of the tool versus its importance.

Binford (1979, 1980) linked these two technological approaches to settlement mobility related to subsistence strategies, arguing that hunter-gatherers obtained food either by foraging or collecting. As noted above, foragers exhibit high residential

mobility, often traveling among areas that are high in aggregate resources. The duration of residence and distance to the next site are highly variable, however, and many foragers return to the same site year after year, increasing its archaeological visibility. Technology therefore varies from site to site based upon the most common resource being exploited, although foragers tend to favor an expedient tool technology.

On the other end of the continuum, collectors are organized around specialized task groups following logistical procurement strategies. Collector strategies are usually adopted when residential moves will not solve a resource problem. High seasonal variability and the erratic availability, spatially or by season, of key resources increase the importance of logistical procurement strategies. Because logistical mobility takes collectors away from predictable resources, the need to carry materials is great and the risks of resource encounters are relatively high compared with foragers. For this reason, tools need to be designed for portability and reliability, and strategies need to be implemented to help overcome unpredictable resource availability. According to Binford, collectors favor curated tool technologies that are maintained over long periods.

Douglas Bamforth (1986), however, warns against using curation to identify subsistence strategies, since there can be several reasons for curated technologies. He defines various types of curation, including tools that are 1) manufactured in advance, 2) used over time, 3) transported from place to place, or 4) recycled to serve a new function. Bamforth builds on how archeologists understand curated technologies by broadening the definition of “curation” to include different situations in which tools are used but that still involve greater planning and investment in tool manufacture than expediency.

Peter Bleed (1986) adds to the discussion of technological organization by categorizing tool systems according to “engineering design goals” in ways that expand on the curated-versus-expedient dichotomy. Tool systems, according to Bleed, are designed to be *reliable* or *maintainable*. Reliable designs are intended to function despite setbacks, and are selected when the cost of failure is high. Hunter-gatherers favor reliable designs in situations where prey or resource encounters are unpredictable, as tool failure in these moments carry greater costs since future encounters can not be predicted or even counted on. An example of a reliable design would be affixing a well-fashioned, labor-intensive spear tip, rather than a sharp flake that performs less well, to a shaft to hunt large game. On the other hand, maintainable tool systems can be repaired or quickly adapted as new circumstances arise; these systems are preferred when the need for them is constant. Bleed’s reliable-maintainable continuum fits well with Binford’s (1980) forager-collector sequence, with reliable tools being favored by logistical collectors and maintainable tools preferred by foragers. Though Bleed does not explicitly address expediency, he implicitly links it to maintainability in discussing the Yanomamo tool kit. He notes that bows can be used as spears: “...if a spear is needed to dispatch an animal, it is improvised on the spot and discarded after use” (1986:742). This description of a spear clearly falls under the various definitions offered for expedient tools (Bamforth 1986; Binford 1979).

Discussions of technological organization so far raise two important points. First, terms like curated, expedient, reliable, and maintainable do not describe *types* of artifacts, but rather the goals or strategies of tool makers to meet anticipated needs (Odell 2001). Second, an unintended outcome has been that more attention is given to reliable or curated tool forms over expedient ones. Some clarity for these issues is provided by



Bousman (1993, 2005), who reiterates that maintainability and reliability are design goals rather than typological categories. Also, he adds *expediency* and *efficiency* to reliability and maintainability as design goals (efficiency is a component of expediency and Bousman does not develop it further). Following Bleed, Bousman argues that tool systems share a variety of design goals; for example, reliability and maintainability are not exclusive, but represent some continuum of design choices. Relationships between expediency, reliability, and maintainability are graphed as a triangular chart (Figure 1-5).

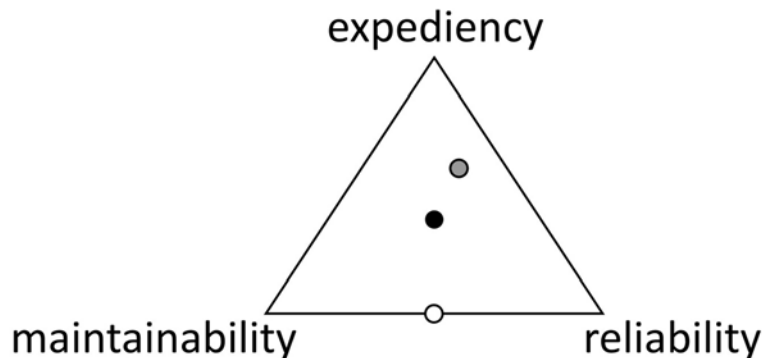


Figure 1-5. Hypothetical relationship between different design goals for tools. The black dot represents an artifact that shares equally in the three design goals. The white dot shows an artifact that shares maintainability and reliability equally but does not have expediency as a goal. The gray dot represents a third artifact sharing unevenly in all three design goals (after Bousman 2005:196).

Like Bleed, Bousman argues that overlaying maintainable-reliable design goals onto the forager-collector continuum is warranted, as it describes different subsistence strategies that led to different tool use patterns. Bousman concludes that foragers typically exhaust their maintainable tools before discard, while collectors discard their reliable tools prematurely to avoid failure during use. At some point, it is easier for foragers to replace maintainable tools, which are less labor intensive, than maximizing utility from them by maintaining them further through resharpening and recycling. For collectors, replacing reliable tools is a risk aversion strategy (although Bousman [2005]

correctly notes that associating expediency with foragers and formal tools with collectors is an over-simplification).

Although the discussion of design goals significantly improves Binford's concept of curated technologies by recognizing a continuum between goals, many examples still result in artifact categories, with analysts frequently labeling tools as "expedient" or "reliable." For example, Bleed (1986) concludes foragers use maintainable tools, while Sassaman (1992) argues women used expedient tools (also Gero 1991). Further complicating the issue is Bousman's (2005) observation that, although each design category represents a mode with continuous variables, the precise distribution of these goals is unknown for any particular artifact. This means that the three hypothetical artifacts shown in Figure 1-5 can not be quantified with respect to the degree to which maintainability, reliability, or expediency influence that tool's design. While analysts realize that more than one design goal informed the shape of any particular tool, to date the relationship of these objectives has yet to be assessed.

### ***Measuring Expediency over Curation as the Critical Variable***

Informed by the studies summarized above, the present analysis perceives that the critical variable for measurement is the actual or realized versus potential utility of a tool. Expedient tools are not intended to be used for extended periods, whereas both reliable and maintainable (i.e. curated) tools are, either through elaborate design (for reliable tools) or easily repaired or replaced attributes (for maintainable tools). The current analysis therefore relies heavily on (relative) expediency rather than reliability or maintainability to understand technological decisions about how to manufacture,

maintain, and discard tools. As noted, expediency is marked by low investment in tool production, lack of formal or repeated morphology, and *relatively* short duration of use. In terms of what expediency tells researchers about the past, expedient tools can be a rapid response to an unexpected need, or a planned response using minimal labor investment (Bousman 1993:69). (Presumably unanticipated needs would be few on residential camp sites like Zatopec that have been recurrently occupied for millennia.) Generally, they reflect a low-risk work environment in which tool failure does not jeopardize procuring or processing resources. They can also indicate a time-stressed work environment in which elaborate tool designs are not feasible. Finally, expediency, defined by simple morphologies and little modification or elaboration, can indicate limitations of technological knowledge (see below). Expediency potentially conveys a lot of important information about the *internal* (within-group) decisions and actions of tool makers and users, and only moderate information about larger, external factors. Expedient tools are curated only short distances, at least in areas where materials to make or replace them are plentiful. For this reason, in such areas they are poorly suited for reconstructing site occupation histories or mobility patterns. In general, expedient tools lack the kinds of stylistic information conveyed by formal designs (e.g., distinctive projectile point types; see Chapter 7) that archaeologists often use to reconstruct regional patterns.

On the other end of the continuum in terms of greater potential use are curated tools, or those that are preserved over time and perhaps space. Curated tools include artifacts that were produced in one location and then potentially transported elsewhere as one way to extend their use lives, as well as tools that are exhaustively resharpened and recycled. Because reliability and maintainability, as design goals, both serve to extend the

potential use life of a tool, they are considered together as having greater potential utility than expedient tools (see Shott 1996 for parallel discussion of curation).

To address problems of categorization and quantification described above, a numeric scale is used to indicate the continuum between maintainability/reliability and expediency (see Chapter 11). This scale is designed to accommodate several factors. First, any particular tool form (such as utilized flakes) can have varying design goals within its category, and also show design changes from one time period to the next (Bleed 1986; Bousman 1993). This scale, described below, recognizes changes in design and patterns of use within a tool category, as well as within a category but over time as external and internal conditions change. Secondly, the scale reflects the inverse relationship described by Binford (1977) between expediency and time investment in tool production, with more elaborate tools starting higher on the scale (less expedient) than simple ones. Third, degree of use is a strong indicator of maintainability, as resharpened tools are considered more curated and less expedient (Bamforth 1986). Measurements taken for each tool type are designed to quantify as nearly as possible how intensively tools are used, and these data produce a score that allows analysts to locate the tool in question on the scale. Finally, tool types are intuitively grouped along a continuum of intensity of preparation for use: flake tools are more expedient than unifaces, bifaces are more maintainable/reliable than both unifaces and flake tools, and some overlap between these categories is possible.

Based on these factors, a 100-point scale was developed to measure the expediency of artifacts, with lower point values indicating expediency and higher values reflecting greater maintainability or reliability (Figure 1-6). The scale range was

arbitrarily chosen, but can easily accommodate future analyses without substantial revision. The three tool types used in this analysis (flake tools, unifaces, and bifaces) are assigned to point ranges within the scale: flake tools are from 0-30 points, unifaces from 30-70 points, and bifaces from 60-100 points. Overlap between unifaces and bifaces recognizes differences in potential utility between well-made unifaces and crude bifaces. Flake tools that are extensively made or used are classed as unifaces, so there is no overlap between these categories. Based primarily on the amount of evident use plus modification in anticipation of utility (and also unrealized potential for use in the case of some tools), this scale is referred to as the Expediency:Maintainability/Reliability scale or E:M/R. In our view, the strength of this scale is not only that it allows analysts to show relationships between expediency and maintainability in tool design, but also that it allows researchers to recognize, quantify, and discuss these changes over time by using empirical trends that can be reproduced or independently evaluated.

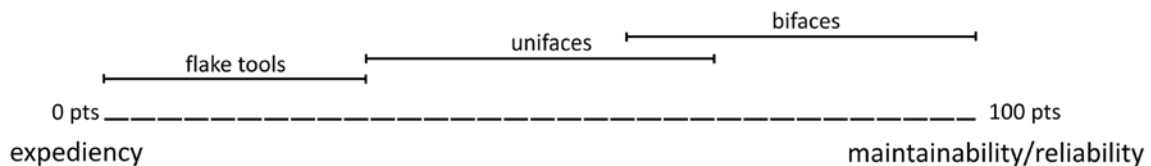


Figure 1-6. Expediency:Maintainability/Reliability (E:M/R) Scale. This graphic shows the point scale using expediency and maintainability/reliability as design goals rather than categories. This scale produces a quantifiable result of the expediency of each artifact without pigeonholing artifacts into a specific category. Dashed line represents an undefined transition area between expediency and maintainability/reliability.

A replicable scoring system for each tool type is based on measurements and observed features. While this system uses similar criteria for each artifact category, different attributes are measured for each tool form. Placement of these three categories on the continuum reflects the intuitive recognition that each represents different amounts of labor investment and design intended, in part, to allow for greater utility. The rating

system for each tool type is described below, and results of this analysis are presented and discussed in Chapters 7 and 11. One beneficial result of the kind of 'scoring' used for this analysis is that expediency is calculated as a value in relation to other artifacts in the same assemblage rather than assigned as an absolute value, and so reflects the kinds of choices made by discrete groups of prehistoric tool makers and users.

Once E:M/R values are calculated for all artifacts as described below, they are weighted based on the tool category they had been assigned. As discussed, flake tools are considered far more expedient than unifaces and bifaces, and all unifaces are more expedient than most bifaces. To appropriately situate each tool on the E:M/R scale, 30 points were added to each uniface score, and 60 points were added to each biface score. In order to assess differences in how certain tools were designed and used by time period, and also to recognize technological changes over time, mean E:M/R values were calculated for each tool type by time period. This score allows analysts to note changes in expediency in different parts of tool kits by time. Such results can indicate periods when logistical forays were relatively more important than others or periods during which expediency was favored. Combined with overall increases or decreases in certain tool categories, such as utilized flakes, analysts can identify periods during which task groups theoretically associated with different kinds of tools made significant changes to the way they designed and used their tools. In order to identify overall increases or decreases in expediency, an E:M/R ratio was derived for each time period by dividing the total points in each cultural era by the total possible points. Changes in overall E:M/R are assessed statistically to identify significant shifts in technological organization by time.

### *Flake Tools*

Flake tools have a very short production time and lack a consistent morphology; size and flake type are highly variable within each time period. As a result, expediency is assessed by visible macroscopic wear in relation to the amount of edge that has potential for use. Following the method developed by Prilliman and Bousman (1998), the circumference, total edge modification (TEM), and potential edge modification (PEM) are measured (see Chapter 7). TEM was then divided by PEM to obtain a TEM:PEM ratio. In order to ensure that the size of the tool was also considered, a second ratio, Total Edge Modification to Circumference (TEM:Circ) was also used. Each ratio was then divided into 6 categories, 5 of which were based upon an even division of the point range allotted to flake tools on the E:M/R scale (0-30). Recorded TEM:PEM values ranged from 8.11%-100%, and TEM:Circ values ranged from 1.89%-100%. Based on these results, TEM:PEM ratios and TEM:Circ values were initially placed on different parts of the E:M/R scale (Table 1-1). The score in each category was then multiplied by 3 points and summed. This created a possible range of 0-30 “expediency points” that allowed that particular artifact to be located along the E:M/R scale based on the degree to which it (1) was designed for use and (2) shows use.

Table 1-1. TEM:PEM ratios and TEM:Circ values for flake tools and their corresponding placement on the E:M/R scale.

TEM:PEM Ratio	TEM:Circ Ratio	E:M/R Scale
8.11%-26.49%	1.89%-21.51%	0
26.5%-44.87%	21.52%-41.13%	1
44.88%-63.25%	41.14%-60-75%	2
63.26%-81.63%	60.76%-80.37%	3
81.64%-99.99%	80.38%-99.99%	4
100%	100%	5

### *Formal Unifaces*

Formal unifaces were also scored using the TEM:PEM ratio and the TEM:Circ. Since the range for these two ratios was found to be smaller than that of flake tools, these tools were initially scored from 0-4 on the E:M/R scale (Table 1-2; as with flake tools, this initial scoring is modified by additional factors). For unifaces, the TEM:PEM ratio was judged to be more indicative of curation than TEM:Circ, so the TEM:PEM score was multiplied by 4, and the TEM:Circ was multiplied by 3, resulting in a possible total of 28 points for any single uniface. Because a range of 40 points was give to this tool category on the E:M/R scale (from 30-70), the remaining twelve points were assigned based on the amount of cortex remaining on their dorsal surfaces, and the regularity of the artifact's form. Unifaces with little to no cortex are considered more labor intensive to manufacture, and therefore less expedient. Total (100%) dorsal cortex received 0 points, 50%-99% cortex received 1 point, 1%-49% cortex received 2 points, and 0% cortex received 3 points. Unifaces with an irregular form or those which were completely amorphous were given 0 points. Unifaces with a regular, definable form were given 3 points, and those falling into a formal, existing typological category (e.g., Clear Fork tools) were given 9 points.

