UNIVERSITY OF CALIFORNIA, MERCED

LIVING IN BORDERLANDS. ARCHAEOLOGY AND MEANINGFUL DIVULGATION OF THE NORTHERN FRONTIER OF MESOAMERICA

by

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Dissertation to obtain a PhD. In Interdisciplinary Humanities

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2022

CERTIFICATION OF APROVAL

LIVING IN BORDERLANDS. ARCHAEOLOGY AND MEANINGFUL DIVULGATION OF THE NORTHERN FRONTIER OF MESOAMERICA

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University of California, Merced

2022

DEDICATION

To Miriam

The light of my life

TABLE OF CONTENTS

List of Figures

List of Tables

Acknowledgements

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Torreblanca Padilla, Carlos Alberto y Manuel Duenas Garcia
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La construcción del Salón de la Columnas de la Quemada, Zacatecas. Arqueología Mexicana 16(162).

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Abstract

LIVING IN BORDERLANDS. ARCHAEOLOGY AND MEANINGFUL DIVULGATION OF THE NORTHERN FRONTIER OF MESOAMERICA

by
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Doctor of Philosophy in Interdisciplinary Humanities
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2022

Professor Holley Moyes, Chair

The state of Aguascaliente's pre-Hispanic history did not become the subject of systematic studies until recently, in the 21st century. Moreover, despite all this new recent archaeological research, archaeologists investigating Aguascalientes's past often fail to communicate and disseminate their findings to the public despite additional archaeological information that is increasingly created and circulated among specialized audiences (i.e.,,, academics, practitioners, and governmental agencies). This dissertation aims to fill the knowledge gap related to the archaeological investigation of the Mexican state of Aguascalientes by producing new knowledge on the Cerro de en Medio (CDEM) site. The project documented 215 architectonical features and created a photogrammetric 3D record of buildings from the ground surveys and drone-based photographs. Afterward, the project excavated in 3
household's compounds and analyzed recovered archaeological artifacts to finally integrate this knowledge within a regional perspective of the Mesoamerican Northern Frontier.
Then, the project design and develop *Meaningful Divulgation* practices to convey the societal importance of the investigated cultural heritage to the Mexican society at large and critically reflect on what it takes to do so. Finally, this dissertation explores a 'theoretical outline for Serious Game development' planned to engage the non-specialized audience interested in Aguascalientes archaeological heritage through a "serious game." This project argues that combining digital technologies and communication strategies is necessary to effectively produce viable
divulgation in museums and sites. In doing so, the project takes a step forward in the conservation and preservation of the archaeological heritage of Aguascalientes, which, although it may be irrelevant to nationalist narratives, is vital for the local population. The local Indigenous cultural traditions can receive new invigorating airs because their depth in time is often ignored, although they are still alive. In this sense, this research seeks to play an essential role in preserving local social memory and heritage.

Introduction
Archaeology and Public Awareness

Mexico's Indigenous archaeological heritage is massive and widely famous. Since 1972, Mexican federal law has recognized the study, preservation, and dissemination of archaeological heritage as matters of national interest. The Mexican federal government grants the National Institute of Anthropology and History (*INAH*) absolute authority over any archaeological material found on national territory.

Under INAH's stewardship, all Indigenous heritage is important, at least on paper. However, within this federal agency, there is a marked preference to research, protect, conserve, and disseminate specific forms of archaeological heritage, based on their relevance to Mexican nationalistic origin myths and/or their potential for heritage tourism purposes (Gallaga et al. 2022). Recent federal administrations have increasingly centralized INAH's practices while constantly reducing its budget. The outcome of these actions has further worsened the neglect of cultural heritage in large regions outside central and southern Mexico and created systematic knowledge voids. This situation worsens disconnection amongst local communities that have lost memory of their indigenous cultural roots in favor of a more generic nationalistic, *mestizo* narrative (Lund 2012).

Behind these controversies is the central problem of *why* and *for whom* to do archaeology, because, at least where the federal and state governments fund archaeological activities, archeology will invariably serve the purposes of political promotion for those same federal and state governments, while doing scientific research in a lateral way. However, archeology has more to contribute, and today these reflections on the commitment of intellectuals in general, and social scientists in particular, calls for a rethinking of these problems.

In addition, the archaeological academic efforts have been disproportionately concentrating on the points of view of elites, when most of the research is conducted in the bigger centers and their ceremonial elites' cores, where the massive–and impressive–constructions captivate academia's attention. In contrast, the more domestic abundant contexts that represent the generality of populations in the past are often ignored, left to be destroyed and only added to museographies and dissemination efforts as a last topic to present. Although an important amount of research has been focused on this kind of research, there are still regions that have been left out.

One of those ignored regions is the state of Aguascalientes, for which pre-Hispanic history did not become the subject of systematic studies until recently in the 21st century. Moreover, regardless of all this new archaeological research, archaeologists investigating the past of Aguascalientes often do not communicate and disseminate their findings to the public, despite the archaeological information increasingly created and circulated among specialized audiences (i.e., academics, practitioners, and governmental agencies). Therefore, the importance of cultural heritage as the central repository of values that keeps society together is not fully appreciated by society at large.

To address that knowledge gap and increase public awareness, this dissertation argues that new archaeological research must be conducted in areas such as West Mexico that are located outside the mainstream of Mexican archaeology. Therefore, this project conducted new excavations at Cerro de en Medio (CDEM), a pre-Hispanic site found in Aguascalientes, and promoted engaging the non-specialized audience interested in Aguascalientes archaeological heritage through a "serious game."

The project examined anthropological and archaeological concepts about social organization, settlement patterns, size, violence, and permanence of ancient populations in Aguascalientes, mainly the role played by locality within a regional and inter-regional system of interactions. All this ultimately serves to interpret the site of Cerro de en Medio for the local public in order to increase public awareness on the importance of their heritage.

The general goal of this research is to create a Serious Game for Heritage of the Cerro de En medio archaeological site and to spread the findings and knowledge produced by this project to the local population, increasing the public awareness of CDEM archaeological heritage values. To achieve obtain this goal, it will be necessary to accomplish the following objectives:

1. To carry out a systematic archaeological study, updating and reviewing the data on the existing archaeological heritage associated with the CDEM archaeological site.
2. To frame archaeological data from Aguascalientes in a regional context as part of the Northern Mesoamerican Frontier.

Chapter 1 revisits a communication strategy proposed by Manuel Gandara V. (2018b) known as "*Meaningful Divulgation"* which aims to close the gap between academic discourse and public awareness of archaeological heritage. This section argues that by using Meaningful Divulgation combined with Cyber Archaeology data in a Serious Game for Heritage, it is possible to engage the non-specialized audience of museums, archaeological parks, and the internet with active participation in the preservation of archaeological heritage and related knowledge. Meaningful divulgation aims to develop a public-facing communication strategy to connect the target audience with the subject matter. This communication strategy is explicitly political and de-naturalizes cultural practices, and while dissemination is intended to reach academics who want to know the results of their peers' research to contribute back to their discipline, divulgation aims to reach non-specialized audiences willing to be entertained by learning or enjoying something they can understand.

Chapter 2 is the study of the archaeological history of the region of study. The state of Aguascalientes is probably one of the least studied Mexican states in terms of archeology. Until a few decades ago, the history of the state was told beginning with the founding of the Aguascalientes' *presidio* and villa during colonial times (Figures 1, 2), and little or nothing was mentioned of the Indigenous populations that accepted the Spanish colonizing efforts, be they the so-called '*Chichimecas*" or other ethnic groups related to them (Santa Maria 1999; Weigand and García de Weigand 1996).

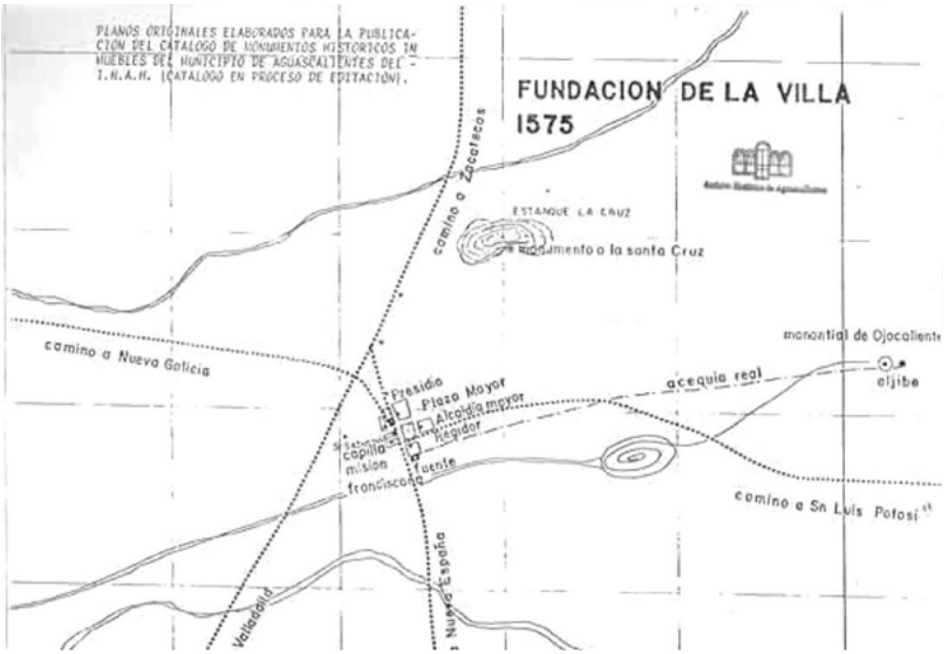


Figure 1. Map of Aguascalientes presidio and Villa (Aguascalientes Historical Archive).

Figure 2. Interior of Aguascalientes, 1830. from Carl Nebel series Picturesque and archaeological journey on the most interesting part of the Mexican Republic, in the years from 1829 to 1834. (C. Nebel 1830).

In contrast, the regions surrounding Aguascalientes have a longer archaeological research trajectory. For instance, the neighboring state of Zacatecas had a series of governors since the 19th century interested in promoting research and conservation of archaeological sites like *La Quemada, El Teul*, and *Las Ventanas* (Jimenez B. 2020; Lopez-del-Rio et al. 2009; Nelson 1997). The state of Jalisco has been the subject of renewed research since the second half of the 20th century (Beekman 2010). The same has happened in the state of Guanajuato, where four monumental archaeological sites (*El Cóporo, Peralta, Plazuelas, and Cañada de la Virgen*) opened their doors to public visitors at the beginning of the 21st century, after decades of archaeological research (Cardenas 1999).

All these efforts have produced new data about the northern border of Mesoamerica region in which Aguascalientes has become *terra ignota*. Therefore, to understand Aguascalientes' pre-Hispanic history, its territory must be integrated into a region that far exceeds the current state's political limits. That vast territory has had different names throughout different investigations, including "*Aridoamerica*" (Kirchhoff 1943), "*Great Chichimeca*" (Braniff 1994), "*Northern Border of Mesoamerica*" and "*Marginal Mesoamerica*" (Braniff 1989), or "*Greater Mesoamerica*" (Foster and Gorenstein 2000). This variety of names comes from the region's conceptualization as an interface zone between *Core Mesoamerica* and *Periphery*, or *Greater, Mesoamerica.*

As mentioned above, there is considerable archaeological data from this region, but mostly from a broadly Mesoamerican-centered research perspective, and although this project summarizes the archaeological context related to the Northern Border of Mesoamerica, the goal is to explain the cultural developments from a local perspective. This border has been studied since the creation of the very concept of Mesoamerica, both were born together, and therefore they share the same problems in their definition. Though archaeological research on the border has focused on the cultural manifestations with more significant similarities to Core Mesoamerica, as investigations have advanced, archaeologists have found a more diverse and fascinating cultural panorama than what was once thought to exist beyond Mesoamerica's cultural corset, represented by a myriad of cultural manifestations. In a general, ambiguous way, the Northern Border of Mesoamerica was defined along the Lerma River (Figure 3), at least by the time of Spanish contact, building an imaginary wall between the indigenous societies that lived on one side and those that lived on the other, supposedly separating the high Mesoamerican cultures from the simple *Chichimeca* hunter-gatherers (Jauregui 2008).

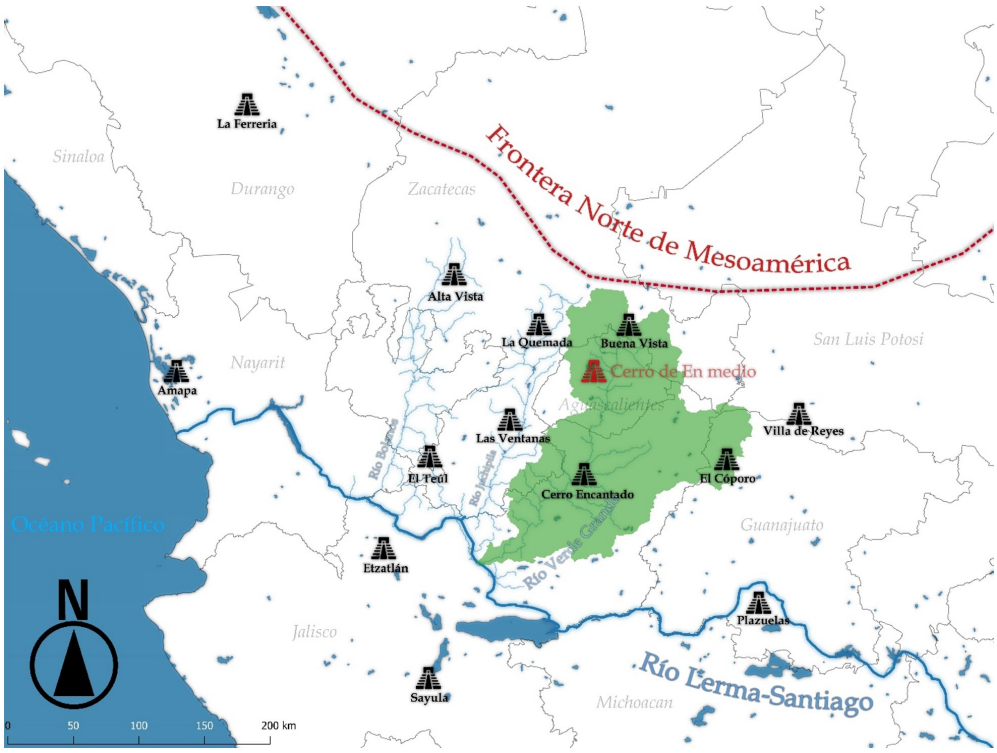


Figure 3. Map of the Northern Frontier of Mesoamerica, Rio Verde Grande basin location (Green area) and the relevant sites during the Epiclassic (600-900 CE). (M. Dueñas).

Because the characteristics used to generate this term were vague, imprecise, and quite widespread (the use of agriculture, the use of the *coa* (a planting stick), the calendar, to name a few examples) to form a solid argument to differentiate these groups, archaeological investigations in the region soon found material culture that shared remarkable similarities with the rest of Mesoamerica. To resolve this contradiction, archaeologists almost at once built the concept of a "fluctuating frontier in time," that is, moments in which Mesoamerica expanded its cultural influence, and moments in which it diminished and contracted.

Under this concept, archaeological research campaigns on the Northern border of Mesoamerica had focused on solving when and how the sedentary way of life arrived in this region north of the Lerma River. Thus, archaeological subareas and cultures have been defined to help study a highly diverse region in environmental and cultural terms. But despite these advances throughout more than a century of archaeological research, a mechanism of translation for the general public in order for the region's heritage to be understood appreciated and protected is still needed.

Chapter 3 focuses on the recent archaeological projects in Aguascalientes. At the turn of the 21st century, efforts from local universities and the regional INAH center's initiated new archaeological projects aimed at the pre-Columbian archaeological heritage. After 22 years of research, the material culture recovered from ancient times not only reveals a diverse, complex culture tied with neighboring areas but a unique cultural melting pot. The recovery of a diversity of diagnostic elements in all Aguascalientes sites, and others found in neighboring regions allows us to see an interrelation among them and throughout the border region in general.

Chapter 4 presents the results of the archaeological research conducted at CDEM, Aguascalientes in the past 12 years. The project research efforts at CDEM have been focused on

investigating domestic contexts and the social relationships within the settlement by examining the patterns in activities of production and consumption.

Through a Marxist perspective, this research emphasized the importance of the role of households as organizing units for cooperative work, production, consumption, exchange of resources, the transmission of property and rights from one generation to another, and the creation and maintenance of ties and alliances with other units through marriage and other forms of exchange, i.e., social reproduction (Rathje and McGuire 1982).

Because households are the level at which a group's social adaptation directly articulates with economic and ecological processes, the study offers an opportunity for archaeologists to examine social adaptation (in a functionalist sense) with direct reference to the empirical details of the archaeological record (Ashmore and Wilk 1988; Wilk and Rathje 1982). Here, it will also offer the opportunity to illustrate to the public that "home" is a fundamental element of human society, and even though society has changed over time the public can relate easily.

Specifically, CDEM archaeological project documented 215 architectonic features, and produced a photogrammetric 3D record of buildings from both ground and drone-based photographs, but most importantly for understanding the site, the archaeological materials recovered through ground-truthing, and excavations revealed the chronology of the site, as well as a general idea of the activities conducted by the ancient CDEM population, population estimated based on the number of classified habitational structures.

Finally, Chapter 5 presents the conceptual development of a *Serious Game* for a meaningful divulgation of CDEM archaeological knowledge to the general public. Learning history is fundamentally dependent upon narratives, often accompanied by illustrations. Therefore, promoting a deeper comprehension of knowledge about the past requires learners' most significant possible degree of involvement. Experiential learning advocates learning by doing; hence, it is possible to narrow the gap between virtual and real spaces by producing a video game that allows users to experience the archaeological record. In recent years, multimodal serious games technologies, such as virtual reality (VR) and augmented reality (AR), have appeared as methods for visualizing a museum's digital artifacts in differing contexts (Figure 4).

The digital representation of heritage through these technologies does not solve divulgation itself, though it offers new opportunities to communicate heritage values, background information, and theoretical fundamentals through its interactive capability. Therefore, combining digital technologies and communication strategies is necessary to produce practical divulgation in museums and sites effectively.

Figure 4. Photograph of me experiencing a VR application at the MAN, Spain. Photo by M. Campos.

The communication process starts with a conceptual design. This conceptual design for meaningful divulgation looks to be the instrument to create a work plan that communicates the heritage values of the CDEM archaeological site to the community of San José de Gracia, where CDEM is found, and in general to the population of Aguascalientes interested in its pre-Hispanic heritage.

Fulfilling these goals takes a step forward in the conservation and preservation of the archaeological heritage of Aguascalientes, which, although it may be irrelevant to nationalist narratives, is vital for the local population. The local Indigenous cultural traditions can receive new invigorations because, although they are still alive, their depth in time is often ignored. In this sense, this research looks to play a key role in the preservation of local social memory and heritage.

Chapter 1
Theory and methodology. Archaeological Heritage and Serious Games: Developing Digital Methodologies for a Meaningful Divulgation of Heritage

1.1 Introduction

Although an increasing amount of archaeological information is produced and circulated among specialized audiences (i.e., academics, practitioners, governmental agencies), archaeologists often fail to communicate and disseminate archaeological knowledge to the general audience. For this reason, the importance of cultural heritage as the primary repository of values that keeps the fabric of society together is not fully appreciated by society writ large. This chapter discusses a communication strategy proposed by Manuel Gandara V. (2018b) named "Meaningful Divulgation" which, if implemented, has the potential to close the gap between academic discourse and public awareness of archaeological heritage. Additionally, this chapter shows how digital methods such as Serious Games achieve this goal and enhance the preservation and dissemination of archaeological heritage to finally disclose the archaeological project theoretical position: Household Archaeology through Marxism.

1.2 Scientific Communication

Various digital representation technologies improve the communication of academic and scientific knowledge to the general public: from digital tools that enable virtual visits to archaeological sites and museums (i.e., virtual reconstructions based on interactive virtual reality of 360º panoramas) to other techniques that enhance in-person visits and experiences such as augmented reality, interactive guides, or mobile apps. The same is true for dissemination: publication in media such as the web, apps, social networks, videos, and interoperable institutional data repositories provide scholars with unprecedented opportunities for sharing their work with the academic community and the public.

Regardless of the potential embedded in these digital technologies, archaeologists must go beyond realistic digital recreations and interaction and instead focus on ensuring that cultural information is well transmitted. To achieve this outcome, it is first necessary to understand that heritage values are not self-evident but taught and learned by promoting a culture of protection and preservation. This requires thoughtfully combining digital technologies and communication strategies to promote heritage awareness and education. There are various concrete strategies to improve heritage education and awareness. Each of the following strategies has characteristics that reflect the type of museum or heritage site in which it was developed: 1) *public communication of science, 2) scientific dissemination, 3) public understanding of science,* 4) *Mediation* and *5) Thematic interpretation.*

While *public understanding of science* was first developed in the U.S. by the National Parks Service (NPS) to spread awareness of natural heritage (Ham 1992), it soon extended beyond that field because many natural parks managed by NPS also have a rich cultural heritage. *Public understanding of science* has been widely adopted worldwide and is today the

subject of many higher-education programs (Colquhoun 2005; Knudson et al. 1995; Veverka 1998).

The development of *Thematic Interpretation* into more current cultural communication approaches necessitates acknowledging that archaeologist cannot communicate archaeological or cultural knowledge to the general public the same way they communicate between academic peers, and to make things more complicated, the challenges related to knowledge dissemination in the social sciences is different from those in the natural sciences (Gandara V. 2018b). Science museums worldwide use general theories produced by the natural sciences, leveraging experiments and equipment to represent and make accessible the scientific discovery they aim to convey. For example, the famous experiment with soap bubbles, widely employed in children's science museums, is built on widely accepted theories on surface tension (Figure 5).

Figure 5. Bubbles: Science in Soap Exhibit. Montshire Museum of Science. USA. Source: https://www.montshire.org/about/press-room/press-photos/montshire-museum-photos

In contrast, social sciences, primarily due to radical postmodernism, argue that it is not desirable nor even possible to produce theories; or challenge existing theories by defining them as "great narratives" or "mere ideological narratives" that provide the public with a biased interpretation of the past and history (Gandara V. 2016). This scenario has negatively affected the social sciences through an ongoing debate on whether social sciences can even be considered "sciences" or whether their methodology and resulting theories can or cannot be communicated to the public. The research process itself is sometimes not considered worth mentioning and is often forsaken by museums and exhibitions. Consequently, museums presenting knowledge from the social sciences often communicate only empirical results, i.e., the so-called "hard data" and technical descriptions (Figure 6). These are useful for a specialized academic audience but invariably fail to convey the relevance of what is presented to the general public.

Figure 6. Feline effigy exhibited at Teotihuacan: City of Water, City of Fire at the de Young Museum, San Francisco, USA (Photo M. Dueñas).

The Meaningful Divulgation approach solves this issue by using historical-anthropological theories to present the values that give meaning to cultural heritage (Gandara V. 2003). It attempts to translate the technical terms of the specialist into a language that can be understood and enjoyed by the general public.

In recent times, heritage sites and museums have used digital techniques to improve their communication efforts and close the gap identified in archaeological dissemination at the beginning of this paper. Unfortunately, the digital representation of heritage through these technologies does not solve divulgation completely, though it offers new opportunities to communicate heritage values, background information, and theoretical fundamentals through its interactive capability. This project argues that combining digital technologies and communication strategies is necessary to produce viable divulgation in museums and sites effectively.

One of these communication strategies is defined as Meaningful Divulgation. This approach was first introduced in Mexico in 1993 as Thematic Interpretation. This strategy was

later renamed the "anthropological and historical approach to thematic interpretation" (Gandara V. 2003), and finally evolved into what Gandara conceptualizes as Meaningful Divulgation of Heritage (Gandara V. 2018b). Meaningful Divulgation is an educational communication strategy developed for contextual education on archaeological and historical cultural heritage. Its objective is to generate a culture of preservation by providing visitors and stakeholder communities with the cognitive, evaluative, behavioral, and spatial orientation that facilitates learning and deep enjoyment of heritage values while fostering understanding of a site's or tradition's current relevance. The following section in this chapter examines this approach in detail.

1.3 The Meaningful Divulgation strategy

Meaningful divulgation aims to develop a public-facing communication strategy by leveraging feelings linked to universal— or at least widely known—concepts. These connect the target audience with subject matter using humanistic practices such as dramatic theory and film scripts. This communication strategy is explicitly political and de-naturalizes cultural practices, establishing a priority commitment to the subaltern classes. Building upon Baba Doium's claim that the public only preserve what they appreciate and only appreciate what they understand (1968) and incorporating the TORE Model developed by Ham (1992, 2013), Meaningful Divulgation encourages citizens to become responsible for preserving their heritage.

Knowing the target audience is critical for a cultural interpreter or archaeologist to select the appropriate communication strategy. Following Sebugal (1995), Gandara V. (2003) defines two types of communication that applicable to the task: *Dissemination* is used when academics communicate to a peer audience. *Divulgation* is used when academics communicate to people who are not our academic peers.