Table 1-2. TEM:PEM ratios and TEM:Circ values for formal unifaces and their corresponding initial placement on the E:M/R scale.

TEM:PEM Ratio	TEM:Circ Ratio	E:M/R Scale
23.08%-42.31%	14.00%-35.50%	0
42.32%-61.54%	35.51%-57.00%	1
61.55%-80.77%	57.01%-78.50%	2
80.78%-99.99%	78.51%-99.99%	3
100%	100%	4



## *Bifaces*

Biface preforms and tools were analyzed in a different manner than flake tools and unifaces. The degree to which bifaces had been used was still the primary factor for determining the extent of an artifact's potential utility; however, because many of these artifacts were preforms, or early-stage reductions for other, ultimate forms, that were often used, TEM:PEM and TEM:Circ ratios were not used. Rather, the outline of each artifact was divided into four sections labeled Edge 1, Edge 2, End 1, and End 2. Both faces of each section were assessed for visible (macroscopic) wear and attrition. Wear was defined as any portion of the edge which had been crushed, or where small flakes were present extending from 1 mm to 3 mm onto the face. When use was present, its intensity was subjectively evaluated. (To maintain consistency for this measurement, all observations were made by the same analyst.) Each utilized section (edges and ends) was categorized as light, moderate, heavy, or fractured with use based on the extent of the observed wear. Unmodified edges received no score, modified without use-wear was given a score of 1, light use a score of 2, moderate a score of 4, and heavy a score of 7. If an edge or end was fractured from use, then that edge was also scored as "heavy." The score for both edges and both ends was then summed for a total possible score of 28. Another point was added to the sum if an edge or end was fractured from use. Beveling was given 5 points since it is a clear indicator of resharpening. Other distinctive forms of edge-modification such as notching or serration were given 2 points. Finally, the amount of cortex was scored based on observed measurements: >50% cortex = 0 points, 1%-49% cortex = 2 points, and 0% cortex = 4 points.

### ***Discussion of Expediency: Maintainability/Reliability Measures***

The foregoing is, admittedly, a complex commentary on but one approach to understanding hunter-gatherer technological organization at Zatopec. In our view, one reason for this complexity is that archaeologists have dealt inconsistently with the phenomena of tool expediency and tool curation (see Rahemtulla 2006; Shott 1996). While recognizing technological trends over time are one ultimate objective of this research, differences *between* tool categories for the same time period are also significant; these are presented in Chapter 7 while larger diachronic trends are explored in Chapter 11. Importantly, the results of our expediency assessments need to be considered along with relative changes in the frequencies of different tool types by time. For example, it is essential to remember that (expedient) flake tools *and* (curated) bifaces increase in Toyah times while considering that *all* tools are also used much more intensively at this time (Chapter 7 and 11). Based on these findings, we can not conclude from the greater frequency of informally fashioned but also more heavily used (less expedient) tools in Toyah times that Zatopec residents were either more residentially mobile or had adopted a logistical adaptation. Our results are more complex, and require exploring additional factors to explain how tools associated with logistical forays can increase in number and use intensity at the same time that tools theoretically associated with expedient tasks *also* increase in number and use intensity.

Informed by a long history of analysis on hunter-gatherer technological decisions, this analysis uses a quantifiable scale of expediency-to-maintainability/reliability to analyze the tools found at Zatopec. We consider whether design goals within a category of artifacts (such as flake tools, formal unifaces, or bifaces) varied from one cultural era

to another, and also whether differences can be seen in how different tools were designed and used within a particular period. By developing an innovative (if complex) system to evaluate these design goals, a more specific understanding of how tool makers and users designed their tool kits is presented. This model, when evaluated with other lines of evidence, such as different technological behaviors that may be associated with different task groups (see below), allows researchers to suggest more realistic explanations for the significant changes in hunter-gatherers technological organization that are seen.

### **Sources of Intra-Assemblage Technological Variation**

Important goals of this analysis include understanding technological strategies involving specialized production or patterns of labor allocation by age, skill, or sex over time. In contrast to the focus on expediency versus potential tool utility described above, in this case attention is given to how individuals participated in important tool-making or food-getting activities differently according to their experiences, priorities, and aptitudes. Within the potential spectra of different kinds of socially conditioned prehistoric people, the current analysis also focuses on divisions of labor according to age and sex roles, enculturation processes as neophytes acquire important craft skills, and the possible emergence of specialized production during particular intervals of the site's history. In this aspect of the present analysis, "technology" describes how different kinds of people mediated their physical and social surroundings through tool production and use.

Important to view is that the views and concerns of all of the participants in a coherent social group are somehow represented in that technological system. Following Binford (1965) and many others, we observe that not all of the prehistoric occupants of Zatopec

or its surrounding region were identical in nature, and suggest that these differences can be ascertained to some degree through appropriate kinds of technological analyses. Dobres and Hoffman (1994:215-216) summarize a social understanding of technology, which for them “equally concerns social interaction (e.g., divisions of labor), belief systems (e.g., origin myths and their relationship to the cultural and physical landscape), and practical knowledge of techniques and the environment.” The present analysis, which relies almost exclusively on Zatopec’s stone tool record, focuses on what these authors call social interactions and practical knowledge.

### *Divisions of Labor*

Divisions of labor based on age and sex have long been noted in historic and contemporary hunter-gatherer societies (Brown 1970; Burton et al. 1977; Dahlberg 1981; Frink and Weedman 2005; Hayden 1981; Hill et al. 1987; Hurtado et al. 1985; Lee and DeVore 1968; Murdock 1937, 1949; and others). In looking at different Native American cooking techniques for instance, Ellis (1997) reviewed over 100 ethnographic and ethnohistoric sources from North America to create an analogous framework for understanding prehistoric burned rock middens in Texas. Each of the 14 different cooking techniques described involved some division of labor by age or sex (Ellis 1997: Table 3). Archaeologists presume that labor was similarly organized in prehistoric societies (e.g., Meltzer 2004; Sassaman 1992; Waguespack 2005:668), and a few approaches are used to understand different kinds of social actors based on patterns in the material record.

One approach to ascribing tasks to a specific sex is *task differentiation*, involving use of ethnographic or historic examples to understand the past by way of analogy. In her study of the Plains Hidatsa, Janet Spector (1998) notes that women collected and processed all food and natural resources and constructed and maintained domiciles. Men were responsible for killing bison during the summer and also for conducting rituals that accompanied these hunts. Hidatsa women worked within a one-mile radius of camp, often carrying out their tasks within or immediately around the lodge. Men often conducted their work at much greater distances. This study can provide a basis for spatial frameworks that can in turn be used to formulate hypotheses regarding where evidence of certain activity areas may be found. Such studies can also be used to infer which tools were used in those tasks (e.g., Costin 1996), thereby building a model for men's or women's work spaces and tool kits that can be compared with the archaeological record.

Another common approach involves analyzing burials, burial contexts, and grave goods. Bioarchaeological analyses of sexed individuals have strong potential to reveal evidence of wear or repetitive motions that accrues through sexually ascribed tasks. Larsen (1997:257, cited in Gilchrist 1999:43), for example, observed wear patterns on teeth suggesting that women in some societies chewed plant fibers for basket-making or hide for clothing or structures. Ogilvie (2005) analyzed 199 femora from 139 individuals representing Late Archaic foragers in Texas, Late Archaic-to-Early Agricultural part-time agriculturalists in Arizona, and agriculturalists from Pottery Mound, New Mexico. Ogilvie considered the effects of the transition from foraging to established agricultural practices on skeletal morphologies and noted that, as agriculture became important, men continued to be highly mobile while women's locomotion steadily decreased. Given

sufficient population sizes, studies such as these can help archaeologists understand aspects of labor divisions that can illuminate patterns in the material record.

Problems exist, however, with both approaches to recognizing prehistoric gendered labor divisions. Bioarchaeological analyses require large comparative samples before representative trends in burial data can be recognized, analyzed, and understood. Isolated or small burial clusters do not provide irrefutable evidence for how particular tasks were carried out across societies by sex or age. Additionally, considerable overlap in grave goods associated with both male and female burials has been noted in some cases (e.g., Knutsson 1999, cited in Sternke n.d.: 6), suggesting that men and women performed many of the same tasks in some ancient societies (see below). For example, analysis of approximately 227 burials at the Ernest Witte and Leonard K cemeteries, 41AU36 and 41AU37, found no consistent patterning in the associations of certain artifact types with either age or sex categories (Hall 1981:88). The only exception was that bone artifacts (awls, needles, points, etc.) were never found with children.

Even in cases where certain kinds of tools are strongly correlated with a particular sex, care is required before a given task can likewise be ascribed to that sex. For example, analyses of mortuary assemblages in Texas suggest that most artifacts identified as knapping implements or tool kits are associated with male burials (Dockall and Dockall 1999: Table 4). However, these data do not indicate that *only* males performed stone working activities. To the contrary, to the extent that grave goods by themselves indicate the tasks people carried out, the manufacture and use of stone tools *in general* does not appear to have been gender exclusive. To conclude that knapping paraphernalia in mortuary contexts indicates the predominant or even exclusive engagement in stone

working by sex should also involve bioarchaeological analyses for repetitive stresses or locomotor patterns associated with that activity. Consideration should also be given to different kinds of stone working. For example, producing projectile points for hunting large game can involve altogether different strategies and techniques than the production of informal tools, scrapers, gouges, drills, and other items for domestic activities, maintenance, or processing (see Chapter 7). In the absence of data to the contrary, it is reasonable to expect that different kinds of tools may have been produced by members of prehistoric societies who used those tools.

Lacking robust samples of grave goods exclusively associated with sexed individuals bearing corroborating skeletal pathologies indicating certain repetitive motions, perhaps the best approach to understanding sexual divisions of labor involves constructing analogous frameworks for posing hypotheses that can be tested against archaeological data. To this end, Ember and Ember (1995) argue that global or cross-cultural ethnographic analogy is more appropriate than particularistic, site/region-specific comparisons when searching for positively correlated variables to be used for archaeological reconstruction.

A number of ethnographies were conducted from the late-nineteenth century to the early half of the twentieth century, many of which have been used to in massive continental or world-wide syntheses of technological, social, demographic, health, and other attributes of extant hunter-gatherer societies. For example, Driver and Massey (1957) compiled information about subsistence, material culture, economics, and social organization from 238 societies from North, Central, and South America. Another synthesis meeting Ember and Ember's (1995) criteria for cross-cultural sampling is by

Murdock and Provost (1973), who compiled data on the division of labor by sex from 185 of the 186 world-wide societies sampled by Murdock and White (1969). The study by Murdock and Provost (1973: Table 1) indicates the kinds of patterning that has been associated with males and females in historic and contemporary societies. To the extent that this sample accurately indicates valid, positive correlations between certain tasks and by whom they were conducted, it can be used to understand the record at Zatopec.

In examining divisions of labor by sex, Murdock and Provost (1973) identified fifty important technological activities and examined their ethnographic database for how these tasks were conducted. For tasks that were present, each was scored 1 in cases where they were an exclusively male undertaking, 0.8 when they were predominantly male, 0.5 when there was approximately equal participation by males and females, 0.2 when the task was predominantly carried out by females, and 0 when it was associated exclusively with females. The sum of all responses for a task was then divided by the total number of responses for that task to calculate an index of masculine participation. An index of “100” indicates exclusive male participation, and lower indices reflect increasing female participation in the task.

In spite of problems of male over-representation and of defining what constitutes an “important technological task,” this study provides a useful indication of cross-cultural associations between some activities and sex. Part of the bias against female involvement can be overcome by subtracting the index value (which scores male participation) from 100; the result is the index score for female participation in that same task (Table 1-3). When graphed, these trends reflect some cross-cultural regularities that archaeologists



can use to identify tasks that may have been exclusively gendered, primarily gendered, or relatively non-gendered in the past (Figure 1-7).

Table 1-3. Indices of participation in “technological” tasks by sex for 185 societies; from Murdock and Provost (1973: Table 1).

<b>Task</b>	<b>M<sup>1</sup></b>	<b>N<sup>2</sup></b>	<b>E<sup>3</sup></b>	<b>G<sup>4</sup></b>	<b>F<sup>5</sup></b>	<b>Male Index</b>	<b>Female Index</b>
Hunting large aquatic fauna	48	0	0	0	0	100.0	0.0
Smelting of ores	37	0	0	0	0	100.0	0.0
Metal working	85	1	0	0	0	99.8	0.2
Lumber working	135	4	0	0	0	99.4	0.6
Hunting large land fauna	139	5	0	0	0	99.3	0.7
Work in wood	159	3	1	1	0	98.8	1.2
Fowling	132	4	3	0	0	98.3	1.7
Manufacture of musical instruments	83	3	1	0	1	97.6	2.4
Trapping small land fauna	136	12	1	1	0	97.5	2.5
Boat building	84	3	3	0	1	96.6	3.4
Stone working	67	0	6	0	0	95.9	4.1
Work in bone, horn, and shell	71	7	2	0	2	94.6	5.4
Mining and quarrying	31	1	2	0	1	93.7	6.3
Bone setting and surgery	34	6	4	0	0	92.7	8.3
Butchering	122	9	4	4	4	92.3	7.7
Collecting wild honey	39	5	2	0	2	91.7	8.3
Land clearance	95	34	6	3	1	90.5	9.5
Fishing	83	45	8	5	2	86.7	13.3
Tending large animals	54	24	14	3	3	82.4	17.4
House building	105	30	14	9	20	77.4	22.6
Preparing soil	66	27	14	17	10	73.1	26.9
Net making	42	2	5	1	15	71.2	28.8
Making rope or cordage	62	7	18	5	19	69.9	30.1
Generating fire	40	6	16	4	20	62.3	37.7
Bodily mutilation	36	4	48	6	12	60.8	39.2
Preparing skins	39	4	2	5	31	54.6	45.4
Gathering small land fauna	27	3	9	13	15	54.5	45.5
Crop planting	27	35	33	26	20	54.4	45.6
Manufacture of leather products	35	3	2	5	29	53.2	46.8
Harvesting	10	37	34	34	26	45.0	55.0
Crop tending	22	23	24	30	32	44.6	55.4
Milking	15	2	8	2	21	43.8	56.2
Basket making	37	9	15	18	51	42.5	57.5
Burden carrying	18	12	46	34	36	39.3	60.7
Mat making	30	4	9	5	55	37.6	62.4
Care of small animals	19	8	14	12	44	35.9	64.1
Preserving meat and fish	18	2	3	3	40	32.9	67.1

Loom weaving	24	0	6	8	50	32.5	67.5
Gathering small aquatic fauna	11	4	1	12	27	31.1	68.1
Fuel gathering	25	12	12	23	94	27.2	72.8
Manufacturing clothing	16	4	11	13	78	22.4	77.6
Preparing drinks	15	3	4	4	65	22.2	77.8
Pottery making	14	5	6	6	74	21.1	78.9
Gathering wild vegetal foods	6	4	18	42	65	19.7	80.3
Dairy production	4	0	0	0	24	14.3	85.7
Spinning	7	3	4	5	72	13.6	86.4
Laundering	5	0	4	8	49	13.0	87.0
Water fetching	4	4	8	13	131	8.6	91.4
Cooking	0	2	2	63	117	8.3	91.6
Preparing vegetal foods	3	1	4	21	145	5.7	94.3

1. M indicates participation exclusively by males; score “1” in the male index of participation and “0” in the female index.
2. N indicates participation predominantly by males; score “0.8” in the male index of participation and “0.2” in the female index.
3. E indicates approximately equal participation by males and females; score “0.5” in both male and female indices of participation.
4. G indicates participation predominantly by females; score “0.8” in the female index of participation and “0.2” in the male index.
5. F indicates participation exclusively by females; score “1” in the female index of participation and “0” in the male index.