As mentioned before, these diverse types of communication and audiences have received different names over time across the world, including scientific communication, dissemination of scientific knowledge, or more generally, academic communication. Divulgation is also known as *public communication of science*, *popularization of science*, or formerly *scientific vulgarization* (sometimes pejoratively, implying that something is lost when scientific knowledge is translated for an uneducated public).

While dissemination is intended to reach academics who want to know the results of their peers' research to contribute back to their discipline, divulgation aims to reach non-specialized audiences willing to be entertained by learning or enjoying something they can understand. The latter are usually recreational audiences that choose cultural content at their own discretion and use it for leisure and can stop paying attention anytime because they are bored, or the message is not relevant or somehow does not meet their expectations. Schramm (1971, in Ham 2013:26) notes that these audiences want to use their free time most enjoyably and do not want to make too much effort. Therefore, since retaining or understanding what is communicated is not a priority beyond satisfaction in the experience itself—such audiences use cultural communication products to have fun and maybe learn something new.

If general audiences do not find the message relevant, or at least entertaining (in the sense of "keeping your attention occupied," not necessarily fostering a pleasant emotion, as Ham [2013] explains), then they will disconnect themselves from the conversation. Consequently, the communication fails. This is what the TORE model captures: interpretation should be centered on a theme ("T") or central idea; should be organized ("O") in such a way as to be easily

followed; should be relevant ("R") for the intended audience; and should be entertaining ("E"), in the sense of keeping of the visitors intellectually engaged in the experience (Ham 2013:19).

Therefore, Meaningful Divulgation is not about what the interpreter, i.e., the archaeologist or museum curator, defines within the parameters of her institutional position and professional interest, but instead what could the audience needs to know, feel, or do, to understand the relevance of the presented heritage. In other words, according to the Meaningful Divulgation framework, communication of knowledge must have a cognitive orientation, convey knowledge that helps the public understand the heritage values associated with the archaeological/cultural case study, and summarize what they could benefit from knowing or doing in a museum or site to enjoy it more deeply.

To achieve this, Meaningful Divulgation must contain a: 1) evaluative orientation, or what emotions facilitate producing personal meanings, appreciation, and empathy that calls for preservation; 2) orientation for action, or what actions one can take, not only make one's visit valuable and respectful, instead of banal, but how one can assume the co-responsibility of heritage preservation at the end of the visit. Moreover, 3) the audience needs spatial orientation, how space is organized and can be expertly navigated, and how to guarantee that they see the elements that condense heritage values immediately, or in other words the "must see" of a heritage site or museum (Gandara V. 2016).

To achieve the Meaningful Divulgation of CDEM, the archaeological project chose household archaeology to be the framework in which the data collected would help us convey the relevance of heritage to San Jose de Gracia public. Household archaeology involves researching the architecture, material culture and features associated with the daily life, in order to understand the social organization and their economic and ecological conditions.

By using Meaningful Divulgation approach to CDEM households, the project seeks to illustrate to the public that what might have initially seemed unique and unrepeatable in history, is in reality an example of generalized processes widely shared by all human beings. While of course there are historical and cultural differences in each case, Meaningful Divulgation exposes characteristics of a shared humanity, or what Gandara V. describes as the anthropological approach to thematic interpretation (2018b). The model links the archaeological heritage and the present indicating the similarities, to make the past relevant today in the lives of visitors, and useful in a design for the future. Archaeology is a continuous and ever-changing process and even if archaeologists don't have the answer to everything, the message should point out that as long as heritage is preserved, archaeologists and other researchers will be able to continue to answer questions and understand archaeological cultures by preserving the past for the future. This is essential for turning the public into allies.

1.4 From Virtual Realities to Cyber Archaeology. Realism, interactivity, and usability in digital simulations.

Emerging technologies applied to cultural and archaeological heritage have resulted in the development of new concepts such as Virtual Heritage, Digital Heritage, Digital Archaeology, Virtual Museums, Cyber Archaeology, or Virtual Archaeology, among others (Forte 2010; Levy et al. 2010). In their book *Cyberarchaeology*, Maurizio Forte and colleagues introduced the theory and practice of digital archaeology. Contributors to this book state that the first application of digital technology to archaeology happened in the 1990s when Virtual Archaeology emerged as a discipline focused on designing the reconstructive process for

communication and interpretation of the past (Forte and Siliotti 1997). However, these Virtual Environments are just one of the latest developments in Cultural Heritage preservation. For instance, Lopez-Menchero and colleagues (2017) summarize a century's worth of literature regarding the state-of-the-art principles that apply to archaeological heritage reconstructions.

Various international documents and best practices well represent the evolution of heritage preservation through time. The *Athens Charter for the Restoration of Historic Monuments* of 1931 prompted a serious debate amongst specialists about the most appropriate methods and techniques to reconstruct cultural and Historical heritage. The *Venice Charter* of 1964 went even further by presenting ten articles covering physical restoration/intervention guidelines to the importance of preservation, education, and other avenues for international cooperation in these domains. The main contribution of the Venice Charter was to reject physical reconstruction as a type of restoration and emphasize the need for only a minimum degree of intervention on the original remains. Another important document was the *Charter for the Protection and Management of the Archaeological Heritage*, ratified in Lausanne, Switzerland, in 1990. Within this document, a valuable piece of content can be found in Article 7, which introduces a key recommendation to understand the latest developments in the management of archaeological heritage. This article states that the presentation of archaeological heritage to the general public is essential to promote its understanding, but that it is also crucial that the reconstructions should be carried out with great caution. This is necessary to avoid disturbing any surviving archaeological evidence. Reconstructions should also consider evidence from all sources to achieve authenticity (Article 7 on Presentation, Information, Reconstruction).

More focused on the specificity of a 3D visualization of cultural heritage, *the London Charter for the Computer-based Visualization of Cultural Heritage* seeks to establish the requirements necessary to verify that a 3D visualization of cultural heritage is intellectually responsible and solid (Beacham et al. 2009; Lercari and Busacca 2020). The *London Charter* was created in 2006 within an international academic context interested in examining the transparency of the various elements of a 3D visualization applied to cultural heritage. Its main objective was to overturn the principle of authority in creating virtual reconstructions and 3D models. Until then, the authority and scientific standing of a 3D visualization of cultural heritage had depended on the creator of a given model. The *London Charter* replaced authority with the scientific method, according to which all virtual models must feature a set of data and information (metadata and paradata) facilitating their verification and evaluation by independent experts (Beacham et al. 2009).

While the *London Charter* includes recommendations applicable to cultural heritage in general, the *Seville Principles* focus their attention solely on archaeological heritage. According to them *(Lopez-Menchero 2013)*, virtual archaeology is the scientific discipline that seeks to research and develop computer-based visualization for the comprehensive management of archaeological heritage. Since the emergence of new technologies and media, institutions have started incorporating them as a conduit for transmitting ideas in museums and heritage sites. These virtual spaces address visitors' needs to access content in new and exciting ways to increase the spread of heritage-related knowledge.

Virtual Archaeology contributes to creating Virtual Heritage (*VH*) by constructing a virtual past that incorporates related social memory. Champion (2007) defines *Virtual Heritage* as virtual environments that are embedded within cultural heritage itself. Virtually reconstructing the past and reinforcing its memory represents great potential for archaeologists, but elements such as accessibility, usability, and complexity must always be considered: the user factor must

be essential to mitigate its limitations. Hence, the fundamental notion in Virtual Heritage is to transform the user into "an active agent of the knowledge process, capable of using his imagination to recreate historical events and the image of historical figures, their values and worldviews in their mind" (Monod et al. 2006:1336).

The representation of a different culture does not require a completely faithful representation of reality to achieve maximum effectiveness; it only needs to make available and understandable the problems of our daily lives (Herrington et al. 2007). This leads to the most critical component in the development of virtual spaces: engaging the user with a direct investigation of the past (in the case of immersion technologies, through practice in real scenarios and situations) while deepening the memory represented in objects, to contextualize their personal experience. However, this process only works if the virtual reconstruction is the product of a digital workflow where the interpretation results from a multivocal scientific analysis (data entry, documentation, simulation, comparative studies, metadata). Questions such as how to virtually reconstruct? How much? Which material, textures, structures shall be used? Which phase is going to be virtually reconstructed? All these questions stimulate new and more advanced discussions about the interpretation because they push the researchers beyond a textual description. For example, a very detailed textual description of a site, a monument, or an artifact can suggest multiple hypotheses. However, none of them are necessarily translated in a visual code capable of being used in a virtual environment dedicated to communicating the heritage values. In addition, the archaeological language is often cryptic, complex, and not easily understandable; that is why an interpretation of the archaeological record is necessary. This is also why this project seeks to convey archaeological interpretation and knowledge through the lens of a Meaningful Divulgation communication strategy.

When a virtual reconstruction is laden with a lack of transparency, its objective and scientific evaluation is obscured. Here is where a cyber-archaeological approach becomes relevant. Cyber archaeology is a particular approach within digital archaeology; its theoretical approach states that archaeology is fundamentally contemporary, therefore nowadays fully digital, generating a virtual world through interactions and interconnections of data (Lercari and Wendrich 2022). This method requires the production, storage, management, and representation of digital archaeological data, including, and privileging born-digital data, like laser scans, remote sensing data, satellite imagery, digital photogrammetry, computer vision data, and high-resolution digital cameras. This approach does not necessarily entail visual representation (as in virtual reality or virtual archaeology) but does produce models and simulations that present potential pasts (Levy et al. 2010). Forte (2010) argues that the ecosystemic cybernetic relation of informative-communicative feedback constitutes the core of cyber-archaeology. However, it is not without criticism that cyber archaeology is today a research path of simulation and communication among peers. For instance, within the line of the analysis presented in this chapter, cyber archaeology does not constitute a communication strategy for non-specialized audiences that do not have enough background information to understand the data.

The data workflow generated by cyber-archaeology is digital, and its most important feature is that it can potentially make reversible the interpretation and reconstruction process: from the fieldwork to virtual realities. More specifically, cyber-archaeology elaborates spatial data directly during fieldwork. It uses a bottom-up phase and reprocesses field data in simulation environments where it is possible to compare bottom-up and top-down interpretations using platforms like 3D Geographic Information Systems.

Although cultural sites and artifacts within a Virtual Heritage (VH) environment represent an excellent potential for reconstructing the past, there must be solutions that overcome weaknesses often associated with this approach. For instance, Tan and Rahaman (2009) identify weaknesses such as the high cost, complexity in development, inaccessibility of technology and interface, ocular-centrism, and mainly the fact that VH products tend to avoid dealing with a multi-sensory reconstruction of the past and usability of their content. Additionally, VH tends to consider landscapes only as visual phenomena. This is because the landscape is, for the most part, a visual experience in today's society, and, although archaeologists have now begun to write about the significance of the other senses when engaging with landscapes (Cummings 2002; Mills 2005; Watson and Keating 1999), it is almost always the visual aspect of these landscapes that have been illustrated, possibly to avoid further increasing the complexity of its 3D reconstruction. Macedonia and Rosenbloom (2001) describe that complexity by stating that credibility in creating virtual reality educational technologies requires the following: 1) immersion or providing convincing and realistic experiences; 2) networks and database management, or providing organization, storage, and distribution of content. In addition, to create a meaningful virtual reconstruction, designers need to pay careful attention to the story, providing compelling interactive narratives that drive experiences through well-developed characters, environments, models, and experiences with a clear direction.

This last point is fundamental since learning history is fundamentally dependent upon narratives, often accompanied by illustrations. Therefore, to promote a deeper absorption of knowledge of the past requires the most significant possible degree of involvement from learners. Experiential learning advocates learning by doing, hence, it is necessary to narrow the gap between virtual and real spaces, enabling experiential learning techniques to be more readily and effectively applied. In recent years, multimodal serious games technologies, such as virtual reality (VR) and augmented reality (AR), have emerged as areas of interest as methods for visualizing a museum's digital artifacts in differing contexts. The following section discusses how these technologies have been employed in the field of Virtual Heritage.

1.5 Serious Games for Archaeological Heritage

The increasing use of games in non-entertainment contexts is transforming everyday lives and, most importantly, injecting more fun in everyday contexts due to the power of games to immerse, engage and motivate. The capabilities of games to foster and facilitate cognitive gain, awareness, and behavioral change have encouraged more games of this nature to be deployed in real-life settings. This phenomenon is called *gamification*, or how games are pervading our lives, and it does not go without criticism (Liarokapis et al. 2017).

In this context, serious games (SGs) seek to capture the user through educational, not only recreational entertainment, to continually build and transform meanings through experimentation and simulation. To improve the communication of knowledge of the past through virtual media and democratize both the creation and experience of interactive pasts, it is necessary to better understand how virtual pasts are created (Mol et al. 2017).

From the beginning of the 21st century, new opportunities for understanding the world, its cultures, and histories have been generated through serious games focusing on cultural heritage (Lercari et al. 2013; 2014), because a videogame is essentially an interactive narrative device guided by the player's attempts to face the challenges posed by game mechanics (Mol et al. 2017).

Every time a puzzle is solved, or a decision is taken, the story advances, thus fostering an experience of discovery. Meanwhile, the emphasis on problem-solving is based on trial-and-error mechanisms linked to the scientific method through content knowledge, process skills, and logical reasoning (Morris et al. 2013).

Our experiences in interactive virtual media are not “just a game,” or a make-believe play that is mostly separated from daily life (Bogost 2012; Grimshaw 2014; Huizinga 1949). The virtual is not merely an imagined space, but rather is a variety of "places where the imaginary meets the real" (Bartle 2003:5). As such, the virtual and the real are bound together and influence each other. When it comes to the state-of-the-art in serious game development, the easy answer is that it is identical between *AAA* games and *serious* games. Both types of games share the same infrastructure, i.e., technology base, or as Zyda (2005) notes, "applying games and simulations technology to non-entertainment domains results in serious games." (Zyda 2005:30).

On the other hand, it is worth noting that multimillion-dollar corporations and big teams are behind most of the entertainment video game industry, and serious games usually do not have that infrastructure. Supported by advances in computer science, digital humanities, and digital archaeology, archaeologists and heritage specialists have started identifying the many relationships between the past and videogames. However, several questions remain unsolved. For instance, how can archaeology be represented authentically in a videogame without taking away the medium's entertainment value/potential? How can video games be designed to avoid representing looting and move towards understanding context and history?

This project seeks to address these questions by combining Serious Game for Heritage development with Meaningful Divulgation. A Serious Game for Heritage (SGH) is a 3D real-time application that uses games technology to simulate, visualize, and communicate cultural heritage. Some of the key aspects of an SGH are the accuracy of visualized cultural information, transparency of the sources of data generation processes, reliability of the narrative, and thorough validation of the results (Lercari et al. 2013; 2014).

With the integration of VR and AR, the use of gaming technologies provides a compelling set of techniques to build an interactive exhibition. An SGH enables a multimodal reconstruction of cultural/archaeological landscapes, making it a robust framework for communicating archaeological information. This capability differentiates Serious Games for Heritage from commercial video games where landscapes and scenarios are often considered aesthetic or background features not worthy of a scientific approach (Lercari et al. 2013; 2014).

At present, digital technologies using the game development tool Unity 3D the recreation of landscapes is a feasible operation. For instance, a digital simulation implemented in Unity 3D allows researchers and users to explore the landscape as an "open asset" and not as a single reconstruction or a frozen snapshot of the past. From a methodological point of view, a digital historical landscape must include artificial components, human and non-human activities, natural components, and cultural perception, meaning how societies envision the environment. In these terms, the critical goal of the simulation in SGsH is to correlate all these aspects with the user's actions and feedback that occur in the virtual environment (Lercari et al. 2013).

While mainstream games with archaeological themes have been trendy commercially, educational, or “serious” games, featuring archaeology are not as sophisticated or widespread. Although several newer games being produced have found a balance between education and entertainment (*Assassin's Creed Odyssey* is a good example, Figure 7), most tend to fall on one side or the other.

Figure 7. A market scene in Assassin's Creed Odyssey Ubisoft. Source: https://www.polygon.com/reviews/2019/9/10/20859403/assassins-creed-odysseys-discovery-tour-review-ancient-greece-education-game

Serious Games in archaeology can have many different objectives, ranging from teaching historical content from an archaeological perspective or allowing the player to learn through discovery, excavation, and interpretation. Simulation mechanics are the best-suited tools to make the player appreciate the consequences of his/her decisions (Mortara et al. 2014). Therefore, together with roleplaying and adventure games, simulations are also widely adopted for raising awareness about affective and morally contingent issues for the powerful sense of empathy they can evoke. Indeed, the player slips into another skin and lives simulated experiences first-hand. Serious games for archaeological heritage are particularly suited to implement a "learning by doing" approach related to constructivist theory (Glasersfeld 1989). According to this approach, the player learns by constructing knowledge while doing a meaningful activity. Consequently, the learner does not passively receive information but instead constructs new knowledge by finding information in the game, understanding it, and applying it to fulfill tasks. As underlined in Froschauer (2012), players remember more the knowledge related to task completion than information directly provided by the game.

By participating in these settings where the "imaginary meets the real," people experience histories and heritages that are equally imaginary and real. Virtual pasts are convincing, authentic, and malleable, yet their experience occurs mainly outside the traditional channels that produce and communicate knowledge about the past (Champion 2015). As such, videogames have the potential to impact both players' perceptions of the past, as well as players' identities in the present, possibly to a much greater extent than through other, less interactive encounters with the past. Parallel to education, these simulations allow us to test hypotheses against evidence, and for this reason, scientific thinking is at the core of all contemporary archaeology. However,

how much of these non-traditional archaeological practices are presented to the public? Can this fascination with discovery be exploited, while explaining what archaeology social role is?
To solve these questions, this project follows the Cultural Presence concept defined by Erik Champion (2014). It necessarily requires being physically embodied (having a body that affects and is affected by surrounding forces; being socially embedded (meaning that in the virtual space exists the presence of others with whom feel socially bound) and being culturally inscribed (our actions leave a lasting and meaningful impression on the world). While not all subjects and topics are amenable to Serious Games creation, archaeology is particularly well suited to inclusion in this approach because of its recurring themes of discovery and puzzle-solving and its ability to recreate the lost worlds of the past through digital media.

1.6 Unlimited potential

Virtual heritage and virtual reality have the potential to enhance public understanding and interest for neglected, lost, or strongly degraded archaeological heritage. However, to fully uncover the pedagogical potential of these digital techniques, the heritage values they convey must be made accessible to their audiences by promoting a culture of preservation. Integrating digital information from static 3D cultural artifacts with interactive narratives augmented with historical characters and virtual reenactment of events from the past is an essential component for virtual heritage. This approach requires new technologies and communication strategies, both aimed at heritage education. Therefore, what changes our capacities of perception in a virtual environment is how the user experiences cultural presence in a situated environment. In addition, as promoted by a Cyber-Archaeological approach, making knowledge discovery reversible ensures the possibility of scientific progress, adding discovery and future research to the corpus of information that populates the virtual reconstructions.

This thesis claims that the gap existing in archaeological dissemination can be closed if it is developed towards a Serious Games for Heritage, using digital data acquired in archaeological investigations through cyber-archaeological methods that are interpreted for the public using a Meaningful Divulgation communication strategy.

In conclusion, the interpretation of archaeological heritage is no simple task and more needs to be done to interpret archaeological knowledge for non-specialized audiences. The next chapter summarizes the archaeological knowledge about the Northern Border of Mesoamerica, where the efforts of scholars have been disproportionately concentrated on the points of view of elites, with most of the research conducted in the larger sites and their ceremonial elites' cores, where the massive constructions captivate academia's attention.

Chapter 2
Archaeological background. The Northern Frontier of Mesoamerica and its Archaeological record

2.1 Introduction

Mesoamerica is an example of a geographically diverse cultural region comprised of multiple societies interconnected economically, politically, and culturally. In this chapter, we will explore the socio-cultural environment of the northern Mesoamerican periphery: The Northern Frontier. Mesoamerica is constantly debated, mainly because the anthropological theory has moved forward from early notions. Mesoamerica as a concept arose[1] along with a set of unanswered questions that would lead the course of all archaeological investigations for almost a century.
In its very conception, the northern border of Mesoamerica (Figure 8) was distinguished from the southern border by a much greater degree of mobility and insecurity, alternating periods of expansion to the north with others of retraction to the south (Kirchhoff 1943).
Those alternating periods of expansion and contraction have become one of the main points of discussion in the academic circles, particularly the issues around the interactions among societies behind these expansions and contractions (Frisbie 1983; Jimenez B. 1989; Mathien and McGuire 1986).

These fluctuations have been detected in at least four different moments (Figure 8, 9). The earliest one occurred during the Late Pre-Classic and Early Classic periods, dated roughly from 150 BCE to 200 CE; the moment that accounts for the first sedentary societies. Questions about the origin of these communities include whether this sedentarism is a local development, the product of migrating groups, or a phenomenon of acculturation.

Figure 1.1. The northern frontier of Mesoamerica as variously defined.

Figure 8. Proposals for Mesoamerica northern border (Gorenstein and Foster 2000).

[1] During the Mexican Anthropological Society round table of 1943.

Figure 9. Fluctuations Map (M. Dueñas).

Later, during the Classic period (200 to 600 CE), these sedentary communities developed great ceremonial centers, and social complexity increased. They went from spaced small villages to aggregated communities around large ceremonial centers. These communities experienced their absolute apogee during the Late Classic (600 – 900 CE), a moment that represents the most significant expansion of Mesoamerican culture towards the northwest. Finally, most sites in the northern border were abandoned in a process that started around the 900 CE, withdrawing the sedentary occupation next to the Rio Grande de Santiago until the arrival of Spanish contact (900-1521 AD).

These fluctuations make the academic circles wonder about the nature of the interactions between the different communities that lived throughout these processes of cultural change. Some researchers argue that the northern part of Mesoamerica was its limit, where the incursions of merchants, invasions, and colonization events were decisive in developing all northern local societies (Di Peso 1974; Foster 1986; Kelley and Abbott K. 1975; Reyman 1978).
Other researchers prefer to see the development of this region as an autochthonous event and, although they recognize that there are fundamental elements of Mesoamerican origin such as agriculture and some ceramic types, they consider that the interaction with societies in the center of the country cannot be considered significant (Haury 1976; McGuire 1980; Nelson 1981; 1986).

Finally, and in more recent proposals, some academics like to take fewer radical positions and are more likely to seek answers that explain this interaction problem and the impact it may have had on northern societies extending as far as the USA Southwest (Jimenez B. and Darling

2000; Jimenez B. 1989; Kelley 1986; Le Blanc 1986; Mathien and McGuire 1986; Riley 1986; Weigand 1982; Whitecotton and Pailes 1986).

Indubitably, the history of Mesoamerica and its cultural borders is tightly connected with the long-distance commercial exchange of prestige goods and the routes that were used to conduct it. This economic mechanism necessitated a local social differentiation and artisanship specialization. The first one allowed control over the economic resources and the latter allowed goods for exchange (Cabrero 2005). These two elements (local elites and specialized artisans) appeared when the local villages were integrated into the regional economic systems, increasing their complexity over time, favoring their development even if they were not aware of all the participants in that system since it provided the cultural cohesion and competitiveness for the control of prestige goods.

Nowadays, most researchers agree that the Mesoamerican aspects of the northern frontier culture are not the product of local evolution, but of influences or even direct migration of groups coming from the south, with their characteristic features already formed (like agriculture and the religion associated with it) (Hers 1995; Jimenez B. 1998; Kelley 1974).

In the following pages, I will dive deep into the archaeological record that gave birth to all these previous problems, exploring the data per chronological period.

2.2 The first sedentary villages

It is important to remember that since the beginning of the regional archeology of Northern Mesoamerica, researchers proposed that the *Chupícuaro* culture (Figure 10) was responsible for the dispersal of sedentary settlements in northwest Mesoamerica during the Late Preclassic and Early Classic period, based on the similarity of certain types of ceramics (Braniff 1974).

Figure 10. Left: Figurine type H4, Chupícuaro culture, Guanajuato. MNA. Right: Chupícuaro Ceramics. Arqueologia Mexicana 16(92):64.

Chupícuaro culture developed in the Bajío region, in southern Guanajuato and northern Michoacán, and the findings also suggest an origin closely related to Tlatilco and Cuicuilco, both located in Central Mexico in the late formative, or pre-Classic (Porter 1956).
Associated to this culture is a series of villages scattered beyond its nuclear zone between Guanajuato and Michoacán, reaching to Hidalgo, Querétaro, and possibly also northern Jalisco and southern Zacatecas (Braniff 1974), sharing a single culture that can be identified by ceramics related to the archaeological site of Chupícuaro, and that would later develop independently of said center.

The Acámbaro Valley, where the Chupícuaro culture emerged, is divided by the Lerma River, where the site is located on a set of small hills, nearby Chupícuaro town, where the vestiges of the first pre-Hispanic settlements attracted the attention of researchers in the twenties of the 20th (Darras et al. 2012). The Valley is bordered by volcanic chains that hold obsidian and cinnabar deposits, and a dense river network at the bottom generated alluvial terraces rich in clay deposits and swampy areas highly beneficial to agriculture. Between 1946 and 1949, the Solís reservoir was built, which caused the flooding of most of the Acámbaro Valley and covered many pre-Hispanics and colonial towns.
Rubín de la Borbolla carried out the rescue of these remains; however, it would be Muriel Porter who would publish the results of excavations, reporting numerous burials and more than 1000 complete pieces of ceramics (Porter 1956). Recent archaeological data show that the valley was occupied for the first time during 700 BCE, having its peak between 400 and 100 BCE (Bichet et al. 2009).