One obvious concern for using cross-culturally derived data in this manner is in comparing residentially mobile hunter-gatherers with groups that occupied vastly different environments, practiced agriculture, were residentially sedentary, or were politically complex with established social hierarchies. These groups are fundamentally different in so many ways that using their cultural patterns to formulate hypotheses for understanding residentially mobile, largely egalitarian prehistoric hunter-gatherers can be seriously misleading. Furthermore, many of the activities listed in Table 1-3 were not relevant to Archaic-period hunter-gatherers in Central Texas, including hunting aquatic fauna, ore smelting, metal working, tending large animals, soil preparation, loom weaving, dairy production, spinning, and others. Some tasks, such as pottery making, increased in importance in the Late Prehistoric periods (see Chapter 2 for regional culture

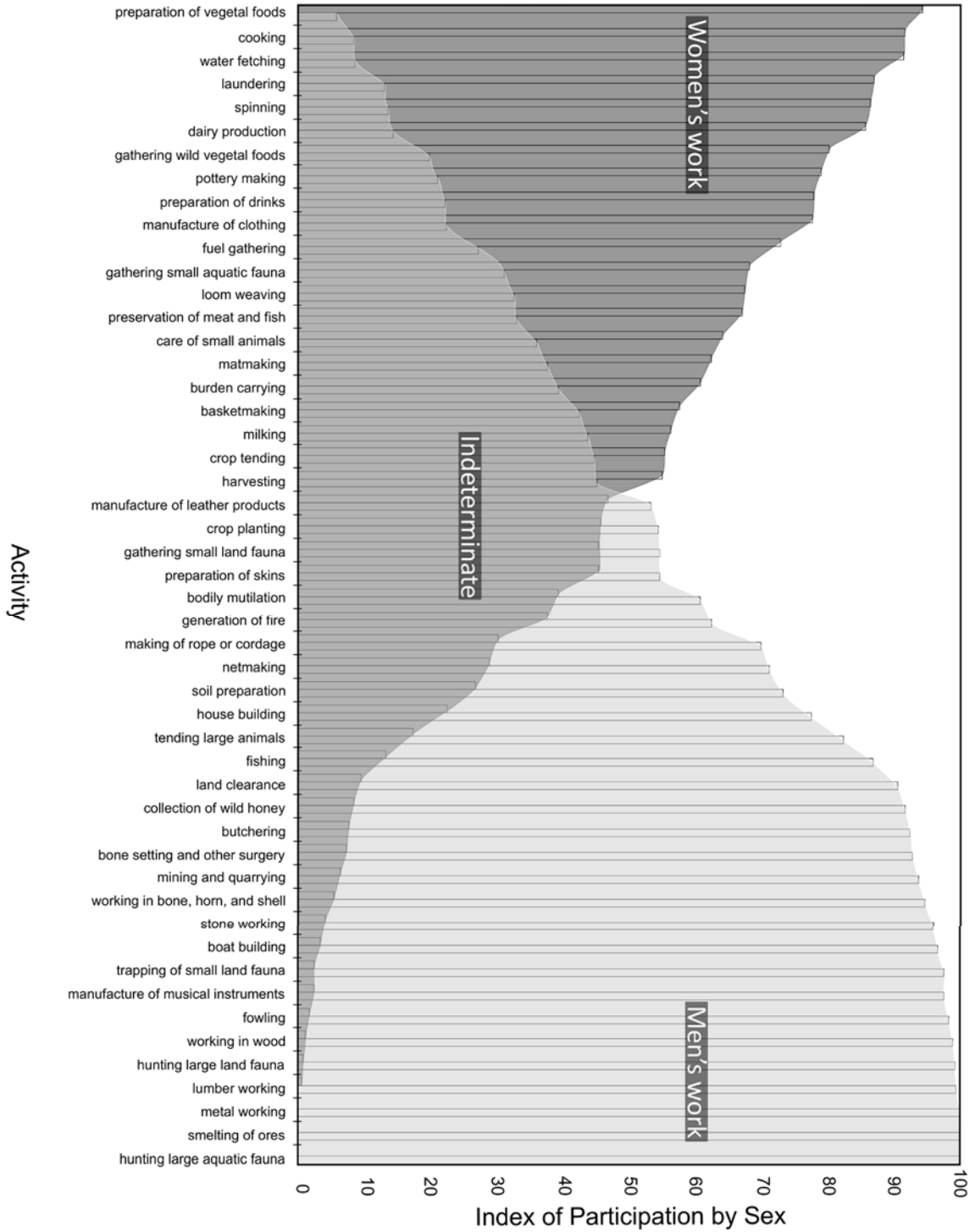


Figure 1-7. Graphed indices of male and female participation in “technological” activities listed in Table 1. Female involvement is indicated by the dark curve descending from left to right and male involvement is shown by the light curve that descends from right to left. Activities in which both males and females participate to varying degrees are indicated where the two curves overlap.

history). Still, many of the tasks listed in Table 1-3 and illustrated in Figure 1-7 were important in Central Texas and warrant consideration.

Contextualizing further the organization of these tasks by sex is possible by considering the degree to which the activities illustrated in Figure 1-7 are carried out among 33 societies specifically from North America. Such societies are presumed to have more in common with the prehistoric groups that occupied Zatopec, which can not be known (see Chapter 8). These include the Ingalik, Aleut, Copper Eskimo, Montagnais, Micmac, Saulteaux, Slave, Kaska, Eyak, Haida, Bellacoola, Twana, Yurok, Pomo, Yokuts, Paiute, Klamath, Kutenai, Gros Ventre, Hidatsa, Pawnee, Omaha, Huron, Creek, Natchez, Comanche, Chiricahua, Zuni, Havasupai, Papago, Huichol, Aztec, and Popluca (Murdock and White 1969: Table 1). Some of these societies (e.g., Aztec) had little in common with the prehistoric hunter-gatherers of South-Central Texas. Still, this list further eliminates many social groups that are or were unrelated to any society that ever occupied the current project area. Murdock and Provost (1973: Tables 2, 3, 4, 5) break down the tasks from each global region according to the degree to which they were carried out predominantly by one sex or the other. Of these, evidence for nine tasks in particular is present at Zatopec for at least one time period. These include hunting large land fauna, trapping small land fauna, stone working (which includes manufacture of stone tools; Murdock and Provost 1973:205), butchering, preparation of skins, gathering small land fauna, pottery making, gathering wild vegetal foods, and cooking (Table 1-4).

Table 1-4. Indices of sexed participation in “technological” tasks considered important to the archaeological record at Zatopec for 33 North American societies; from Murdock and Provost (1973: Table 2, 3, 4, 5) and Murdock and White (1969: Table 1).

<b>Task</b>	<b>Male Index</b>	<b>Female Index</b>
Hunting large land fauna	98.7	1.3
Trapping small land fauna	95.5	4.5

Stone working	92.9	7.1
Butchering	79	21
Preparation of skins	30.7	69.3
Gathering small land fauna	47.5	52.5
Pottery making	13.8	86.2
Gathering wild vegetal foods	12.3	87.7
Cooking	4.2	95.8

On the basis of cross-cultural comparisons alone, activities listed on either end of the continuum from men's to women's work in Figure 1-7 can be used to suggest which tasks may have been carried out exclusively or nearly exclusively by a single sex in the past. When the organization of these tasks is considered for only the 33 North American societies listed above, some changes occur. In particular, the frequency of female participation in hunting large land fauna, trapping small fauna, stone working, trapping gathering of small land fauna, and cooking increases slightly (less than 3 index points). Female participation increases moderately (3-13.3 index points) in butchering, trapping small land fauna, pottery making, and gathering wild vegetal foods. Female participation in the preparation of skins increased substantially, from a global index of 45.4 to a North American index of 69.3.

These comparisons and discussions show that, according to cross-cultural sampling at both global and continental scales, some tasks are carried out predominantly but not exclusively by one sex or the other. Both sexes contributed evenly to other tasks, such as gathering small land fauna. How different tasks were conducted by sex has very important implications for technological organization at Zatopec over time. These results are used to offer the following important proposition regarding labor divisions by sex:

Some tasks were carried out by males and females in approximately the same proportion and manner during the prehistoric occupation of Zatopec as indicated by the cross-cultural ethnographic data.

*Archaeological Evidence for Gendered Divisions of Labor at Zatopec*

Realistically, no irrefutable answer can be given for this important proposition. Still, certain testable implications, if they can be demonstrated at Zatopec, support the proposition's validity. In future research, these implications can be used to pose more developed testable hypotheses concerning labor divisions by sex. These implications involve associating certain tools with sexed individuals; recognizing patterns in tool use; recording activity areas reflecting gendered use of space; and detecting manufacturing patterns reflecting different approaches to tool design, maintenance, and discard. These implications are as follows.

**Implication 1.** Tools used for tasks associated primarily with a particular sex in the cross-cultural ethnographic sample will also be primarily associated with that sex in certain archaeological contexts.

This implication has been addressed in the discussion about analysis of mortuary remains. Given the high participation index by sex for certain tasks, such as stone working (mostly men) or cooking (mostly women), it can be reasoned that aspects of the tool kits and technologies related to each task had certain components that were more familiar to, and closely associated with, people carrying out those tasks than to others. For example, in their review of flint knapping tool kits found in mortuary assemblages in Texas, Dockall and Dockall (1999: Table 4) note that items such as antler billets, flakers, and punches; hammerstones; whetstones and abraders; and ocher (Dockall and Dockall 1999: Table 2) are found with males in 85.7% (12 of 14) of the sexed burials in their

sample. One conclusion that can be reached based on these associations is that they reflect the degree to which flint knapping work involving billets and *related* items was conducted by males and females in the region and time periods represented by these burials. This conclusion should be verified by a larger sample, but it happens to closely mirror trends noted by Seeman (1985) from mid-continental North America, in which similar knapping tool kits are associated with males in 86.6% (26 of 30) of positively sexed burials found with such assemblages.

To the degree that these two studies accurately characterize larger social patterns, it can be proposed that from approximately 13-15% of women in some prehistoric bands engaged in stone working that involved billets and related paraphernalia. This number compares favorably with the participation index of 7.1 for female participation in generalized stone working calculated by Murdock and Provost (1973) from North American societies, and can be used to support the assertion that most prehistoric billet flaking was a male pursuit. While associations such as these are useful for understanding relationships between male and female participation in knapping in a general way, no comparable burial data are available from Zatopec that can be used to draw conclusions about how that billet flaking was organized at the site. Nevertheless, based on these data, CAS proposes that billet flaking at Zatopec was primarily, though not exclusively, a male pursuit (see below, also Chapters 11 and 12).

**Implication 2.** Tools used for predominantly-gendered activities will be characterized by mutually exclusive patterns of wear or use.

Several tasks that were conducted at Zatopec, such as preparation of skins, butchering, and gathering small land fauna, are hypothesized to have been carried out by

both sexes based on the Murdock and Provost (1973) study (see Table 1-4). The inclusive nature of these activities makes it difficult to recognize possible “men’s tools” from possible “women’s tools.” Indeed, these labels are probably not applicable to the majority of artifacts recovered from residential sites like Zatopec. Other tasks, however, are more exclusively linked with a particular sex, such as hunting large land fauna (primarily male) or gathering wild vegetal foods or cooking (primarily female).

It is expected that tools used for strongly-gendered activities will reflect characteristic wear patterns. Additionally, tools used in these activities are far less likely to have been used by the opposite sex. Demonstrating the validity of Implication #2 involves identifying certain artifacts that show exclusive evidence of use for tasks identified as a primarily-gendered activity. Possible examples include cooking facilities and tools used to gather or collect vegetal foods from near the camp (female), and points used for hunting large mammals (male); other possibilities might also exist. In the present analysis, only macroscopic evidence for impact was recorded for projectile points. However, future analyses can better address this question by applying systematic microscopic use-wear analyses on contextually-controlled assemblages.

**Implication 3.** Tools potentially associated with strongly-gendered tasks will demonstrate spatial patterning according to how and by whom they were used.

Four factors that potentially attenuate the results of this kind of spatial analysis warrant discussion. First, the location where artifacts are recovered indicates where they were discarded, and not necessarily where they were used (Schiffer 1972). Therefore, the focus of study should rely primarily on undisturbed contexts that potentially reflect intact



activity areas. At Zatopec, these are relatively few as a result of bioturbation as well as the processes of sedimentation across the site (see Chapter 4). Second, gender-exclusive tasks may not always have been carried out in ways that reflect the exclusive use of space by sex-based task groups (e.g., Boderhorn 1993; cited in Gilchrist 1999:34). Tools from areas comprising remains of two or more activities conducted side-by-side may be inseparable, making it impossible to ascertain which tool forms were used for which activities. Even though these kinds of patterns, if present, can not be used to identify gender-exclusive tasks, they *can* speak to non-gendered spaces. Third, site over-printing, in which task-specific activity areas “move” across the site over the course of sequential occupations, can lead to mixing of task-specific assemblages with tools used for other activities as well. Fourth, some tools may have been used away from the site and then returned for repair or discard. Projectile points for the logistical hunting of migratory or herd animals that often avoid areas inhabited by humans are one example.

In response to the first three factors, careful contextual analyses are required to separate primary, undisturbed contexts from potentially mixed ones. Still, it is likely that many tasks will remain incompletely understood with respect to how they were organized by sex. Addressing the final consideration is relatively straightforward. Unless they show evidence for use as knives or cutting implements with possible utility in several settings and for a range of purposes, it is assumed that projectile points showing heavy impact damage were used away from residential sites like Zatopec, and that the people who used them were involved in short- or long-term logistical excursions. Likewise, informal tools reflecting expediency as a design goal are assumed to have been used in and around the camp context by people who commonly engaged in those kinds of tasks.

**Implication 4.** Many of the tools associated with gender-specific tasks were made by the people who carried out those tasks, and can be characterized by distinctive manufacturing techniques and approaches.

According to Murdock and Provost (1973:205), stone working includes the “manufacture of stone artifacts.” Based upon their coded data, those authors calculate a male participation index of 95.9 (4.1 female participation index) for 185 societies worldwide for “stone working” as they broadly define it. This figure declines slightly to 92.9 (7.1 female participation index) for 33 North American societies (see Table 1-4). Problematic, however, is that this task was coded for less than half (73 of 185) of the societies in their sample (see Table 1-3), and is not included in their summary of coded data from selected societies (Murdock and Provost 1973: Table 8). This unfortunate omission makes it impossible for researchers to return to the original sources to verify whether this activity was mentioned, in what context it was conducted, and by whom and in what settings it was carried out without combing through over 1,000 bibliographic citations, a number of which are only personal communications. Additionally, no explanation is given of exactly what kinds of stone working are included in this task. For example, manufacture of projectile points often relies heavily on bifacial reduction techniques and soft hammer percussion for carefully removing controlled thinning flakes in order to achieve broad, thin preforms that can be finished into points. In contrast, expedient flakes used as *ad hoc* tools can be removed from smashed pebbles and nodules, require little labor investment and (in some cases) technological knowledge to prepare, and are often discarded upon use.

Considerations involving labor divisions by sex are certain to have factored into the production of different kinds of tools. These include who used different tools, what they were used for, how their production was scheduled into other tasks, how they were maintained, what costs arose if they failed at critical moments, and how easily they could be replaced if lost or broken. Some of these considerations may have been similar for tasks conducted more or less evenly by males and females and tools used for those tasks. However, it is unlikely that individuals participating in *strongly*-gendered activities held identical views of how a tool used for any given task should look, feel, or function. For example, Weedman (2010) describes in excellent detail how contemporary Konso women in southern Ethiopia make hide scrapers using distinct technological approaches, and even prefer stone to metal or glass because it is more suitable for their tasks. Moreover, it defies principles of time and labor scheduling logic and rationality to presume that some people sat idle, with their tasks going unattended until a needed tool could be made by someone else. Based on the 7.1 female participation index for stone working in North American societies, detailed descriptions of tool use and manufacture by women in other ethnographic accounts (e.g., Jarvenpa and Brumbach 1995; Kehoe 2005; Weedman 2005, 2010), and the archaeological associations of knapping kits with female burials, it is a near-certainty that at least some females made some stone tools. Based on previous discussions, however, the challenge lies not in confirming this fact, but in distinguishing between stone tools made and used by males from those that were made and used by females.

One approach to discerning female participation in stone tool production, not just use, involves assigning the artifacts used for different tasks to the sexed individuals who

performed those tasks, such as ascribing big game hunting weapons to males and tools associated with domestic or general maintenance activities to females. Hayden (1992:35-36), for example, notes that “high investment tools” related to hunting were not likely to be shared with women, who might ruin them (cited in Jarvenpa and Brumbach 1995:47). In Joan Gero’s (1991) article “Genderlithics,” she attributes production of informal and *ad hoc* tools to women, and notes that these often dominate archaeological assemblages though they receive far less attention from archaeologists than bifaces and biface-related systems of production (see discussion of expediency, above). According to such studies (Sassaman 1992), stone tools made by females are those that are informally designed, expediently manufactured, lack elaborate reduction sequences, and are at times crudely made (but see Weedman 2010 for discussion of highly skilled female knappers). However, these traits can also be used to distinguish tools made by inexperienced rather than proficient knappers (see below), regardless of sex. Additionally, without other supporting evidence, this approach diminishes the capacity of some prehistoric people to perform technological acts with developed skill or proficiency.

A *chaîne opératoire* analysis (Apel 2008; Dobres and Hoffman 1994) offers an alternative means for recognizing conceptually distinctive approaches tool production that potentially corresponds with gendered perspectives on how tools should be made, used, recycled and maintained, and discarded. This concept is broadly comparable to what Collins (1975) describes as a “processual approach” to reconstructing lithic reduction and tool manufacture. The approach seeks to recognize and understand the significance of patterned reduction acts by socially conditioned individuals through reconstructing the behaviors of different *kinds* of tool makers from the earliest stages of

reduction to a final product. Each reduction act or individual flaking event, such as testing raw chert nodules for their suitability, final trimming of nearly finished tools, removing flakes in different ways, shaping preforms, or maintaining core platforms constitutes an intentional gesture which reveals something of the social conditioning behind it. One objective of *chaîne opératoire* analyses is compiling a record of different kinds of gestures reflective of different kinds of socially conditioned individuals to understand something of how that population views or viewed stone tool working. As applied in the current study, the goal is to define, insofar as possible, conceptually different approaches that may be found within the same cultural group to the design, production, maintenance, and discard of stone tools that may have been used for discrete and non-overlapping tasks. The objective of a *chaîne opératoire* approach is not to ascribe individual technical acts or gestures to a certain kind of socially conditioned person. Rather, its strength is in linking series of technological acts (technical sequences, or “chains”) specific to different tool forms used in particular ways with different kinds of socially conditioned persons.

In seeking evidence for gendered tool production that might have been associated with gendered patterns in tool use and activities, three primary reduction trajectories are identified within the overall lithic assemblage at Zatopec. These include (1) reduction of chert nodules for bifaces intended specifically for the manufacture of projectile points; (2) reduction of chert nodules for general purpose bifaces that in turn offer flexibility for different kinds of tools that can be fashioned, such as flake cores, scrapers, and other expedient implements; and (3) reduction of chert nodules not involving any form of intentional bifacial design to create easily replaced tools for general purposes. Technical

traits including the presence of bi-polar reduction, the kind and degree of platform preparation and maintenance, hard versus soft percussor type, and even patterns in the intensity of tool use are correlated with tool form to consider whether these reduction trajectories ever represented two distinct technological systems for producing kinds of tool. The presence of distinct and non-overlapping patterns of tool design, production, and use (together, these define a socially constituted technology) provide strong evidence indicating gendered distinctions in tool manufacturing and use. If present at Zatopec, these distinguishable technological practices can be used to hypothesize gendered divisions of labor.

### ***Learning, Variable Skill, and Uneven Production***

In addition to the effects of gender-related influences on tool design and form, use, maintenance, and discard, the ways that different individuals learned to produce usable implements also contributes to the variation seen in tool assemblages at Zatopec. Recent research has made advances in how patterns of learning and skill acquisition can be recognized in the archaeological record (Bamforth and Finlay 2008; Ferguson 2008; Finlay 1997; Högberg 2008; Lohse 2010; Pigeot 1990; Roux et al. 1995; Shelley 1990; Stout 2002; Weedman 2010).

Learning and skill acquisition in any craft, including flint knapping, is conducted across multiple spectrums encompassing gradations in age, proficiency, or often both. In prehistoric societies reliant on stone tools, individuals likely began acquiring skills necessary to become adept tool-makers while very young. Advances in age are accompanied by developments in both motor skill and the cognitive ability to

comprehend requirements for controlling flake removals. However, inexperience does not always correspond with youth (e.g., Acheson 1977), and individuals who start acquiring these skills at a later age can also produce artifacts that reflect inexperience and a lack of tool-making comprehension (Stout 2002). Additionally, some individuals have higher levels of aptitude than others. Experimental studies reveal both variability between experienced knappers, and uneven levels of performance by the same knapper over different knapping episodes (Finlay 2008). Thus, learning and variable or uneven production relating to skill are significant components in technological behaviors organized around certain kinds of tool production. Therefore, archaeologists should not expect that all competent or even highly experienced knappers to consistently produce tools exhibiting the same qualities. Discussions below focus first on recognizing the process of learning, and second on evidence for excelled or advanced production capabilities and intensities (referred to here as uneven production), trending into what some researchers have called specialization.

Assessing skill in stone tool manufacture is a complex and often subjective process (Andrews 2003; Bamforth and Finlay 2008; Clark 2003; Shelley 1990; Stout 2002). Multiple factors, both mechanical and cognitive (Roux et al. 1995), are involved that affect the precision with which flake removals are controlled. Pelegrin (1990) has reduced these factors to two essential concepts that describe the cognitive ability to comprehend the requirements of tool manufacture and the physical ability to execute the necessary tasks. Pelegrin describes the knowledgeable practice, strategic decision-making, and “abstract engagement” (Bamforth and Finlay 2008:3) necessary to understand tool production as *connaissance*. This concept is referred to as **cognitive**

**knowledge.** Practical knowledge, dexterity, motivation, motor skill, and technique are included in *savoir-faire*, referred to as **know-how** (Figure 1-8).

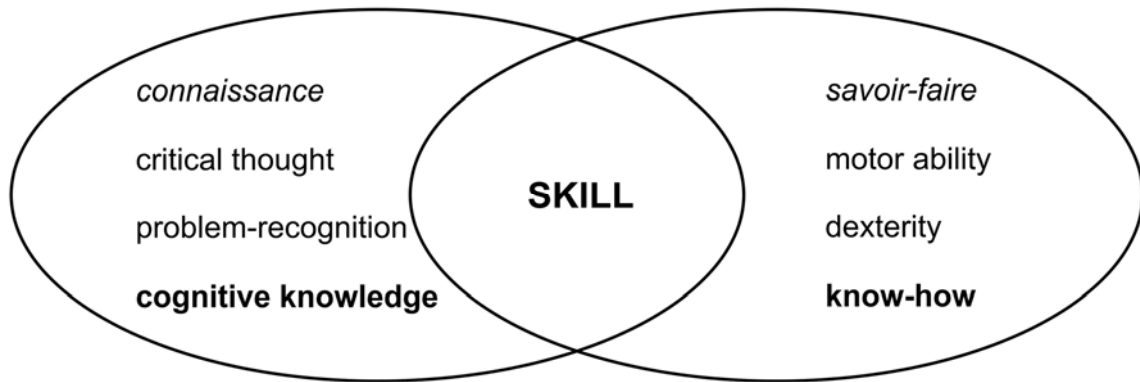


Figure 1-8. Skill at the intersection of cognitive knowledge and know-how (after Bamforth and Finlay 2008: Figure 1).

Both experimental replication studies (Ahler 1989a; Finlay 2008; Shelley 1990) and analyses of well contextualized archaeological assemblages (Grimm 2000; Pigeot 1990) have identified traits stemming from low skill by producers. Examples include irregularity of form, predictable errors, stacked step and hinge terminations, mis-hits and hammermarks, inconsistency in production, wasteful and ineffectual use of raw material, failure to rejuvenate, low length-to-breadth flake ratios, and a peripheral location with respect to where knapping activities occur (Table 1-5) (after Bamforth and Finlay 2008: Table 2). Skilled knappers can make any of these mistakes as well, however, meaning that assessing skill levels based on these or other criteria require analyzing large assemblages to seek patterns in *relative* frequencies in the occurrences of any of these traits. Additionally, expressed skill depends a great deal on the technological objectives of a particular cultural pattern, and mistakes in one period might be successes in another. This means that skill assessments are most appropriate when conducted within time-controlled assemblages.



Table 1-5. Possible indications of both novice and highly skilled knapping (from Bamforth and Finlay 2008: Tables 1, 2)

<b>Novice Knapping</b>	<b>Skilled Knapping</b>
Irregular form	Unusually large size
Predictable errors	Extreme thinness in relation to width
Stacked step and hinge terminations	Extreme length in relation to width or thickness
Mis-hits	Complex outline form
Hammermarks on tool face	Regularity/symmetry of form
Wasteful use of raw material	Smooth/symmetrical cross-section
Failure to rejuvenate	Precision or regularity of flaking
Low length-to-breadth flake ratio	Well-controlled flaking
Peripheral location for knapping work	Low variation in artifact size
Deviation from expected reduction sequence	Complex multi-stage reduction sequence
	Consistency in production

As noted, some individuals have an innate ability to craft tools more skillfully than others. At different times in the past, there were situational reasons or motivations to develop this ability to the point where it represented a form of task or economic specialization. In forager societies, simple age- and sex-based labor divisions and instances of specialization are intrinsically linked, meaning that specialization, when it occurs, is an extension of some aspect of uneven, variably skilled production. Long ago, the French sociologist Emile Durkheim noted that divisions of labor often gave way to more substantial investments of time or energy for some individuals in what he labeled *organic solidarity*, or mutually interdependent relationships of functionally non-equivalent groups within a society (compare Binford 1965:205). Burton et al. (1977:227) similarly propose that “division of labor has long occupied a prominent place in sociology and anthropology as the foundation of processes of economic specialization in human society.” In the current discussion, “specialization” refers to “a situation in which a relatively large portion of the total production of a given item or class of items is generated by a small segment of the population” (Cross 1990:35). John Clark and

William Parry (1990) also discuss specialization as it exists outside of ranked or stratified societies. For them, specialization is the “production of alienable, durable goods for non-dependent consumption” (Clark and Parry 1990:297). In forager societies, this means only that an individual makes a good that he or she does not directly consume, but rather exchanges for other goods or services.

Specialized production has been widely discussed by archaeologists (Clark 1996; Clark and Parry 1990; Costin 1991; Cross 1993), and is addressed by analysts using a number of traits. Like expression of skill, specialized production will be contextualized within a cultural system, and so may appear differently in any particular case. Traits used by archaeologists can include standardization (Arnold 1985); quality of workmanship (LaFlesche 1926); higher success rates (Finlay 2008); successful execution of technically challenging steps, such as fluting (Crabtree 1966); or some combination of these.

Specialization was significant to the technological organization and practices of many Native American groups when Europeans arrived in the New World, including those located in Central Texas, and continued to structure economic production and exchange well into the historic period (Figure 1-9). The differences perceived by people between skilled specialization and “normal” production continued to be significant into the early 20<sup>th</sup> century, and is clear in the following statement by a member of the Plains Omaha, concerning bow making: “I could make a bow for you, but it would only be an imitation, not a real bow. Any man who can whittle and scrape with a knife can make something like a bow, but it takes a man skilled in the making of bows to make a bow as it should be made. There are only two Omaha men living who can be called bow makers” (LaFlesche 1926:488, cited in Seeman 1985:13).

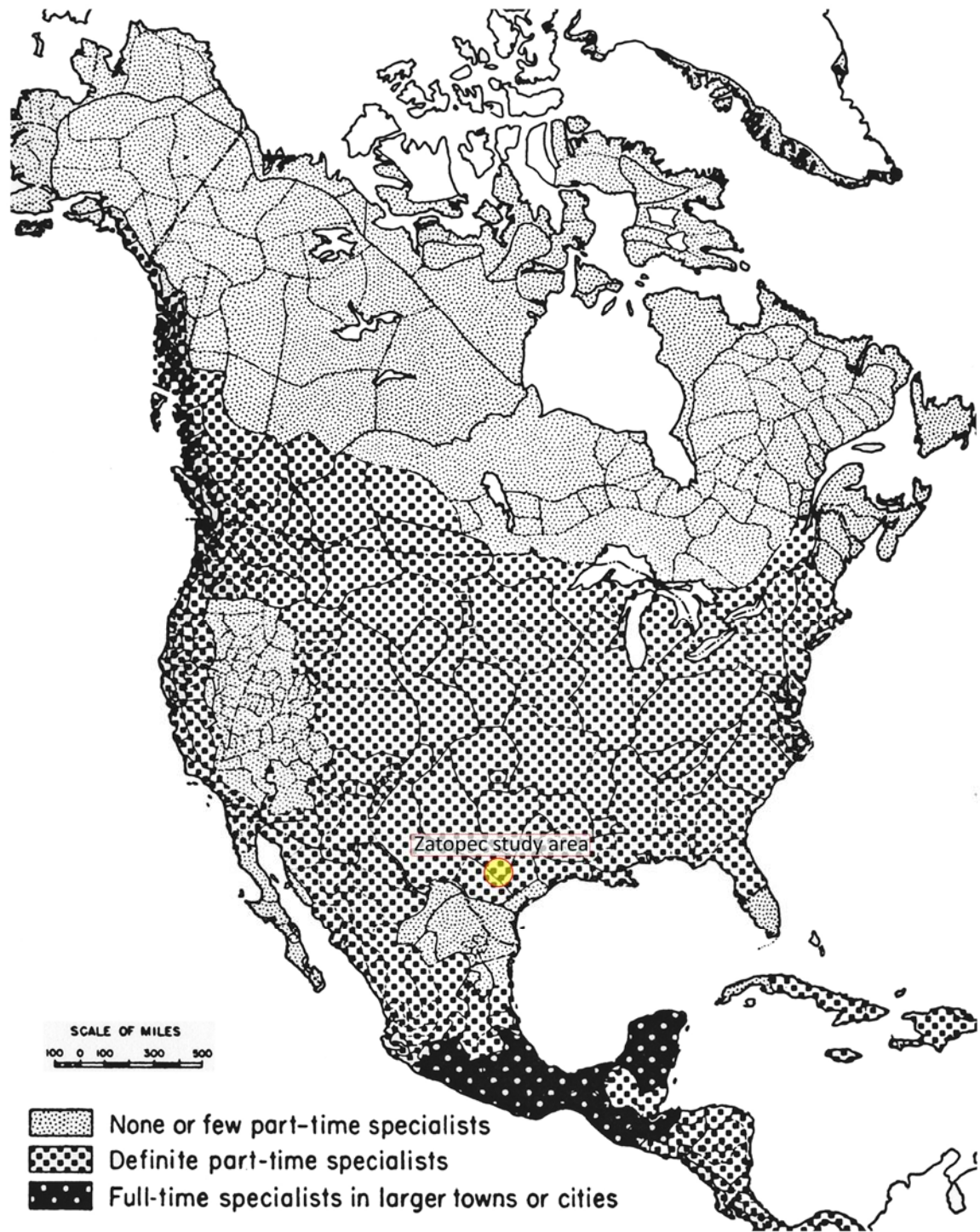


Figure 1-9. Instances of craft specialization among historic Native Americans. Note that the part-time specialists were recorded in the study area. 238 groups (from both North and South America) were used for this study (from Driver and Massey 1957: Map 147).