Contemporary to Chupícuaro, the Shaft Tombs Tradition is another cultural tradition that suggests influence or contacts in the north by Mesoamerican groups. Its influence comes from the cultural regions from West Mexico, in the current states of Jalisco, Colima, Nayarit, Michoacán, southern Sinaloa, the zone of the canyons in Zacatecas and western Guanajuato (Solar V. 2010).

This tradition is peculiar because the only things preserved from its settlements are its funeral architectural works and the deposited grave goods (Figure 11). The tombs consisted of an underground shaft that ranges from 3 to 8 meters deep, at the bottom of which are a series of burial chambers, where bodies and offerings were deposited.

The tombs with the most abundant offerings are found near or below later public architecture in ceremonial centers, evidencing a social separation translated into social stratification. For example, the more modest tombs such as those at Tabachines (Galvan V. 1991) than El Arenal or the Huitzilapa tombs (Corona N. 1955; Ramos and López M. 1996) show a marked social status difference. Obsidian workshops and the obsidian artifact exchange (Weigand et al. 2004) appear to be the decisive factors for interacting and expanding this way of life (Beekman 2010).

The imported goods present in the offerings are usually similar in many respects to those found in the early tombs of Opeño, Michoacán, suggesting similar external connections from their earliest stages, such as figurines and shell ornaments that ideologically connect the elite groups of the late formative within the same worldview (Figure 12) (Beekman 2010).

The most important finding that allows us to see cultural integration in the northern frontier of Mesoamerica occurred in 1970, when Betty Bell excavated the archaeological site of El Cerro Encantado, very close to the current town of Teocaltiche, in the Highlands of Jalisco.

Figure 11. Left: Hypothetical two chamber shaft tomb after Cuevas and Pickerin 2004 (Williams 2000). Right: Section and top view of Tabachines Shaft tomb, a "boot" type (Vela 2014).

Figure 12. Shaft Tomb recreation offering. West Mexico Hall, MNA.

The findings consisted of several burials accompanied by ceramics, shell objects, and the peculiar figurines decorated in a negative fashion, known as "Cornudos" or "horned." These materials are associated with primary burials in Shaft Tombs in other parts of West Mexico, but these structures were absent at this site. Betty Bell was also able to obtain radiocarbon dating, which placed the site in operation from 100-150 CE, being contemporary with the Shaft Tombs tradition. This information suggests that both traditions, Chupícuaro and Shaft Tombs, are mutually exclusive, except in this area of Los Altos de Jalisco, where this artifacts from both traditions can be found.

With the primary data here presented, we can argue that the sedentary life in the northern border of Mesoamerica arrived from the south, and the Chupícuaro and Shaft Tombs traditions are the ones to blame. However, at least in the Highlands of Jalisco, integrating these two cultures (vastly loaded with Mesoamerican cultural ties) seemed to be creating a third local one. After this period, this connection with Mesoamerica would only increase.

The first sedentary settlements in what could be considered the northern Mesoamerica belong to a horizon of regional village culture with evident Mesoamerican cultural roots (Kelley and Abbott K. 1966; 1987; Kelley 1971; 1974). There are proposals about an influence coming from southern regions, as we already discussed Chupícuaro or the Shaft tombs tradition, from regions such as West Mexico, the Bajío, or more southern regions such as central Mexico (Kelley and Abbott K. 1987; Kelley 1971; Weigand 1978).

The arrival of southern sedentary populations is manifested in the Chalchihuites region and the Canutillo phase. This phase is composed of small villages located mainly in the valley of the Colorado River in central Zacatecas, where the investigations of Charles Kelley uncovered an architectural pattern and artifact complex associated with these early Mesoamerican villagers (Kelley and Abbott K. 1966; Kelley 1971). Kelley places the Canutillo phase of the Chalchihuites culture between 200 to 650 CE, mentioning a date for constructing the Alta Vista ceremonial center in 450 CE (Kelley and Abbott K. 1987).

2.3 The Northern cultural developments during the Classic period

During this phase, the mining activities of the Chalchihuites culture and the long-distance turquoise exchange activities began (Kelley and Abbott K. 1987). In this regard, Weigand (1978) mentions that the quarry operations and perhaps even the very mines were open pit mines. The main objective of the mining work seems to have been the exploitation of a series of blue-green stones. These stones and their color had a tremendous ceremonial significance in the high cultures of Mesoamerica. They represent rain, water, and fertility.

Contemporary sites related to this Canutillo cultural dynamic are found south in the Malpaso Valley region, located at the northern mouth of the Juchipila River, mainly because of ceramic materials correlation (Jimenez B. 1988; 1989; 1992; 1995; Jimenez B. and Darling 2000; Trombold 1974; Weignad 1978). Likewise, local solid Mesoamerican cultural developments had been reported in the Juchipila area and in the contiguous Mezquitic-Bolaños region (Kelley 1971), regions that have been considered fully Mesoamerican and occupied since the Pre-Classic (Weigand 1978).

However, to the south of the Malpaso valley in the Juchipila Canyon, there are ceramic materials that also appear to be very early, but that is more related to the tradition of shaft tombs in western Mexico and to the Morales complex described by Braniff (1972) as related to Chupícuaro, the other two Mesoamerican presences in the region during this time.

The late formative and early classic in the northern border are characterized by phases with expansive population developments towards new areas, showing a more significant social differentiation (Beekman 2010).

2.3.1 The Teuchitlan tradition

The ceremonial centers of the Teuchitlán tradition include two new architectural forms in the region, with similar social functions. The first is the ball courts, architectural devices widely disseminated throughout Mesoamerica (Taladoure and Colsenet 1991).
The second constructive form is the *Guachimonton*, which is made up of a platform around a stepped circular altar; Structures, usually eight, rise above the platform, creating a complex with a distinctive appearance (Weigand 1985; 1996; 1999).

According to some interpretations, these temples materialize the multilevel universe of Mesoamerican cosmology (Figure 13) (Beekman 2003; Kelley 1974). Since 1997, Pollard proposed that the sites with Guachimontones belonged to a single State, an idea that Weigand (1985) continued, concluding that to execute this type of architectural arrangements a social organization is necessary at such a level that it allows dispersing and executing the same idea in different regions. However, this interpretation is based primarily on surface information.
With recent excavation data from Llano Grande and Las Navajas sites, Beekman (2005) finds that the platforms around the circular altars are built with various materials and different construction systems.

Figure 13. Teuchitlán Aerial photography (Olay B. 2015).

This information takes him to interpret that they were built by different groups guided by the same architectural model, which he thinks is the product of elite groups sharing authority and power. The ceremonial centers can have from one to ten Guachimontones of different sizes (Ohnersorgen and Varien 1996; Weigand 1985), creating an apparent relationship between the core (around the Tequila Volcano) and the periphery throughout West Mexico, in the distribution of archaeological sites with the presence of this type of ceremonial architecture, a relationship that is still no clear what kind of hierarchy could have (Figure 14).

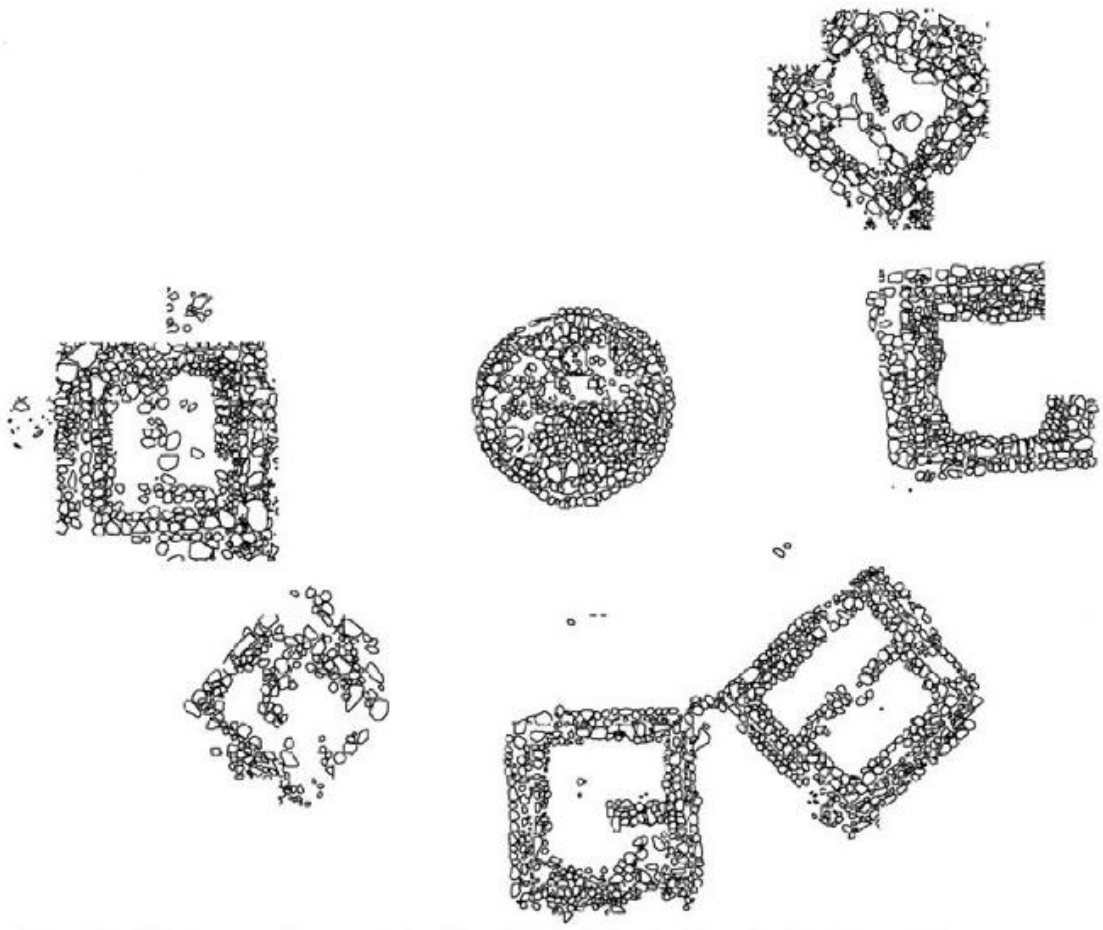


Figure 14. Top view drawing of a Guachimontón, at Navajas archaeological site, Jalisco (Beekman 2004).

The oldest evidence of occupation at Teuchitlan dates from 300 BCE, although the first guachimonton constructions from 100 BCE. There is also evidence of fortified sites at the entrances to the Tequila valley, perhaps as evidence that the valley became a political unit around the archaeological site at Teuchitlán (Beekman 1996). Studies by Stuart (2003; 2005) also revealed a canal system used to intensify agriculture in the valley, dating to the beginning of the classical period (200 AD). This, coupled with the rich offerings with materials obtained from a long-distance exchange in ceremonial sites (Teuchitlan, Navajas, Llano Grande) as well as in contemporary shaft tombs such as those of Huitzilapa and San Sebastián (Beekman 2005; Beekman and Weigand 2008; Galván V. 1991; Ramos and López M. 1996) suggest the hypothesis of an increase in the centralization of power.

Smaller versions of Guachimontones have been reported north of the nuclear region of the Guachimontones, in the current Bolaños Canyon, dated between 200 CE and 600 CE, and in Tepizuasco in the south of the Juchipila Canyon, suggesting a cultural and political dynamism. Indeed, these architectural structures were not imposed; instead, they were adopted by local elites seeking their association with agricultural rituals and opportunities to consolidate prestige within their populations (Beekman 2010).

2.3.2 The Bajío Classic Tradition

The Bajío Classic societies built upon the Chupícuaro tradition, having ceramic forms very similar to that tradition (Figure 15), but the public architecture of these sites diversified around a constructive principle: "the sunken patio".

The sunken patio architecture consists of a platform configuring a bench around a sunken space, on which pyramidal quarters or bases stand (Figure 16). The access to the residential buildings that top the platforms, it is necessary to use a staircase, which distinguishes this architectural arrangement from other places, for example, Teotihuacán, where similar constructions are accessed through open alleys between adjoining buildings. Excavations carried out in Cerrito de Rayas, San Bartolo Aguacaliente, and Plazuelas give a clear example of this type of sunken patio architecture (Cardenas G. 1999).

Figure 15. Morales's pottery, style and shapes carried on from Chupícuaro times. West Mexico hall, MNA.

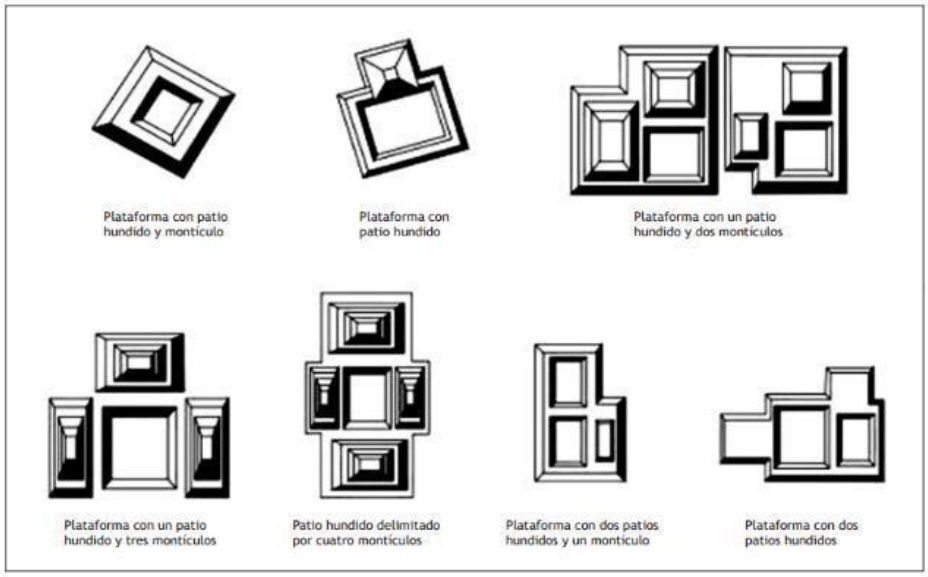


Figure 16. Examples of different sunken patio classic complex (Cardenas G. 2008).

A meaningful change concerning the previous stage is the social complexity that the archaeological settlements present, having a hierarchical segmentation evidenced by the distribution of their sites, with centers of power controlled by elites (Cardenas G. 1999).

It is essential to mention that, for researchers such as Archaeologist Efraín Cárdenas, the cultural area of the Bajío during the classical period is outside the Teotihuacan sphere of influence, the material links that bind them are almost null and instead speak of a set of communities that expanded from the Chupícuaro region taking with them a style of construction to the north of Guanajuato and south of Michoacán. The chronological process of this expansion is still unknown since absolute dating is missing.

In this way, the Bajío was unified in sharing an architectural tradition, with different political units identified from spatial analysis (Cardenas G. 1999), which interacted with other areas in a differentiated way. For example, settlements further west have small Guachimontones, which appear intrusive (Beekman 2000; Weigand 2000). On the opposite side, the eastern part of the Bajío had contacts and connections with central Mexico, mainly with the Teotihuacan city, evidenced by the architectural type of sunken plaza. This architectural form had its first appearance in the big city during the Tzacualli phase (1-100 CE) (Beekman 2010).

Teotihuacan also shared some ceramic types found in the Barrio de la Cruz site, in Querétaro, while in the rest of the Bajío there are some types related to the Tlamimilolpa-Xolalpan phases (200-600 CE) (Brambila and Velasco 1988; Castañeda L. et al. 1996; Crespo O. 1998; Saint-Charles 1996; 1998).

Most of these ceramics appear in burial contexts, to which Filini and Cárdenas G. (2007) suggest they are very insignificant to speak of a domain or even direct contact with Teotihuacán. They use information collected in the Cuitzeo Basin and propose that artifacts like *thin orange* and *Pachuca green-golden obsidian* are rare prestigious goods imported by local elites. However, it is more common to find local copies with carefully selected symbology since, clearly, Teotihuacan iconography had significant importance for validating autonomous local elites.

Artifacts from the Loma Alta phase, and perhaps people from the western region, have been identified in multiple contexts in Teotihuacán (Gomez C. 1998; 2002; Gomez C. and

Gazzola 2007; White et al. 2004), so it can be inferred that communication is bidirectional. The importance that Teotihuacán had during this period at the macro-regional level is undeniable, especially as the core of a system that exports ideological terms and whose mere association confers prestige, but there is little to no evidence of a direct Teotihuacan incursion into the West and North of Mexico.

2.4 The Apogee during the Epiclassic

The term Epiclassic (sometimes referred to as Late Classic) designates the period between the fall of Teotihuacán and the emergence of Tula as a new core within the Mesoamerican world system (Diehl and Berlo 1989; Jimenez B. 2020). The Epiclassic is a period of change with implications in different parts of Mesoamerica. Given the intense archaeological research in the great ceremonial centers in this peripheral part of Mesoamerica, this period is the best-understood stage in Mesoamerica's northern border.

These ceremonial centers were mainly built between 550 and 600 CE, and by 700 - 800 AD, they lived their absolute apogee (Braniff 1992; 2001; Hers 1989; Jimenez B. and Darling 2000; Jimenez B. 1998; Kelley 1990; Nelson 1997; Trombold 1990). During this time, we see the intensification and expansion of agricultural fields, the proliferation of luxury products, and lots of construction activity in these ceremonial centers. With this information, we can infer the existence of local elites, with an intense interregional interaction, manifested by the widespread dispersion of materials such as pseudocloisonne, *type I* figurines, and some architectural elements such as the closed-sunken patio with a central altar (Jimenez B. 2006; Lelgeman 2000).

In the Malpaso Valley, the latest research showed that the Epiclassic period is in which the La Quemada site rises as a regional system (Jimenez B. and Darling 2000; Jimenez B. 1989; 1998; Lelgeman 2000; Nelson et al. 1993; Nelson 1997; Trombold 1990), in the so-called La Quemada complex, that dates approximately between 600/650 and 850 CE, in which reaches its maximum extension and new ceramic types come into use (Figure 17). Among the diagnostic types for La Quemada are the *Incised-Sgraffito Coyotes, Red Ramos on Brown,* and *Negative Tepozán*; the latter is shown as a highly elaborate local ceramic tradition, although various negative ceramics seem to come from other regions to the south, such as the Juchipila Canyon and Altos de Jalisco (Figure 18) (Jimenez B. and Darling 2000; Jimenez B. 2006).

Figure 17. La Quemada archaeological site. Photo M. Dueñas.

Figure 18. Alta Vista Pottery. Orellana Drawings (Medina G. 2000).

In Alta Vista, a settlement located very close to the Tropic of Cancer, the implementation of astronomical calculations in the orientation of the main buildings is notorious (Aveni et al. 1982), in addition to the trace of the ceremonial center that it responds to the replication of a ritual landscape and a cosmological system comparable to its neighbors in central Mexico and the Mayan area (Medina G. 2000).

Also, notable changes in the ceramics of the Alta Vista phase (600-850 CE) were significant. The Michilia Black Incised-Sgraffito type, filled with red pigment, now included anthropomorphic and zoomorphic geometric designs and pseudo-glyphic elements, undoubtedly marks of increased complexity in elite messaging. Similar motives started to appear in other ceramic types, like Suchil red on buff (Jimenez B. 2006; Kelley and Abbott K. 1987).

Similarly diffused, a very characteristic architectural pattern became widely applied through the northern frontier, the ceremonial architecture named *patio compound*. It consists of a group of buildings erected atop raised platforms that surround a sunken patio. This patio invariably has an altar in its center and, in most cases, a small pyramid on one side. Generally, a room of considerable extension is part of the complex, while the ones with more constructions make up a building with several rooms (Lelgeman 1997). Finally, several sites in the frontier display complex architectural planning, with astronomical orientations, that correspond to the Mesoamerican calendrics periods (Lelgemann 1997).

2.4.1 El Tunal Grande

Another area that experienced its apogee in terms of growth of sedentary populations was the Tunal Grande region, in the current state of San Luis Potosí. Archaeological sites are described as small village settlements regularly located at the foot of the hills, and near the sources of water supply (Braniff 1992; Crespo O. 1976), whose architecture (Figure 19) consists of rectangular rooms with foundations of stone and adobe walls (Braniff 1992).

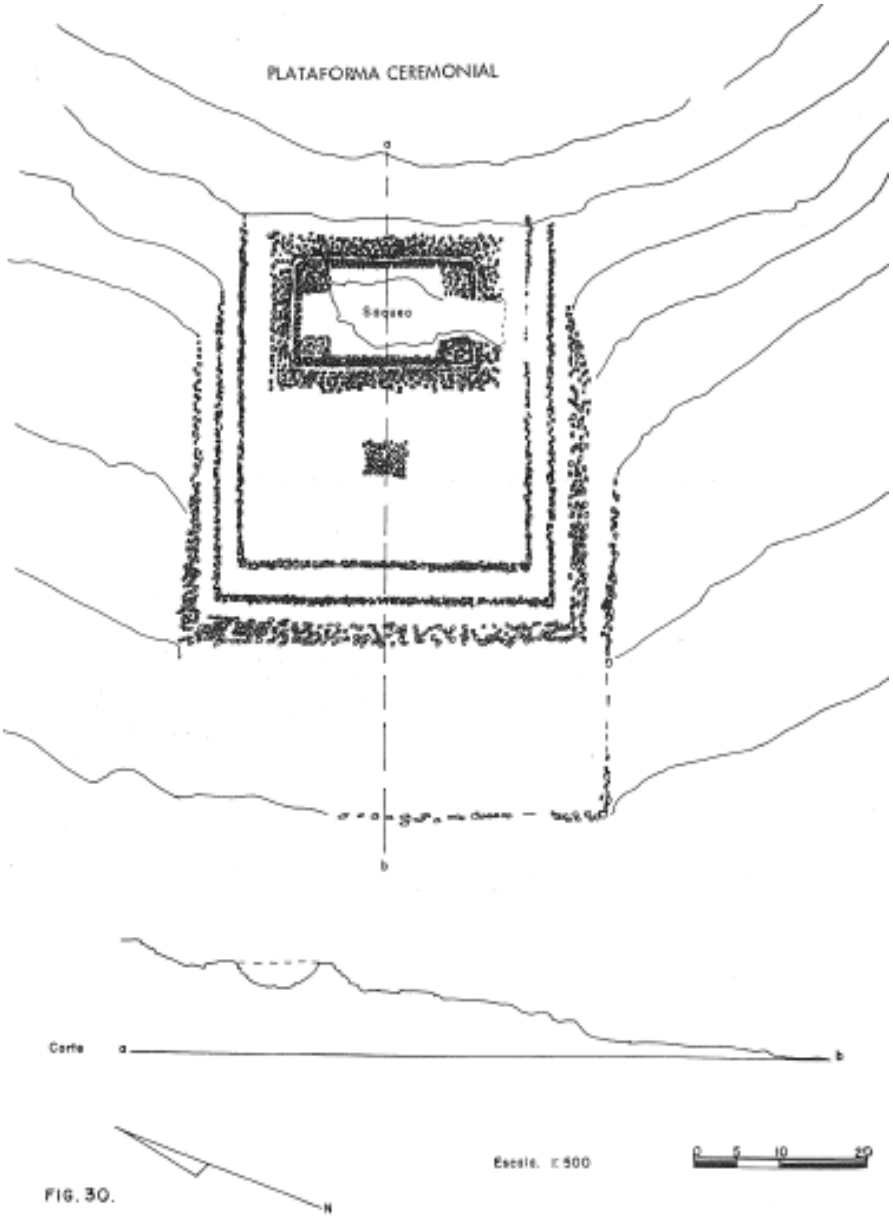


Figure 19. Villa de Reyes mound (Crespo O. 1976).

The best-known pre-Hispanic settlement in this region is *Villa de Reyes*, also known as *Electra* archaeological site (Braniff 1961; 1992). On this site, Braniff carried out a formal archaeological investigation between 1966 and 1967, and as a result, she proposes three phases of occupation (Braniff 1992).

It is important to note that initially, a continuity between the three proposed occupational phases was proposed. Later, Braniff identified a long period of abandonment between the first and second phases (Braniff 2001), so the time of the first occupation phase is considerably reduced. Regarding the three previous phases, Braniff mentions that the interesting thing about these three phases is that they do not show an evolution that led from one to the other, but totally different, from which it follows that they were colonizations of different populations and that the chronological separation between the first two phases implies an abandonment of the site for many years. The first phase, which we place chronologically around 70-200 CE, is distinguished

by quarters of earthen walls and well-made pottery, whose dishes decorated with red lines are a distant reminder of the tradition of symmetrical designs that originated in Chupícuaro and that persisted in Guanajuato.