There is a critical distinction to be made between specialization defined in this manner and a simple division of labor. In standard labor divisions, people perform different tasks according to age or sex roles and exchange the products of their labor with others who perform different tasks. The concept makes no assumption about whether some individuals are more skilled, more efficient, or spend more or less of their time carrying out their work. Presumably, everyone in the same task group performs approximately the same range of tasks at more or less the same intensity. In contrast, when specialization occurs, it does so *within* a socially defined task group as some people develop better skills, become more efficient, demonstrate higher success rates, or achieve greater standardization than others. For hunter-gatherer societies, specialization occurs *in the context of divisions of labor*, and is not inherently related to the production of surplus or prestige items.

The definitions by Clark and Parry (1990) and by Cross (1993) are important for defining specialized production as it occurs in hunter-gatherer societies in ways that can be distinguished from “regular” production. Both definitions are linked by a common thread in which individuals who are engaged in part-time specialization spend more of their time at a particular task than others. Thus, in addition to addressing aspects such as greater skill, standardization, and efficiency, the scheduling time and labor must also be considered. That is, whenever specialization occurs, it is scheduled and carried out along with other activities. These scheduling requirements that make it possible to assess the degree to which an individual may engage in part-time specialization compared with other members of their task group. For example, a projectile point can display exquisite workmanship but can not be taken as evidence of specialized production unless it can be

demonstrated an individual spent an inordinate amount of time producing it, to the point that they did not contribute as significantly to other activities ascribed to their age-and sex-based task group. As a result, two ways to see specialization in the archaeological record are (1) identifying highly specific tasks that are *not* shared amongst larger task groups and (2) noting significant differences in the amount of time spent by different people on the same activity.

### *Archaeological Evidence for Learning and Uneven Production at Zatopec*

Recognizing learning and variable skill in the archaeological record is complex and involves precisely describing and recording multiple attributes and patterns on different parts of the assemblage. Informed by experimental studies (Ahler 1989a; Ferguson 2008; Shelley 1990) as well as archaeological analyses that correlate higher success rates with greater experience (Sheets 1978), the current analysis describes and measures different traits found in several artifact categories (see Chapter 7 for detailed discussion of these analyses) that reveal relatively lower or higher levels of skill. These traits are presented in Table 1-5. Analytical details and results are presented in Chapter 7, and discussed in Chapter 11.

Recognizing specialization, on the other hand, relies on different methods from those used to determine relative skill levels. Nevertheless, these approaches potentially yield different but complementary perspectives concerning the presence and/or role of part-time specialization in hunter-gatherer economies, and what these modes of technological organization meant for those societies. The current analysis outlines two approaches for identifying specialization at Zatopec. The first approach is intended to

help archaeologists understand the degree of specialized production that might have been undertaken by members of the same task group by assessing the amount of time spent producing a particular tool form as it relates to higher rates of success or standardization. The second approach focuses on how or whether activities were conducted by very small groups of task-specialized people by looking at intra-assemblage tool diversity.

With respect to demonstrating specialization, the manufacture of particularly skilled items only reflects differential skill among tool makers. In order to show specialization in the production of tools, archaeologists need to correlate some form of uneven (more skilled or greater output) production with a differential investment of time. Analyzing an assemblage for evidence of part-time specialization therefore involves multiple steps. First, archaeologists must recognize some of the necessary steps for making different kinds of tools. Not all tools are made with the same technical acts, and discerning techniques associated with a particular tool form is necessary to avoid linking the time invested in making one kind of tool to other kinds. Second, analysts must recognize higher or lower success rates for certain technical acts based on some distinguishing characteristic or trait. Third, these traits must be measured in a way that reflects variable time and labor investment. This sequence of analytical steps can be reconstructed as follows: (1) artifact form **X** involves production steps **1**, **2**, and **3**; (2) a particular technical trait defines production step **1**, **2**, or **3**; and (3) more time invested in achieving this trait leads to the more successful execution of that production step. Based on this reconstructed sequence of decisions and acts, tool-makers who spend more of their time on certain traits that were necessary for the successful production of artifact

form **X** achieved higher success rates in producing that particular artifact, but would have had less time available for contributing to other activities.

An example that illustrates this scenario and that is important in the current analysis involves billet flaking associated with the production of proportionally wide, thin bifaces. Based on Goode's and Johnson's (Goode 2002; Johnson 1995; Johnson and Goode 1994, 1995) work on Late Archaic biface production in Central and south-Central Texas, analysts paid close attention to how the striking platforms of billet and other flakes were prepared. The Late Archaic lithic tradition for the Zatopec region is characterized by broad bladed projectile points and point forms. Producing these kinds of broad, thin blades required well-controlled flaking using soft hammer percussors such as bone or antler billets (Hayden and Hutchings 1989), which produce a distinctive kind of flake (called billet flakes) that can be easily recognized. Many billet flakes from Zatopec show evidence of grinding or abrading on the striking platforms. This practice is common in biface production (Sheets 1973), and strengthens the platforms so that they can better withstand blows of sufficient force to remove flakes that extend far into the biface. This grinding or abrading technique, which ranges from very light (called raking) to intensive grinding to the point of a polish (Titmus and Woods 1991), is present to varying degrees in prehistoric assemblages at Zatopec and the surrounding region. Since increasing the amount of abrading on some billet flake platforms leads to more successful flaking, it can be used as an indication of the amount of time that some knappers spent on this important technique. Results of this analysis of billet flake preparation are presented in Chapter 7, and implications for part-time specialization are discussed in Chapter 11.

A second approach to understanding specialization at Zatopec involves recognizing deliberate tool-making behaviors that represent only a very small part of the overall lithic assemblage. This analysis focuses on evidence for specific tasks being undertaken by only small portions of ancient societies, and relies on the presence of prismatic blade technology over time. Blades and specially prepared blade cores have been described for the early Paleoindian Clovis interval (Collins 1999; Collins and Lohse 2004; Green 1963) and the Toyah phase of the Late Prehistoric (Black 1986; Hester and Shafer 1975; Ricklis 1994; see Chapter 2 for regional culture history). Blades are also found among Native American tool kits in Spanish missions across South Texas and Northern Mexico (Hester 1989; Inman 1999; Lohse 1999; Tomka 1999; Ricklis 2000), though blade cores and associated debris are not frequently encountered in these contexts. Blades and blade cores, though known to occur sporadically on Archaic sites, have received less attention than similar materials from other time periods (Arnn 2008:310 – 314). One reason for this oversight is that these materials are commonly found in only very small numbers in time periods other than those previously mentioned. Specially prepared blade cores as well as prismatic blades are noted in small quantities at Zatopec, and others sites (see Shafer 2006:96), suggesting that very few people were associated with the production of these implements.

Support for blades as evidence of specialization comes not only from their limited frequency, but also from their restricted utility when compared with equivalent items. Studies comparing blades from blade cores versus flakes removed from bifacial cores both in terms of the time required to prepare and remove blades and also of the usable cutting edge of each form conclude that blade and biface cores are about equally efficient



(Jennings et al. 2010; Rasic and Andrefsky 2001). However, bifacial cores offer greater flexibility in the kinds and sizes of potentially useful tools that can be derived, whereas blades from blade cores are suited to a more narrow range of tasks since only long, narrow tools can be struck from them. On the basis of their experiments, Rasic and Andrefsky (2001:77) concluded that bifacial cores are well suited for circumstances in which a wide range of tasks can be expected. In contrast, blade technology can be expected to be present where a specific, perhaps narrow range of tasks is reliably predicted. Given the greater task specificity associated with these tools, the authors conclude that “blade cores may be more accurately viewed as specialized components of a tool kit that was possibly only used in very specific situations” (Rasic and Andrefsky 2001:78). This conclusion echoes earlier assessments by Hester and Shafer (1975:183), based on analysis of archaeological specimens, of blades as a “specialized flint working industry” based on their appearance in only some ecological settings. Based on these studies, the Zatopec assemblage is analyzed for the presence of deliberate, systematic blade production using both blades and blade cores (see Chapter 7) as possible evidence for task specialization. Findings indicate that blades increase in frequency during certain intervals, including a marked increase in Toyah times. From these findings, analysts can conclude that some form of task specialization involving the greater reliance on blades was an important part of technological organization at the site for some time periods.

### **Summary Discussions Concerning Technological Organization**

The fourth research domain for this project is clearly an involved and complex one. However, in our view this topic has perhaps the most potential of the four research

issues addressed at the site for describing and explaining the kinds of behavioral variability that archaeologists seek in the past, and that are necessary for presenting the subject matter of this project in a humanistic, meaningful way.

Approaches to technological organization that are outlined and pursued have been designed to record evidence for assemblage variation in response to multiple factors. Some factors represent group-level decisions about how best to exploit particular resources through changes in settlement movements, logistical behavior, and tool expediency. This facet of the analysis yields useful results helpful characterizing the diversity of technological choices made by Zatopec residents over different time periods. However, an important outcome of this part of the analysis is that significant differences are also apparent reflecting the technological choices of different kinds of tool makers and users that clearly do not extend across the entire assemblage.

Consequently, additional factors are also considered that may have conditioned technological organization during any particular time period. This facet of the analysis focuses directly on the capacity of socialized individuals to contribute to technological variation at the site. While archaeological attention to individual persons is not common in the study area, the results of this work (Chapters 7, 11, and 12) make clear the potential importance of this focus for understanding how hunter-gatherer groups organized their technologies based on sex, age, aptitude, and uneven participation in certain tasks. In our view, these two levels of attention, one to group-level behavior and the other to the level of individuals, are highly complementary and are essential to accurately characterizing something close to the full range of technological choices made by prehistoric hunter-gatherers at Zatopec.

## **CHAPTER 2**

### **THE SITE AND ITS ENVIRONMENTAL SETTING, PREVIOUS INVESTIGATIONS, AND REGIONAL CULTURE HISTORY**

David Yelacic and Jon C. Lohse

This chapter introduces the context of the Zatopec site in terms of environmental setting, regional culture history, and previous investigations. Environmental context is divided into sections describing the soils, hydrology, flora and fauna, climate, and paleoenvironment. Underlying geology is an important consideration insofar as it contributes to the environmental context of the site; this is described in Chapter 4 (Results of Excavations: Sediments Analysis and Stratigraphy). Previous investigations are presented in two sections: previous investigations at Zatopec, and investigations of sites in the vicinity. Regional culture chronology, divided into Paleoindian, Archaic, Late Prehistoric, and Historic periods, includes a synthesis of Central Texas archaeological data from the earliest known inhabitants to European arrival.

#### **ENVIRONMENTAL SETTING**

The Zatopec site is located below the Balcones Escarpment which marks the interface between the Edwards Plateau (Hill Country) to the west and the Blackland Prairie to the east (Figure 2-1). Transitions such as this one between adjacent, large-scale environmental provinces are known as ecotones; these are high-energy settings capable of supporting tremendous diversity in terms of plant and animal species (Crumley 1994).

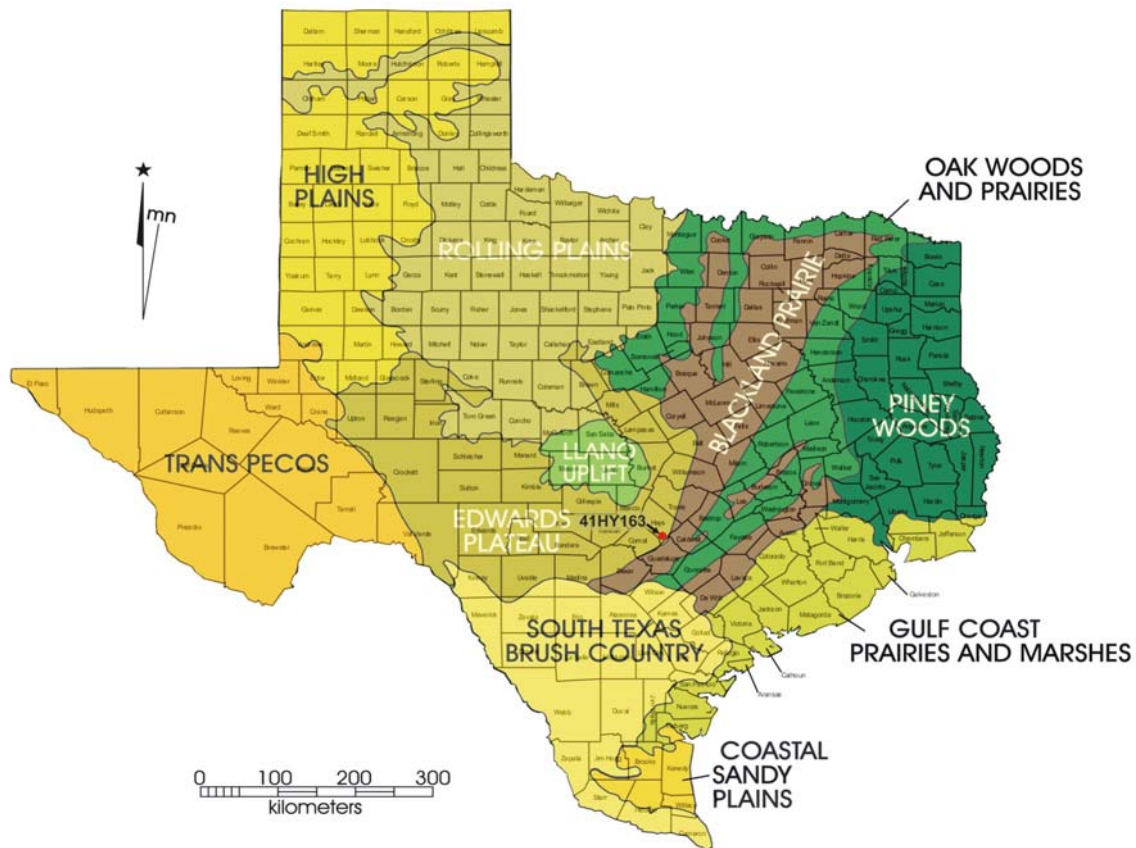


Figure 2-1. Zatopec site, 41HY163, on map of counties and environmental regions of Texas.

### Contemporary Environment

**Soils** Soils of this area are described in the Soil Survey of Comal and Hays Counties Texas (Batte 1984). Units include Comfort-Rock outcrop complex, undulating (CrD); Rumble-Comfort association, undulating (RUD); frequently flooded Orif soils (Or); and, Denton silty clay, 1 to 3 percent slopes (DeB). The Comfort-Rock complex consists of shallow, clayey soils (Comfort soils) and rock outcrops on side slopes and hill and ridge tops. Comfort soil is typically dark brown, with a stony clay surface layer of about six to seven inches (15.2 to 17.8 cm) in thickness overlying a subsoil of approximately 12

inches (30.5 cm) in thickness. Rumble-Comfort soils consist of shallow to moderately deep deposits located on uplands and side slopes. Rumble soils consist of a dark reddish brown surface layer of cherty clay loam that averages approximately 10 inches (25.4 cm) in thickness. Underlying this is dark reddish brown clay that extends as much as 28 inches (71.1 cm). The moderately extended depth of these associated deposits creates the possibility for shallowly-buried deposits. However, the presence of the soils across side slopes suggests that they are susceptible to down-slope movement. Denton silty clays also occupy upland valley slopes. Typically, the upper-most layer of DeB soils is 14 inches (35.5 cm) of dark grayish brown silty clay underlain by 11 (27.9 cm) inches of dark brown silty clay. Orif soils are deep, well drained loams which compose flood plains. Depending on their location relative to the channel, Orif soils have variable amounts of coarse grain fragments.

***Hydrology*** San Marcos Springs, known to the historic Tokawas as Canocanayesatetlo, European settlers as St. Mark's, and currently as Aquarena Springs, have attracted human populations for at least the last 11,500 years (Tyler 1996:5:869). These are the second largest springs in Texas and support a tremendous amount of wildlife. The San Marcos Springs are the headwaters of the San Marcos River, which has provided power to historic gins, corn, and grist mills (Brune 1981). The mean annual flow of the San Marcos River is 170 cubic feet per second (cfs) (Slattery and Fahlquist 1997). This measurement, however, is heavily dependent upon weather and climate, and may not accurately represent discharge in the past. Aquarena Springs was an important stop on Spanish *El Camino Real*, the historic network of roads that linked interior Mexico with

frontier regions of the Spanish Empire to the north (McGraw et al. 1998), and also on the Chisholm cattle trail, which in its heyday (ca. AD 1867-1884) led five million cattle from as far south as the Rio Grande Valley to Kansas where they were shipped to markets in the east via rail road (Tyler 1996:2:89).

Purgatory Creek, a tributary of the San Marcos River, is immediately southeast of 41HY163. Purgatory Creek, whose headwaters are at the western edge of Hays County, flows approximately 20 miles to its confluence with the San Marcos River just southeast of the City of San Marcos. This creek is dry today and only carries water during periods of heavy rainfall. However, it likely held at least a small perennial stream in antiquity, making the landform where the site is located an attractive locale for seasonal habitation.

***Flora and Fauna*** As the location of the site is ecotonal, floral and faunal characteristics of both the Edwards Plateau and Blackland Prairie are present. The region's natural vegetation is generally a grassland-woodland-shrubland mosaic, where grasslands separate patches of woody plants and scrubs (i.e., mesquite, Texas oak, Shin oak, cedar elm, hackberry, etc.) (Ellis et al. 1995). Tall grasses, Osage Orange (*Maclura pomifera*), Anaqua (*Ehretia anaca*), Netleaf Privet (*Forestiera reticulata*), Netleaf Hackberry (*Celtis reticulata*), Honey Mesquite (*Prosopis glandulosa*), and China Berry (*Melia azedarach*) are currently present in the site vicinity.

As described by Blair (1950), typical modern fauna found in the region include white-tailed deer (*Odocoileus virginianus*), eastern cottontail (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), opossum (*Didelphus virginiana*), and badger (*Taxidea taxus*). Additionally, Armadillo (*Dasypus novemcinctus*), Beaver (*Castor canadensis*), Black Rat

(*Rattus rattus*), Coyote (*Canis latrans*), Crayfish (*Cherax quadricarinatus*), Domestic Dog (*Canis familiaris*), Eastern Gray Squirrel (*Sciurus carolinensis*), Eastern Wood Rat (*Neotoma floridana*), freshwater mussel, Gray Fox (*Urocyon cinereoargenteus*), Hispid Cotton Rat (*Sigmodon hispidus*), Horse (*Equus caballus*), Muskrat (*Ondatra zibethica*), Opossum (*Didelphis marsupialis*), Pig (*Sus scrofa*), Red Fox (*Vulpes fulva*), Turkey (*Meleagris gallopavo*), Western Diamondback (*Crotalus atrox*), and Whitetail Jackrabbit (*Lepus townsendi*) are among the modern wildlife commonly found in the area. Many, though not all, of these were also present in the prehistoric period and are reflected in the site's inventory of animal remains (see Chapter 9).

***Climate*** Weather in south-central Texas is dynamic and quickly changing, and is often dramatic and marked by severe events. In Hays County, summers have mean maximum temperatures approaching 97° F, and winters have mean minimum temperatures near 40° F. December and January are the only two months in recorded history that have not had temperatures above 90° F, while freezing temperatures have been recorded anywhere from October to April (Dixon 2000). The mean annual precipitation recorded for Hays County is 33.75 inches; late spring and early fall are particularly precipitous (Dixon 2000; Tyler 1996). Hazardous weather is not uncommon in Central Texas. The Hill Country, in general, has a serious threat of flash floods due to thin soils and steep slopes. Cloud bursts may unload a relatively high amount of precipitation on a confined area in a short period of time, resulting in the area's tributaries and river levels to rise rapidly (Woodruff 1979). Additionally, drought is common to

Central Texas; there is not a decade in the twentieth century that did not experience drought conditions (Bomar 1995:153).

## **Paleoenvironment**

Reconstructing paleoenvironmental conditions, often by modeling past climatic as well as floral and faunal variables, is an important way to better understand prehistoric human adaptations. Paleoenvironmental reconstructions help researchers understand the natural conditions that may have affected the availability of important resources as well as factors that have potentially affected site preservation. As ancient conditions cannot be directly observed, however, paleoenvironmental reconstructions often rely on proxy measures; proxy evidence includes but is not limited to speleothems, phytoliths, stable carbon isotopes, sediments, and faunal remains. Paleoenvironmental proxies are second order, or higher, lines of evidence, meaning they do not directly reflect past environments, but rather, they can be used to infer characteristics of past environments (Ellis et al. 1995). A single proxy varies geographically, just as components of environments (moisture, for instance) do today, and additionally, proxies have disparate conditional thresholds and react differently to environmental stimuli (Ellis et al. 1995). For example, animals within a region will react differently to increasing aridity depending on their specific geographic location, and plants and animals in the same specific geographic location will respond to the same environmental stimulus at different times. Therefore, as more lines of evidence are compiled, more is understood about a paleoenvironment. Within the past two decades, research has increasingly contributed to the understanding of Texas' paleoenvironmental history (e.g. Bousman 1998; Brown



1998; Caran 1998; Ellis et al. 1995; Frederick 1998; Fredlund et al. 1998; Kibler 1998; Ricklis and Cox 1998). Ellis et al. (1995) note that a large amount of environmental variation across Texas renders regional boundaries unclear; nonetheless, a regional focus on proxy measures from Central Texas is necessary for the current project.

One line of evidence used for estimating prehistoric climatic conditions involves calculating speleothem growth rates. Speleothems are clastic cave deposits (e.g., stalactites and stalagmites) that typically grow faster with increased available moisture (Musgrove et al. 2001). However, due to soil and epikarst moisture storage capacity (the ability for limestone landscapes like that of Central Texas to store surface water and keep it out of environmental circulation), soil carbonate content, and rates of evapotranspiration, speleothem growth rates do not provide a one-to-one correlation with available moisture at any point in time or location. Nonetheless, results of such studies are useful for providing a general understanding of precipitation patterns in the past. Growth rates can be calculated using uranium-series geochronologic measurements (Musgrove et al. 2001) based on the radioactive decay (e.g., half-life) of uranium and thorium isotopes.

Sedimentary and biological deposits, many of which are also found within caves, can contain additional lines of evidence useful for paleoenvironmental reconstructions. Fossil pollen and stable carbon isotope records are attuned to local and regional environmental conditions, and studies of these records are also used as indicators of the paleoenvironment (e.g., Bousman 1998; Nordt et al. 2002). Fossilized pollens are direct evidence of past vegetation, whereas soil stable carbon isotope ratios are characteristic of plant communities' photosynthetic regimes. C4 plant communities, which include mid-

and tall-grasses, acclimate to warmer, dryer environmental conditions, while C3 plant communities, including woody species, are adapted to cooler, wetter environments. Below is a generalized overview of extant records that indicate what environmental conditions were like in Central Texas beginning in the late Pleistocene and extending through the Holocene to the historic record (Figure 2-2).

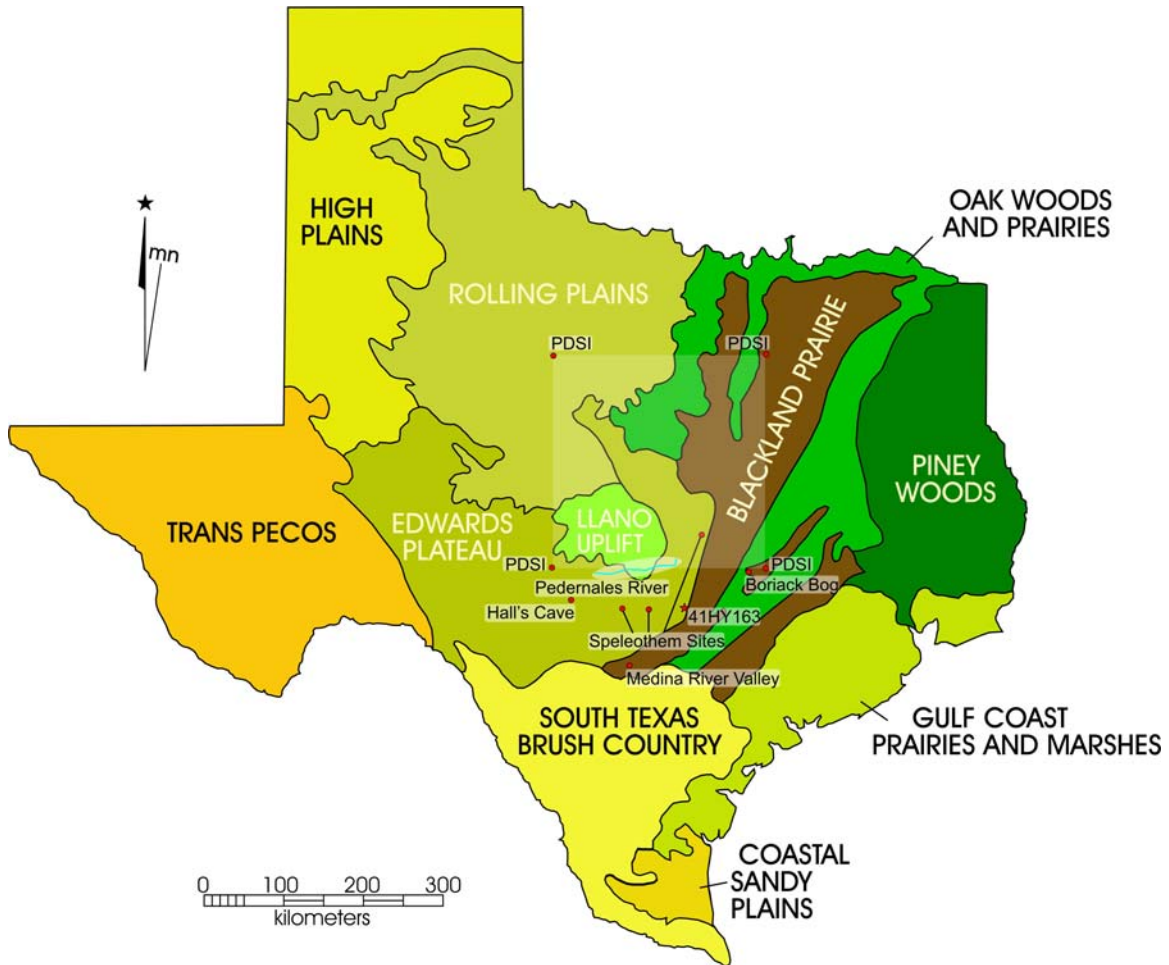


Figure 2-2. Map of Texas' environmental regions with sites of paleoenvironmental proxies indicated by red dots and labels.

Several lines of evidence together suggest that the end of the Pleistocene was generally cooler and wetter than contemporary conditions in the project area, but evidence also indicates that climatic conditions were in flux. For example, Toomey

(1993) found evidence in the faunal record of Hall's Cave during the Pleistocene for a generally cooler and wetter climate based on the presence of vertebrate taxa requiring high to moderate moisture. However, warmer, dryer intervals were evident at ca. 14,000-13,000 BP and 12,000-10,400 BP. Based on relatively increased rates of speleothem growth in the karstic Edwards Plateau during the Pleistocene, Musgrove et al. (2001) also infer that Pleistocene climatic conditions were wetter. Palynological (fossil pollen) and stable carbon isotope data from open air sites in the region also indicate generally cooler/wetter yet fluctuating conditions by the end of the Pleistocene. Palynological evidence from Boriak bog, located along the eastern edge of Central Texas, indicates vegetation dominated by woodlands (C3 habitats favoring cooler, wetter climates) with grassier (C4 habitats reflecting warmer, drier conditions) intervals at ca. 16,500 and 12,500 BP (Bousman 1998). Nordt et al. (2002) confirm woody vegetation patterns, indicated by relatively decreased C4 productivity, interrupted by grassy intervals at ca. 15,500-14,000 BP and 13,000-11,000 BP, indicated by increases in C4 productivity, in the Medina River Valley, on the southern edge of Central Texas, during the Pleistocene.

In terms of climate and environment, the transition from the Pleistocene to the Holocene was not distinct. However, despite relatively brief cool and wet intervals, the Holocene was generally warmer and dryer than the Pleistocene. The Pleistocene-Holocene transition is characterized by a decrease in speleothem growth rates, indicating a warmer, dryer climatic trend (Musgrove et al. 2001). A relative increase in the presence of grass fossil pollens indicate a trend of increasing grassland vegetation and a warmer, dryer climate in the late Pleistocene (ca. 12,500), but a decline in grass pollens until ca. 9200 BP are characteristic of a cooler/wetter climatic trend into the Holocene (Bousman

1998). C4 plant productivity increases during the Younger Dryas (~11,000-10,000 BP; i.e., Pleistocene-Holocene boundary), also indicating a warmer and dryer climate, before markedly decreasing from ca. 8000-7000 BP (Nordt et al. 2002). Faunal remains of mesic (moist) adapted taxa are replaced by arid adapted taxa at the end of the Pleistocene, but ca. 10,400-9000 BP marked the most mesic period of the Holocene at Hall's Cave, as indicated by the presence of certain taxa (Toomey 1993).

Although there are general trends towards a warmer, dryer climate during the Holocene in Central Texas, fluctuation in conditions occurred (Bousman 1998; Mauldin et al. 2008.; Nordt et al. 2002). In addition to overall climatic flux, Toomey (1993) infers that, during the Holocene, seasonal variation in temperature and precipitation (e.g., weather) increased. Interrupting a particularly arid interval known as the Altithermal (~7500-3000 BP) during the middle Holocene, the amplified presence of arboreal fossil pollen and a decrease in C4 plant productivity suggest a relatively cooler/wetter climatic interval (Bousman 1998; Nordt et al. 2002). Timing, severity, causes, and geographic extent of the Altithermal are unclear and certainly did not manifest homogeneously across the landscape. Johnson and Goode (1994) suggest that the proximity of Central Texas to the Gulf of Mexico and/or the influence from the Pacific Ocean air currents ameliorated the effects of the Altithermal.

Environmental conditions following the Altithermal were generally warm and dry but still cooler and wetter than those of the Altithermal. Importantly, seasonal fluctuations were increasingly evident after the Altithermal. Fossil pollens indicate the replacement of grasslands by woodlands (Bousman 1998). However, faunal remains from Hall's Cave provide evidence for a brief return to cool and moist conditions near ca.