The main phase, called San Luis and located chronologically between 650 and 900 CE, is represented by a large planned town, where there are platforms and well-built houses of earth and a "ceremonial center" - pyramid, which curiously is not in the center of town. The characteristic ceramic is polychrome with linear designs in black on the red-orange background and the natural color of pots and plates. This pottery is very well made, and appears in large quantities since its inception, which suggests that it comes from elsewhere. The intrusive pottery comes from the neighboring region of Río Verde, where the bowl pipes stand out Braniff 2001). This San Luis phase corresponds chronologically to the heyday of the entire northern Mesoamerican region Braniff 2001). Immediately afterwards, around 900 CE, the people who carry the pottery of Tula, characterized by the Mazapa, the Brushed Orange, the White figurines make their appearance. Although this new population is dispersed in the village, it does not appear to have built anything new. The quantity of materials is very scarce, from which it is inferred that their presence here was not important. In the San Luis Valley, after the disappearance of the Toltecs, we did not find anything indigenous until colonial times Braniff 2001).

The San Juan phase, with a chronology proposed between 100 and 600 CE, a phase that corresponds to the Early Classic period, characterized by the use of red, buff, red on buff, and white on red ceramics (Braniff 1992), corresponding to the arrival of southern settlers.
The San Luis phase, from 600 to 900 CE, the Epiclassic or Late Classic period (Braniff 1992), is characterized by complex polychrome pottery named *Valle San Luis Policromo*, some figurines, and pipes (Braniff 1992, Crespo O. 1976).

Valle San Luis Policromo is almost all ceramics in the Tunal Grande Region, representing 82% of all sherds recovered during surveys and excavations, which allows us to infer that it was the most intense occupation of the region during the late classic (Braniff 1992) (Figure 20).

Additionally, the architecture consists of elements such as stone walls and terraces. The main settlement of Electra was distributed in five housing units, two of them built with stone and adobe and raised on a system of terraces of earlier times. A third unit shows room foundations; however, there are no remains of terraces, but rather the constructions are raised from the ground, and the other two remaining units are located on a hill (Crespo O. 1976).

Moreover, the archaeological record shows religious specialists' existence due to buildings destined for religious activities (Crespo O. 1976). In this way, *Villa de Reyes Electra settlement* is a regional development that

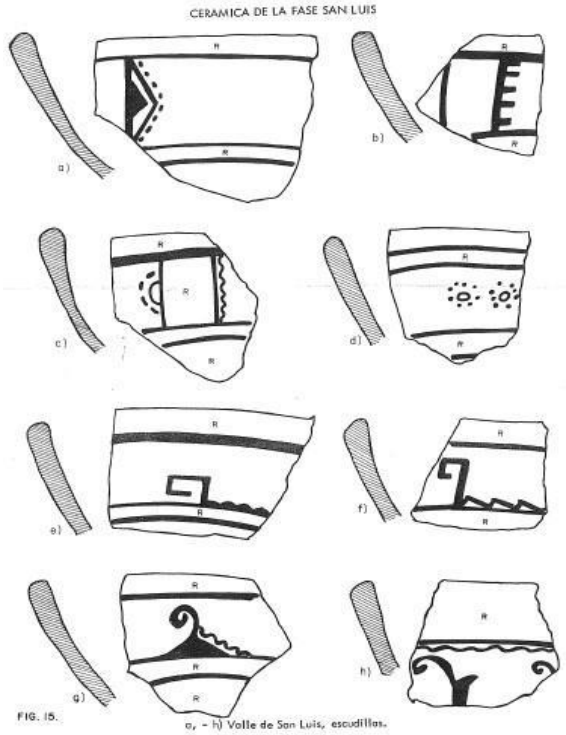


Figure 20. Valle San Luis pottery (Braniff 1992).

participated in an active exchange dynamic with settlements in peripheral areas (Crespo O. 1976).

Finally, the region has a phase named *Reyes*, corresponding to the Early Postclassic, in which some Toltec cultural elements are identified, mainly the use of ceramics such as the *Reyes Gray, Mazapan figurines, Orange on White, White Raised, Brown, Tohil Plumbate, Fine Orange*, some braziers, figurines, and pipes (Braniff 1992).

It is worth noting that, in places such as El Cerrito, in Zacatecas, and Cerro de Silva, in San Luis Potosí, there is a demonstrated existence of non-Mesoamerican groups that only left burials and many stone artifacts such as scrapers and stone projectiles, associated with nomadic groups (Braniff 2001).

2.4.2 The Rio Verde Grande Basin. Cerro de En Medio natural and social context

The Rio Verde Grande basin encompasses present-day southern Zacatecas, most of the state of Aguascalientes, a small portion of northwestern Guanajuato, and all of Jalisco's highlands. Within the basin, the best-studied area is Jalisco's highlands, where more formal archaeological investigations have been carried out; hence, there is a better knowledge of the characteristics of the settlements and the material culture associated with them.

One of the emblematic sites of the region is the Cerro Encantado, near the current community of Teocaltiche. At it, archaeologist Betty Bell carried out excavations in 1970, revealing diagnostic ceramic types from 43 test pits, such as the "Cornudos" (horned) figurines, that were found as an offering in a primary burial, carbon-dated to an early occupation, related to the Shaft Tombs culture, along with ceramics related to the Chupícuaro culture (Williams 1974), both Late Formative cultures (200 BC – 200 AD).

One of the conclusions reached by the researcher when noticing an overlap in this area of two cultures is that the inhabitants of Cerro Encantado most likely received influence from the cultural epicenters of the Chupícuaro culture from El Bajío, and from the Shaft tomb tradition in what is now the center of Jalisco. This interaction between two overlapping cultural spheres in the Altos de Jalisco may have spread northward following the Río Verde Grande.

The hypothesis of local populations along the Lerma-Santiago basin receiving southern cultural influences was first proposed by Glyn Williams in 1974. He conducted archaeological surveys in the northern part of Los Altos de Jalisco, near the north state limits with Zacatecas, where he identified thirteen pre-Hispanic settlements of various sizes and complexities. Then, he proceeded to collect and classified figurines associated with Chupícuaro culture.

More importantly, he started the proposal of a local culture influenced by southern Mesoamerican culture, with components from other basins to the north and west, such as that of the Magdalena River in Nayarit, giving rise to a tradition of its own from the Late Formative period onwards (Williams 1974).

Then in 1976, archaeologists Piña Chan and John Taylor (1976) worked the site of El Cuarenta, Lagos de Moreno municipality, also north of the Altos de Jalisco, east of Cerro Encantado, near the state limits with Aguascalientes and Zacatecas. In their report, the researchers conclude that this site was related to other sites such as La Quemada and Teul, and they propose a cultural expansion coming from these sites located in the area known as The Canyons. They also propose that El Cuarenta is a link that connects with the east, in a region

known as El Gran Tunal, in San Luis Potosí, particularly with the sites such as Electra or Villa de Reyes.

Later in the eighties, the researchers Carolyn Baus and Sergio Sánchez identified the Caxcanes, Cocas, and Tecuexes settlements, ethnohistorical groups in the Spanish chronicles of the 16th century in the state of Jalisco. They carried out field surveys and mapping in the area, and in 1986 they published "Archeology in the Tecuexe region," in which they report materials recovered in Cerro Támara, Teocaltitán, and Tlacuitapan, located near the current towns of Jalostotitlan, Teocaltitán, and Lagos de Moreno in the northeast of Los Altos (Baus de Czitrom and Sanchez C. 1986). They reported elements within the ceramic types such as "everted edge," "annular base" and certain types of figurines that, according to the classification of Williams (1974) are types I and IV that will become diagnostic of the entire Río Verde Grande Basin during the Epiclassic (600 – 900 AD).

The southern part of the basin was investigated in the late 1980s by Blas Román Castellón and Jorge Ramos, who carried out surveys by the National School of Anthropology and History (ENAH) near the towns Atotonilco-Tototlán. At the beginning of the '90s, INAH Jalisco created the Altos de Jalisco Archaeological Project, which carried out surveys of pre-Hispanic settlements. This project provided important data regarding the regional settlement pattern, types of settlements, architecture, and associated archaeological materials (Lopez M. et al. 1994). They identify that some sites are located in the upper part of the hills, sometimes these hills are part of a mountain system, or sometimes they are located in the middle of a Valley, a topo-form known in the region as Chiquihuite, as in the case of Peñol del Chiquihuitillo (Weigand and Garcia de Weigand 1999).

This settlement pattern is common in the southern part of Los Altos, in the sites located by Blas Román Castellón (et al. 1988 *at* López M. et al. 1994), as well as in some sites in the northern area of the Río Verde Grande, such as that of Cerro de los Antiguos, El Tuiche and Cerro de Chihuahua, close to Nochistlán, Zacatecas.

In the same work, the authors also refer to the regional settlement pattern and the general characteristics of the architecture present:

> "Regarding the settlement pattern, these sites are located on hilltops with primarily steep slopes and close to spring water sources. Its privileged topographic situation, with rock shelters and rocky outcrops, displaying manufactured modifications like high slopes on terraces and platforms, as well as possible walls [… and] complete visual control of the surrounding regions gives these sites a defensive and strategic character that seems to indicate significant instability at the time they were built. In the architectural aspect, we can say that the basic pattern of elements does not differ from many sites located in El Bajío since the main idea is similar. They only vary in terms of their distribution depending on the topography of the terrain.
> This pattern is an ensemble of structures around a "*sunken patio"*, or square plazas delimited by flat platforms, with a square plan mound located on the eastern side of the patio, whose function has been interpreted as civic-religious, suggesting a highly canonic style. There are other peripheral elements like square or rectangular platforms, patios, plazas, and in two sites, a pair of parallel elongated structures were found that suggest ballgame courts. There is also a system of terraces with rock retaining walls well adapted to the topography" (Baus and Sanchez C. 1986:2-4) (Figure 21).

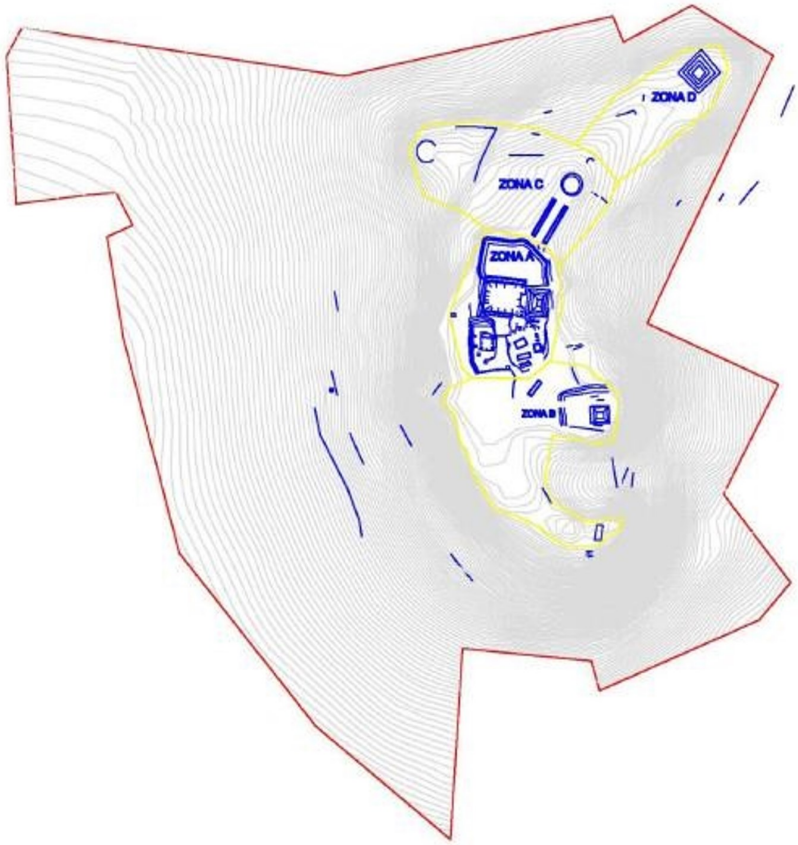


Figure 21. Teocaltitán site map (Montejano 2015).

Something similar is reported by Lopez M. et al. (1994), describing these ceremonial and civic areas, just adding that the residential areas are related to the terraces, which are generally located on the hill slopes and are related to agricultural activities, serving the surrounding areas as support areas of the settlement for water supply, hunting, and food gathering, as well as for the extraction of raw materials.

The authors propose various phases of occupation in Jalisco's highlands, one from 300-900 CE, represented by the ceramics of the Orange/cherry group, very abundant, and of local tradition (Lopez M. et al. 1994). There are other important ceramic types for this period, defined mainly by their color decoration, such as Red / Red on buff/ Orange, that are mentioned as more useful to identify domestic spaces particularly, ceramics that in Western Mexico (and broader in Mesoamerica) have a wide dispersion range, from the Formative to the Postclassic times.