2500-2000 BP, with a return to more arid conditions leading up to the present (Toomey 1993). According to Nordt et al. (2002), an increase in C4 plant production from ca. 3000-1500 BP, indicating a warmer, dryer climate, is preceded by a relatively cooler interval at ca. 4000-2500 BP. Following moister, cooler conditions prior to ca. 1000 BP as indicated by Nordt et al. (2002) and Toomey (1993), Blum and Valastro (1989) record evidence for a transition to the present climate.

Complementing pollen, speleothem, and isotope data are analyses of the developmental histories of some river systems that run through Central Texas. For example, near ca. 1000 BP, the Pedernales River, situated in the eastern portion of the Edwards Plateau, transitioned from carrying a coarse grained sediment load to a more fine grained sediment load with a concomitant decrease in width-to-depth channel ratio (Blum and Valastro 1989). The shift in sediment load and channel morphology is indicative of decreasing discharge, which is in turn characteristic of an increasingly dryer climate. Mauldin et al. (2008) confirm a general decrease in moisture at this date, but at a finer scale, and also observe erratic fluctuations in precipitation rates. Using the Palmer Drought Severity Index, Mauldin et al. (2008) conclude that weather patterns over the last 1000 years grew increasingly volatile, with brief periods of heavier-than-normal rainfall interrupted by exceedingly dry conditions. The Palmer Drought Severity Index (PDSI) is a mathematical model of soil moisture based on historical records of precipitation and temperature, and is commonly used by the agriculture industry as an index of drought. Recent research has correlated a grid of dendochronologies (dates taken from tree rings) with PDSI to extrapolate drought conditions in the United States for up to the past 1000 years (Alley 1984; Cook et al. 1999), rendering the model useful for

some archaeologists dealing with this span of time. Mauldin et al. (2008) calculated year-to-year PDSI variability using data from four grid points that frame Central Texas and found that climatic variation increased after AD 1000; in general, weather from year-to-year was more variable than that prior to AD 1000 (Figure 2-3). This increase in variation may have contributed to higher levels of bison mobility, having important implications for human groups who were heavily reliant on that important resource.

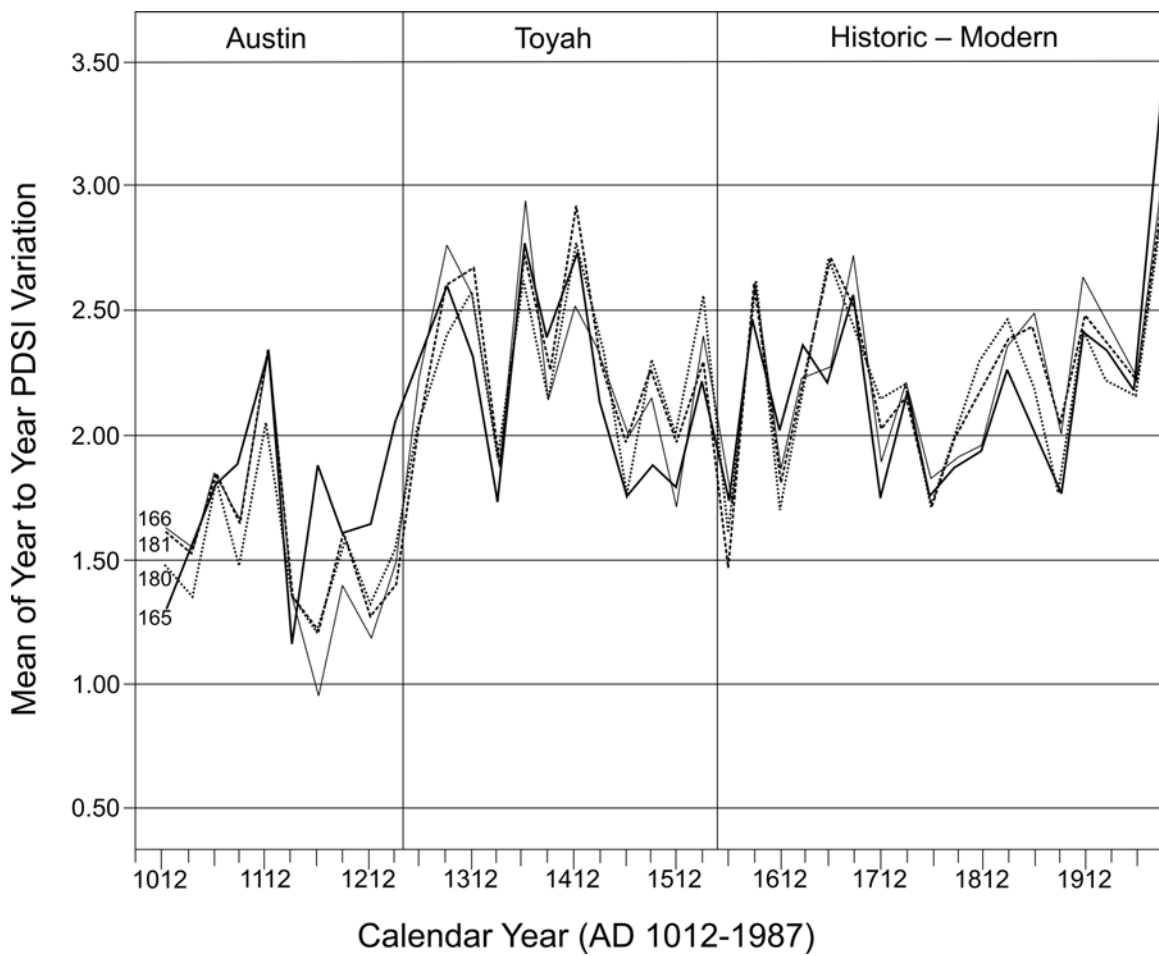


Figure 2-3. PDSI variability from 1012-1987. Redrawn from Mauldin et al. (2008: Figure 6).

Overall, reviews of paleoenvironmental reconstructions are meant to supplement, and provide an environmental foundation for, archaeological investigations. Generally, the environment of Central Texas during the late Pleistocene was suited for the cooler, wetter climate. Transitioning from the Pleistocene to the Holocene, the environment became increasingly arid, peaking during the middle Holocene Altithermal. Following the Altithermal, the climate had a relatively brief period of cooler temperature and increased moisture before reaching the more arid conditions of the present. Importantly, the last millennium has been characterized not only by increasing aridity, but also by dramatically increasing year-to-year temperature and precipitation fluctuation.

#### **PREVIOUS INVESTIGATIONS AT ZATOPEC**

The initial site survey of 41HY163 was made in June 1983, and subsequent excavations were conducted during the summers of 1983, 1984, 1985, and 1986 under direction of Dr. James Garber, Katherine Brown, and David Driver and sponsored by Texas State University-San Marcos (Southwest Texas State University at that time). In 2002, the site was briefly resurveyed and tested by limited shovel probes (Karbula et al. 2003). In 2007 CAS initiated data recovery excavations at the site. Each of these projects employed slightly different approaches to understanding the site, its stratigraphic components, and the record of Native American occupation that it contains.

In the field school's first two years, 1983-84, test units were distributed relatively evenly across the site with a few exceptions where trench-like units were excavated to delineate large features. The remainder of the field schools' units, excavated from 1985 to 1987, was located in the northern portion of the site, in the vicinity of a large burned

rock midden and what was perceived to be domestic debris. Units were numbered in a series beginning with 1 and extending to over 70. Over these years, approximately 173 m<sup>2</sup> of sediment were excavated to varying depths in arbitrary 10 cm levels or by natural levels where these were apparent. The majority of excavations consisted of 2-x-2 m units that were further subdivided into four 1-x-1 m quadrants for finer resolution. Smaller excavations units were occasionally used for determining the extent of certain activity areas. All of the excavated sediment was passed through a ¼” screen. At least fourteen features, representing various stages of lithic production, cooking, butchering and domestic occupation, were observed and recorded at the site during field school excavations (Garber 1987). Units were often excavated in blocks of four or more, were used to expose large features, and were staggered to increase the area covered. This method of excavation yielded a broad horizontal exposure.

Research goals underwent change through the course of the field schools, but the theme of investigating prehistoric settlement patterns and subsistence strategies of the San Marcos area remained constant (Garber 1987). Broad horizontal exposure was used to investigate the spatial organization of this hunter-gatherer camp, and trench-like units were used to reveal profiles and vertical distribution of features. When the focus of excavations shifted to the northern portion of the site following the discovery of large burned rock middens, a large core reduction area, and postholes, research questions or goals were turned towards investigating the cultural lifeways of the Transitional Archaic inhabitants of the region.

In February of 2002, archaeologists from Hicks & Co. revisited the site as part of an intensive pedestrian survey for the proposed Wonder World Drive Extension Project



(Karbula et al. 2003). These investigations focused on assessing the level of overall site integrity, and the degree of disturbance that may have occurred since the earlier field schools (Karbula et al. 2003:21). During this brief project, seven shovel tests were excavated. Results of this investigation revealed that, although the western portion of the site was impacted by the construction of a large dam and spillway control feature, a significant portion of the site remained and potentially contained intact cultural strata.

In August of 2007, CAS initiated data recovery excavations at the site. One of the first field tasks performed was to relocate the earlier field school grid system so that the 2007 excavations could complement the earlier data. All CAS units were assigned coordinates based on their location in relation to this grid (Figure 2-4). Initially, 14 m<sup>2</sup> were to be excavated by hand, with at least 10 m<sup>2</sup> of this area dedicated to the northern part of the site where the putative Transitional Archaic structure had been identified. The remaining units were to be placed in a part of the site that had not been previously investigated. This original level of effort was expanded when human remains were identified in the southernmost two units, which were expanded two additional square meters.

FIGURE 2-4. REDACTED

Figure 2-4. Zatopec site map showing locations of units excavated in SWT field schools (with unit numbers) and 2007 CAS data recovery (units with grid coordinates). North is to the top, and grid intervals along map margins are in meters.

Following the manual excavations of 16 m<sup>2</sup>, the site area was mechanically stripped of overburden to search for other possible features. Five areas were identified in this activity as possible features or activity areas, and these were cross-sectioned to

record their profiles. Each of these excavations exposed approximately one square meter. Additionally, scraping revealed a deposit of sediments older than what was encountered during the original CAS excavations. This layer was sampled with two additional square meters. The mechanical scraping also identified two additional sets of human remains that each required 2 m<sup>2</sup> of hand excavation. By the time the 2007 CAS excavations were concluded, a total of 21 1-x-1 m units and one .50-x-2 m unit had been excavated in addition to the earlier SWT excavations (see Figure 2-4). All CAS excavations were conducted in arbitrary 10 cm levels, with elevations controlled from a central datum point established in the middle of the site. Some exceptions occurred in cases where natural or cultural stratigraphy could be observed in features or possible features. These exceptions are discussed in the individual feature descriptions (see Chapter 5). After the completion of excavations, the remaining accessible portion of the site area was mechanically stripped to ensure that no further features or human burials remained.

### **PREVIOUS INVESTIGATIONS IN THE VICINITY OF 41HY163**

In the vicinity of 41HY163 and the fertile San Marcos Springs, there are several recorded sites including 41HY37, 41HY147, 41HY160, 41HY161, 41HY165, 41HY317, 41HY319, and 41HY432. A brief description of each site is presented using information from the Archeological Site Atlas Database (Database) and available technical reports.

The site of Edward Burleson's San Marcos homestead has been designated 41HY37. The decorated military man and politician built the log cabin atop the ridge overlooking San Marcos Springs in 1848 (Bousman and Nickels 2003). In 1983, the site was excavated by a Texas State field school under the direction of Dr. James Garber, and

this investigation resulted in the discovery of a prehistoric component (Garber and Orloff 1984). Prewitt and Associates, Inc. revisited 41HY37 and performed further investigation by means of mechanically excavated trenches (Arnn 1999). Stratified cultural deposits and a Late Archaic projectile point, recovered by archaeologists from Prewitt and Associates, Inc., and diagnostic projectile points, discovered by Garber, date the range of prehistoric occupation at this site from the Middle Archaic to the Late Prehistoric. Through investigations of the Burleson homestead in the summer of 2000, CAS archaeologists discovered that the site had been severely disturbed by the modern construction of a replica-cabin and a gondola station (Bousman and Nickels 2003).

As described by James Warren (1977) on the Database, site 41HY135, a State Archeological Landmark, was discovered at the confluence of the San Marcos River and Purgatory Creek during an aerial survey performed by the Soil Conservation Service for a San Marcos Riverfront Park. The site, of unknown age, consisted of a surface lithic scatter, and showed modern disturbance from a sewer line and gravel path, as well as natural erosion. Testing was recommended to further delineate it both vertically and horizontally; however, no information pertaining to further investigations was found.

In 1978, Southern Methodist University (SMU) professor Joel Shiner (1979, 1981, 1983) began underwater investigations at Spring Lake, an artificial lake created by damming the San Marcos River just downstream from the springs. Shiner first began excavating at site 41HY161, but this site appeared to be disturbed and contained a mixture of prehistoric and historic artifacts. In 1979, Shiner shifted investigations to 41HY147, located adjacent to a large springhead. At 41HY147, he recognized three strata on an eroded slope at the base of the escarpment. The top stratum contained shouldered

and notched Archaic projectile points, the middle stratum contained shouldered and lanceolate projectile points, and deepest stratum contained Paleoindian projectile points and large faunal remains. Shiner's underwater excavations produced abundant evidence of Archaic and Paleoindian occupations, but the remains were not found in sedimentary contexts that could be used to reconstruct detailed views of past occupants' lifeways. Nevertheless, Shiner (1983) proposed that Paleoindian inhabitants of 41HY147 were semi-sedentary and stayed at the springs for long periods of time. This hypothesis was based on the relatively large number of Paleoindian projectile points and bones found in his excavations in comparison to well-known kill sites in the High Plains. Additionally, he suggested that the presence of large springs with constant water temperatures would allow "edible flora and fauna [to] be available year-round" and the "green foliage near the temperate water would attract large fauna during the dry or cold seasons" (Shiner 1983:5-6). However, Johnson and Holliday (1983) contested this hypothesis and suggested that the abundance of projectile points was related to the abundant supplies of chert available in the region rather than a semi-sedentary pattern of mobility.

Site 41HY160, a State Archeological Landmark, was investigated during a field school directed by Dr. James Garber. As described by Garber et al. (1983), the site is located near Tee Box 6 of the Texas State University Golf Course, adjacent to Spring Lake, and was investigated through the excavation of 1-x-1 m and 2-x-2 m units. Chipped stone tools, burned rock hearths and middens, a post mold, and a stone alignment, all representing the Paleoindian period through the Late Prehistoric period, were recovered although Paleoindian materials appeared not to be *in situ*. Further investigations were recommended, and in 2001, CAS conducted extensive testing of the site (Bousman et al.

n.d.). One component of the 2001 testing of 41HY160 included the excavation of 22 cores which were described and analyzed by Dr. Lee C. Nordt (Bousman et al. n.d.). Through this investigation, Nordt defined a total of six depositional units, A through F, across the San Marcos River/Sink Creek Valley, that reflect changes in the course of Sink Creek, periods of increased and decreased stream flow, and changes in the resulting depositional regimes. These units were deposited in chronological order, from oldest to most recent, and range from Paleoindian (A) to Late Prehistoric and Historic periods (F). The Tee Box 6 excavations remain largely unreported.

State Archeological Landmark site 41HY161, located just below the Ice House Dam to the south of the springs, was initially investigated by Joel Shiner. His data showed a significant amount of disturbance, with Archaic artifacts were found mixed with historic artifacts. In the early- to mid-1980's, a series of field schools, directed by Dr. James Garber investigated sites in San Marcos and included fieldwork at 41HY161. A decade later, in 1992, Drs. Garber and Glassman recovered two prehistoric burials from the site; preservation of the bone was moderate, but both burials were disturbed and only partially recovered (Garber and Glassman 1992; see Chapter 8). As described by Aery (2007), prior to development in the 1990's, testing of the southwestern portion of the site revealed an intact Late Archaic component overlying a Late Paleoindian component (Ford and Lyle 1998; Lyle et al. 2000). Eric Oksanen (2007) and Dave Nickels supervised the most recent excavations of site 41HY161 in 2004 during which intact Early Archaic deposits were encountered.

In 1984, 41HY165, also in the vicinity of Spring Lake, was recorded and briefly tested. Excavations were renewed in 1996 and continued through 1998. Jennifer Giesecke

(1998) analyzed the faunal remains for a class project. Christopher Ringstaff (2001) analyzed the artifacts and depositional contexts for his M.A. thesis. Otherwise, the excavations at this site have not been reported.

Site 41HY317, a late Holocene burned rock and lithic scatter, was discovered during an intensive survey performed by the Center for Archaeological Studies (Jones 2003). As described by Richard S. Jones (2003), shovel tests and backhoe trenches revealed cultural deposits and the potential for deeper, intact deposits. However, no diagnostic artifacts were recovered, and it was recommended that further investigations at 41HY317 be conducted.

The Center for Archaeological Studies performed a survey on behalf of the City of San Marcos in 2001, resulting in the discovery of 41HY319, a prehistoric site of unknown age (Barrera 2002). Beneath disturbed sediments, a possible intact cultural deposit, represented by lithic debitage, was found with an upper boundary of 50 cmbs (centimeters below surface). Due to the shallow nature of the proposed development and the absence of temporally diagnostic artifacts, no further work was recommended (Barrera 2002).

In the spring of 2007, site 41HY432 was discovered by archaeologists from Hicks & Co. while they were conducting a survey on behalf of the City of San Marcos. A combination of shovel tests and mechanical excavation revealed a prehistoric site of undeterminable age (King 2007). As described by King (2007), the proximity and similar depth suggest that 41HY432 is potentially an extension of 41HY319.

## REGIONAL CULTURAL CHRONOLOGY

The cultural chronologies for Central and South Texas are not completely understood or agreed upon. However, archaeological deposits indicate rich cultural development spanning several millennia. Black (1995), Hester (1995, 2004), and Collins (1995, 2004) have recently synthesized available archaeological evidence from the region. All dates are in the radiocarbon time scale and given as years before present (BP, i.e. before 1950). Human presence is divided into three periods: Prehistoric, Protohistoric and Historic.

### PREHISTORIC

The Prehistoric period is divided into three major temporal stages, the Paleoindian, Archaic and Late Prehistoric. The Paleoindian stage begins with the earliest known human occupation of North America and extends to approximately 8800 BP. The Archaic stage follows, extending from ca. 8800 BP to 1250 BP. The Late Prehistoric stage begins ca. 1250 BP and is characterized by the development of bow and arrow and ceramic technologies.

#### *Paleoindian*

Collins (1995:381–385, 2004) dates the Paleoindian period in Central Texas to 11,500-8800 BP; we divide the Paleoindian into Early (11,500-ca. 10,200 BP) and Late (~10,200-8800 BP) phases. Early Paleoindian artifacts are associated with the Clovis and Folsom cultures and diagnostic items include fluted, lanceolate projectile points. Clovis is also characterized by well-made prismatic blades (Collins 1995; Green 1964). The Early Paleoindian stage is generally characterized by nomadic cultures that relied heavily on



hunting large game animals (Black 1989); however, recent research suggests that early Paleoindian subsistence patterns were considerably more diverse than previously thought, and included reliance on local fauna including turtles (Black 1989; Bousman et al. 2004; Collins and Brown 2000; Hester 1983; Lemke and Timperley 2008). Folsom cultures are considered to be specialized bison hunters, as inferred from the geographic location and artifactual composition of sites (Collins 1995).

The Late Paleoindian substage occurs from ca.10,200-8800 BP. Reliable evidence for these dates was recovered from the Wilson-Leonard site, north of Austin (Bousman et al. 2004; Collins 1998). At Wilson-Leonard, archaeologists excavated an occupation known as Wilson, named for the unique corner-notched projectile point. The dense occupation also included a human burial (Bousman et al. 2004; Collins 1998). In addition to the Wilson occupation, Golondrina-Barber and St. Mary's Hall components, dating between 9500 and 8800 BP, were excavated. Collins (1995) suggests the Wilson, Golondrina-Barber, and St. Mary's Hall components represent a transitional period between the Paleoindian and Archaic Periods due to the subtle presence of notched projectile points and burned-rock cooking features.

### ***Archaic***

Collins (1995, 2004) contends the Archaic stage in Central Texas lasted approximately 7500 years, from 8800-1200/1300 BP, and divides the stage into Early, Middle and Late Archaic based on Weir's (1976) chronology. The Archaic stage marks several important transitions: a shift in hunting focus from Pleistocene megafauna to smaller animals; the increased use of plant food resources and use of ground stones in food processing; increased implementation of stone cooking technology; increased use of

organic materials for tool manufacturing and an increase in the number and variety of lithic tools for wood working; the predominance of corner- and side-notch projectile points; greater population stability and less residential mobility; and systematic burial of the dead. What appears as a new emphasis on organic materials in tool technologies and diet is most likely merely a reflection of preservation bias.

*Early Archaic* While Collins (1995:383, 2004) argues that the Early Archaic spans from 8800 to 6000 BP based on three divisions of projectile point types, the current project considers the Early Archaic to extend from 8800 to 5800 BP based on Collins (1995) and Prewitt (1981b, 1985). Significant changes in lithic technology, seen through notched projectile points and specialized tools (e.g. Clear Fork and Guadalupe bifaces), as well as a dietary adjustment, as evidenced by the increased number of ground stone artifacts and burned rock midden cooking features, distinguish this cultural period from previous ones (Collins 1995; Turner and Hester 1993:246–256). A variable climate and concomitant variation in game resources (i.e. bison, Dillehay 1974) are strongly related to shift in subsistence, and Collins (1995) suggests that Early Archaic peoples occupied the wetter portions of the Edwards Plateau. Early Archaic sites are thinly dispersed and are seen across a wide area of Texas and northern Mexico (Weir 1976); however, Collins (1995:383) notes a concentration of Early Archaic components along the southeastern margins of the Edwards Plateau, close to major spring localities such as in San Marcos.

*Middle Archaic* The Middle Archaic, defined by Collins (1995, 2004) as 6000 to 4000 BP (5800 to 4000 BP for the current project), is approximately marked by the onset of the Altithermal. As noted above, climate fluctuated from arid to mesic to arid in Central Texas during the Altithermal. Vegetation and wildlife regimes all fluctuated in

response to these environmental oscillations, with human groups responding accordingly. Collins (1995) divides the Middle Archaic period by projectile point style intervals: Bell-Andice-Calf Creek, Taylor, and Nolan and Travis. The Bell-Andice-Calf Creek interval was a mesic period when grasslands, attractive to bison herds, expanded southwards into Central and South Texas. Bell-Andice-Calf Creek peoples, as evidenced by hunting-based lithic technology, were specialized bison hunters who followed the herds southwards (Johnson and Goode 1994). As the period shifted from mesic to arid, both bison and bison hunters retreated northwards. During this transitional period, Taylor bifaces were manufactured. Later in the Middle Archaic, Taylor bifaces were replaced by Nolan and Travis points (Collins 1995, 2004). The Nolan-Travis interval was a period when temperature and aridity were at their greatest levels. Prehistoric inhabitants acclimated themselves to peak aridity as seen through increased utilization of xerophytes such as sotol (Johnson and Goode 1994). These plants were typically baked in earth ovens and reflected the development of burned rock middens. During more arid episodes, the aquifer-fed streams and resource-rich environments of Central Texas were extensively utilized (Story 1985:40; Weir 1976:125, 128).

*Late Archaic* The Central Texas Late Archaic dates to approximately 4000-1250 BP (Collins 1995:384, 2004). For finer resolution, the current project divides the Late Archaic period by Johnson and Goode's (1994) subperiods: Late Archaic I, 4000-2200 BP, and Late Archaic II, 2200-1250 BP. Sites with ideal stratigraphic separation may reveal three discernable subperiods for the Late Archaic (e.g., Prewitt 1981b, 1985). Late Archaic I, according to Johnson and Goode (1994), is marked by two significant cultural traits: 1) the billet thinning of bifacial knives and projectile points leapt forward in terms

of artistry and technology, and 2) the human population appears to have increased. These patterns vary considerably through time and from one sub-region to another across Central Texas, but strongly shape the archaeological record of the Late Archaic. Overall, evidence suggests an increasingly mesic climate through the Late Archaic (Collins 1995; Johnson and Goode 1994; Mauldin et al. 2008). Mauldin et al. (2008) suggest that climatic variation resulted in a general decrease in grassland bison range. Some archaeologists note the presence of cemeteries at sites such as Ernest Witte (Hall 1981) and Olmos Dam (Lukowski 1988) as evidence that populations indeed increased and that groups were becoming territorial (Story 1985:44–45); however, some other archaeologists challenge the interpretation of a growing population by citing a decrease in burned rock middens (Prewitt 1981:80–81).

### *Late Prehistoric*

Collins (1995, 2004) dates the Late Prehistoric in Central Texas at 1,300/1,200–260 BP, and follows Kelley (1947) in dividing it into Austin and Toyah phases. The current project delimits the Austin phase to 1250-750 BP and the Toyah phase to 750-300 BP. The most distinctive changes in relation to previous eras include a technological shift away from the dart and atlatl to the bow and arrow, and the approximately concurrent incorporation of pottery (Black 1989:32; Story 1985:45–47).

*Austin Phase* The Austin phase is characterized primarily by the appearance of arrow points, including Scallorn and Edwards types. Evidence for increasing social strife, if not overall populations, is seen multiple burials from Central Texas that date to this period. Burials from this time reveal numerous incidents of arrow-wound deaths, suggesting that population growth resulted in disputes over limited resource availability (Black 1989;

Meissner 1991; Prewitt 1974). Burned rock middens are occasionally found with these types of points (Houk and Lohse 1993), and ground and pecked stone tools, used for plant food processing, become increasingly common in the Austin phase.

*Toyah Phase* The beginning of the Toyah phase (750 BP) in Central Texas is characterized by contracting stem points with flaring, barbed shoulders, a style known as Perdiz; by the common occurrence of blade technology that is considered to be part of a specialized Toyah bison hunting and processing toolkit (Black and McGraw 1985; Huebner 1991; Ricklis 1994); and by the appearance of bone-tempered pottery in Central Texas (Johnson 1994:241–281). The wide variety of ceramic styles and influences seen throughout Toyah phase ceramic assemblages provide important information concerning the social composition of these cultural groups (Arnn 2005). Toyah phase ceramic assemblages display Caddo, Texas Gulf Coast, and Jornada Mogollon influences (Arnn 2005). In addition to shifts in material technology, Mauldin et al. (2008) suggest that bison herds foraged across increasingly widespread ranges, at least partly in response to climatic patterns described above. They (Mauldin et al. 2008) conclude that this change in bison herd behavior is partly responsible for what they identify as a change in Toyah hunting strategy, involving increasingly logistically-organized hunting forays in pursuit of spatially dispersed herds (also see Chapters 7, 11). Based on the ratio of zooarchaeological to archaeobotanical data associated with types of sites (e.g. bulk plant processing, bulk meat processing, residential), Dering (2008) provides further evidence of Toyah phase logistically-oriented subsistence strategies and broad diet breadths. Included with logistical subsistence strategies was what appears to be either trade for horticultural products not produced in Central Texas, or of low frequency, localized

horticultural practices. Both scenarios involve maize, which is exceedingly uncommon in Toyah-period archaeological contexts in Central Texas but which has been reported from at least three locales, the Kyle Rockshelter (41HI1) in Hill County (Jelks 1962), Bear Branch (41CA13) in Callahan County (Adams 2002), and the Timmeron Rockshleter (41HY95) in Hays County (Harris 1985).

### **PROTOHISTORIC (SPANISH *ENTRADA* PERIOD)**

In Texas, the Protohistoric period, also known as the Spanish *Entrada* period, was marked by Spanish *entradas*, the formal expeditions from established forts and missions in Northern Mexico into Central, Coastal, and East Texas in the late seventeenth and early eighteenth centuries. These encounters began with the venture into Texas by the Spanish explorer Cabeza de Vaca and the Narvaez expedition in 1528. The period is generally dated between 1500 and 1700 (or 1528, the date of the Cabeza de Vaca/Narvaez expedition, to the establishment of the first Spanish mission, Mission San Antonio de Valero in 1718).

With Alonso de León's expedition of 1680, *El Camino Real* (the King's Road) was established from Villa Santiago de la Monclova in Mexico to East Texas. This roadway followed established Native American trade routes and trails and became a vital link between Mission San Juan Bautista in Northern Mexico and the Spanish settlement of Los Adaes in East Texas (McGraw et al. 1991).

Spanish priests accompanying *entradas* provided the most complete information of indigenous cultures of early Texas. Those documented during the early *entradas* include the Cantona, Muruam, Payaya, Sana, and Yojuane, who were settled around the

springs at San Marcos and described as semi-nomadic bands. Other tribes encountered at San Marcos included mobile hunting parties from villages in South and West Texas, such as Catequeza, Cayanaaya, Chalome, Cibolo, and Jumano, who were heading for bison hunting grounds in the Blackland Prairies (Foster 1995:265–289; Johnson and Campbell 1992; Newcomb 1993). Later groups migrated into the region and displaced the former groups or tribes. These included the Tonkawa from Oklahoma and Lipan and Comanche from the Plains (Campbell and Campbell 1985; Dunn 1911; Newcomb 1961, 1993).

Archaeological sites dated to this period often contain a mix of both European imported goods, such as metal objects and glass beads, and traditional Native American artifacts, such as manufactured stone tools.

## **HISTORIC**

Spanish settlement in Central Texas first occurred in San Antonio with the establishment of Mission San Antonio de Valero (the Alamo) in 1718, and the later founding of San Antonio de Béxar (Bolton 1970; Habig 1977; de la Teja 1995). Some researchers demarcate the transition in Texas between the *Entrada* (Protohistoric) and Historic periods by the construction of the first Spanish missions in Texas. Most knowledge of this period is gained through the written records of the early Spanish missionaries. Besides the mission town of San Antonio, the only other Spanish settlement in the region was San Marcos de Neve, established in 1808, four miles south of present day San Marcos. San Marcos de Neve was abandoned in 1812 as a result of constant raids by local tribes (Dobie 1932). During this time, massive depopulation occurred among the Native Americans, mostly due to European diseases to which the indigenous

people had little resistance. Those few indigenous people remaining were nearly all displaced to reservations by the mid-1850s (Fisher 1998).

European presence in the region increased as settlers received land grants from the Mexican government until 1835. Settlement was difficult, however, due to continuation of hostilities with and raids by Native American tribes. The Texas Rangers provided protection from these conflicts after Texas secured independence from Mexico in 1836. Settlement in the region increased until 1845, when Texas gained admission to the United States, resulting in the formation of Hays County in 1848 (Bousman and Nickels 2003).



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