On the contrary, they define a particular decoration type, the Late Negative decoration, which they consider the most direct indicator of contacts between northern Mesoamerican cultures located in Zacatecas, where it has been identified as a significant marker for the Epiclassic period, from 600 to 900 CE., applied to forms like the ring-based bowls and globular pots.

In short, among the most characteristic elements of this Epiclassic phase, we have new types of vessels, new uses of the decorative techniques like the new negative decoration, or the "pseudo-cloisonné" decoration, that mark a new and invigorated form of interrelation between elite groups at the northern frontier of Mesoamerica (Lopez M. et al. 1994).

Based on the above information, the authors preliminarily conclude that Jalisco's highlands (which is the southern part of the Río Verde Grande Basin) has human occupation since the Late Formative (200 BCE – 300 CE), which is mainly represented by polished ceramics related to the Shaft Tombs tradition of the Atemajac valley. The Classic period (200-900 CE) is represented by the local ceramics (Grupo Naranja / Guinda polychrome and the Negative variants). In contrast, the Postclassic period could not be identified in their research, despite the historical references that mention groups such as *Caxcanes*, *Tecuexes*, or *Cocas* by the contact Spanish chronicles (Lopez M. et al. 1994).

Parallel to Lopez M. et al. (1994) research, Roy Brown (1991) , in his "Archeology and Paleoecology of the North-central part of Mexico" volume, including the sites identified by Williams in 1974, as well as the Cerro Encantado site excavated by Bell in 1970, incorporates them within what he calls "the Río Verde cultural sub-area," which in turn he proposes to insert in the Bajío cultural area (Brown 1991).

The Rio Verde cultural sub-area associated with Jalisco's highlands and the Juchipila canyon region will be referred to as the North Jalisco-South Zacatecas sub-sphere during the Epiclassic of Northern Mesoamerica (Jimenez B. and Darling 2000).

From that cultural unity, we pull most of the contextual archaeological information for the northern portion of the Rio Verde Basin, namely Aguascalientes. Archaeological research in this region has been scarce and very often anecdotal.

The first contribution to archaeology knowledge happened in 1928, in the *Synoptic table of the ruins of the Mexican Republic known to date, a* document mandated by the federal government at the time. In it, a site called *Monte Huma* was reported, in the Municipality of Calvillo, described been composed by an architectural structure, a cave, and a fortification, published by Moises Herrera (Castellanos C. 1994).

In 1939 an archaeological map of Aguascalientes was presented in the project "Archaeological Atlas of the Mexican Republic," where three sites are mentioned: *Jalpa*, *Mecatabasco*, and again *Monte Huma*. Later, Eloy Castellanos, in his report of 1994, reports that the other two sites mentioned are actually within Zacatecas state limits, and only Monte Huma is probably within the state of Aguascalientes, but it has not been located yet.

It is worth mentioning that "Topete," a chronicler of Aguascalientes city, in 1968 reported pre-Hispanic ceramic and lithic materials in some Aguascalientes municipalities, including Asientos and Tepezalá, in his *Guide to visit the city and the state of Aguascalientes*. Nevertheless, it was not until 1986 that formal archaeological investigations began, led by archaeologists Lorena Mirambell and José Luis Lorenzo, who carried out surveys and reported the existence of three pre-Hispanic settlements that presented rock art manifestations and lithic materials: Tepozán I and II, located in the municipality of Calvillo, and Las Raíces, currently known as El Ocote (Lorenzo and Mirambell 1986).

Later in 1989, responding to a federal INAH requirement inspection of archaeological sites in Aguascalientes, Baudelina García and Peter Jiménez surveyed El Ocote and corroborated the existence of cultural remains. They observed the abundance of lithic materials on the surface, made of various raw materials such as rhyolite, flint, quartz, and obsidian, in addition to ceramic material without decoration. They also reported small retaining walls forming stepped terraces.

In 1991 and 1992, the archaeologist Eloy Castellanos carried out surface surveys to identify and catalog pre-Hispanic settlements in the State of Aguascalientes, requested by the National Archaeological Atlas project, where he reported the existence of seasonal campsites near temporary streams and small springs. He also reported semi-sedentary settlements, with a

widely scattered settlement pattern consisting of square structures built on small platforms and small circular structures. Castellanos conducted test pits at various sites within his project, including Cerro de en Medio, Santiago, Cerrito del Meco, Plan de Potrerillos, and San Mateo. These pits were located inside what he presumed to be housing units. Since little cultural material was found within them, he states that most of the activities of their inhabitants were carried out outside the houses. In total, he identified 17 sites, the majority located on the top of hills, and classified them as 1) Sites with structures, 2) Sites with concentrations of ceramics and lithics only, and 3) Sites with cave paintings (Castellanos C. 1994).

Another significant contribution to the state's investigations was archaeologist Daniel Valencia, who made surface surveys in 1992 and 1993. He identified 39 sites, including ceremonial centers, lithic workshops, rock shelters with rock art, and seasonal camps. He proposed a chronology, based on ceramic materials obtained on the surface, being the main types: Red on Beige, Black Sgraffito, Negatives, Black on Orange and Monochrome Gray, and suggests that the sites with cave painting were occupied between the year 100 and 1200 CE (Valencia C. 1993).

In that same year, the archaeologist John W. Foster (1994) proposed the Sierra Fria region as a protected natural area, carried out a survey where he located eight sites that comprise mainly camps and caves with vestiges of human occupation (Foster 1994).

Later in 2001 and to date, the archaeologists of the INAH Aguascalientes center, Ana Pelz Marín, and Jorge Luis Jiménez Meza, have carried out various seasons of excavation and restoration at the El Ocote site (Pelz M. and Jimenez M. 2011), the only project in the state with a continuous excavation activity.

This project restored the ceremonial buildings at the top of the hill, a staircase, and a path leading to it. However, most of the excavation activities were conducted in a domestic compound. She reported finding almost all the diagnostic Epiclassic ceramic types of the North Jalisco-South Zacatecas subsphere, plus 13 burials, many animal bones, some transformed in tools, an oven, a couple of hearths in which they found burned corn, beans, and pepper seeds that were carbon dated between 450-650 cal. CE (Pelz M. and Jimenez M. 2007).

Since 2003 the archaeologist Nicolás Caretta and the biologist Mario Pérez carried out an archaeological rescue due to the construction of the Montoro-Aguascalientes highway, where they identified settlements and concentrations of archaeological material, in addition to partially delimiting the Santiago site.

Cero de Santiago project focused on the protection and management of the Santiago canyon and its natural resources. Thanks to this, it was possible to modify the outline of the highway bypass, which thus avoid the archaeological zone of Santiago. Research has been carried out on this same site since 2004 by Nicolás Caretta, who surveyed the ceremonial area, reporting 14 platforms, 12 mounds, 25 structures, 2 "sunken" patios, 17 retaining walls, or terraces, and a ball court (Nicolas C. and Dueñas G. 2020). Regarding the material found on the surface, they identified various ceramic types such as Red on Beige and gray veined obsidian, flint scrapers, and various grinding tools (Nicolas C. and Dueñas G. 2020).

Among the most recent investigations are those carried out by archaeologists Ignacio Macías Quintero and Gerardo Fernández Martínez, from the Autonomous University of Zacatecas (UAZ), who in the archaeological prospecting project in the southwestern state of Aguascalientes discovered 20 new settlements, including villages, ceremonial sites, caves with human occupation, areas of rock carvings and rock shelters with cave painting (Macias Q. 2006; 2007).

2.5 The Epiclassic changes

The explanation for the changes across Mesoamerica during this period has to be multifactorial. On the one hand, an allegorical interpretation involves a possible political reorganization, sometimes conceptualized as a restructuring of the Mesoamerican world system (Jimenez B. 2006). The political system centered on the Tequila valleys collapsed, and the use of Guachimontones and shot tombs ceased in the West (Beekman and Christensen 2003; Weigand 1990), as multiple new political centers of varying sizes emerged.

As we have already mentioned, the ceremonial center of Alta Vista and La Quemada live their splendor, but also new ceremonial centers appear, such as El Grillo (Galvan V. and Beekman 2001), Ixtepete (Galvan V. 1975), Santa Cruza de Barcenas (Weigand 1990) and la Higuerita (Lopez M. and Montejano E. 2003) in the central valleys of Jalisco.

Also new towns are founded in this period, such as Tingambato (Piña Chan and Oi 1982), Urichu (Pollard and Cahue 1999), Guadalupe (Arnauld and Faugère 1998; Pereira 1999), Zaragoza (Fernandez V. 2004), and Jiquilpan (Noguera 1944) in what is now the current state of Michoacán, that emerged as new population centers in what has been described as the "Lupe Phase" (Pollard 2008).

This phenomenon relates to the intensification in the production of prestigious goods. The multitude of relatively small (compared to the previous stage), and probably unstable political units, compete for legitimacy in a highly volatile political environment, increasing demand for exotic objects and iconography and symbols of authority (Pollard and Cahue 1999; Beekman and Christensen 2003).

It has been proposed that metallurgy, especially copper work, made its first appearances in Mesoamerica through interaction with blacksmiths in northwestern South America. This technology would be used to produce bells, rings, needles, and tweezers through techniques such as lost wax and hammering (Hosler 1994). However, the investigations that propose sites of the Epiclassic where the practice of this technology would have been possible are not precise or are not well published.

The situation is different regarding turquoise. The processing shops in Alta Vista were highly active, in addition to the importation of this resource from the Southwest of what is now the United States (Harbottle and Weigand 1992; Weigand and Garcia de Weigand 2001).
The extensive mines near the Alta Vista site were probably dedicated to extracting green rocks and various minerals used as pigments, mainly for decorations such as Pseudo-Cloisonné (Holien 1977), whose use spread throughout the current territories of Jalisco, Zacatecas, and Guanajuato.

The obsidian mines of Ucareo and Zináparo to the north of Michoacan increased their exploitation, and the products derived from it were transported throughout Mesoamerica (Darras 1998; Healan 2004), thus connecting with sites in central Mexico such as Xochicalco.
The cinnabar mines of the Sierra Gorda de Querétaro, as the site of San José Ixtapa, dating to this period, seems to indicate another corridor of exchange between central Mexico and its northern peripheries (Barba P. and Herrera 1986). The salt production in the southern part of Jalisco indicates that the demand for materials that are not necessarily for prestige also increased, but also for utilitarian goods but equally luxurious (Liot 2000).

In this thesis, I follow the proposal that change was motivated by an increase in economic interaction and a political reorganization, without neglecting the proposals made by paleoclimatic studies (Fisher et al. 2003; Metcalfe 2006; Metcalfe and Davies 2007; Metcalfe et al. 2007). This relatively meager research shows that The Río Verde Grande region has had a

pre-Hispanic occupation since the Late Formative (200 BC- 200 CE), mainly associated with the Shaft tomb tradition and the Chupícuaro culture. However, since these early times, it shows an overlapping of cultures with epicenters located southwest and southeast.

In synthesis, the northern frontier of Mesoamerica study has shown a complicated intricate history. Spanning from the early villages during the formative, with clearly southern Mesoamerican characteristics, represented by the Shaft tombs, Chupícuaro, and Canutillo traditions, with different ceramic complexes, architecture, and social complexity. Later, during the classic, the construction of ceremonial centers, the increments on social complexities, the appearance of a local elite tied to religious architecture, will represent a period of increased interaction between core Mesoamerica and an incipient periphery. This periphery will experience a boom in demography, with coincides (or is caused by) the fall of the Teotihuacan hegemony in core Mesoamerica.

In the northern frontier's central portion, where the Highlands of Jalisco and Aguascalientes, things are just beginning to be uncovered and examined. Inside Cerro de En Medio, all this cultural overlapping is starting to be explored. In the next chapter I will present the latest finds in Aguascalientes archaeology, and the results of fieldwork conducted during this Ph.D. Research.

Chapter 3
Aguascalientes and the Northern border of Mesoamerica

3.1 Introduction

One of the smallest states of Mexico's Republic, Aguascalientes has just begun to explore the prehistory of its territory. At the turn of the 21st century, efforts from local universities and the regional INAH center led to new archaeological projects aimed at the pre-Columbian Indigenous population's archaeological heritage. After 22 years of research, the material culture recovered from ancient times not only reveals a diverse, complex culture tied with neighboring areas but a unique cultural melting pot.

As mentioned in the last chapter, Aguascalientes' surrounding regions have a more extensive research trajectory. Therefore, to understand Aguascalientes' pre-Hispanic past, its territory must be integrated into a region that far exceeds the current state political limits: "The Northern Border of Mesoamerica" (Figure 22).

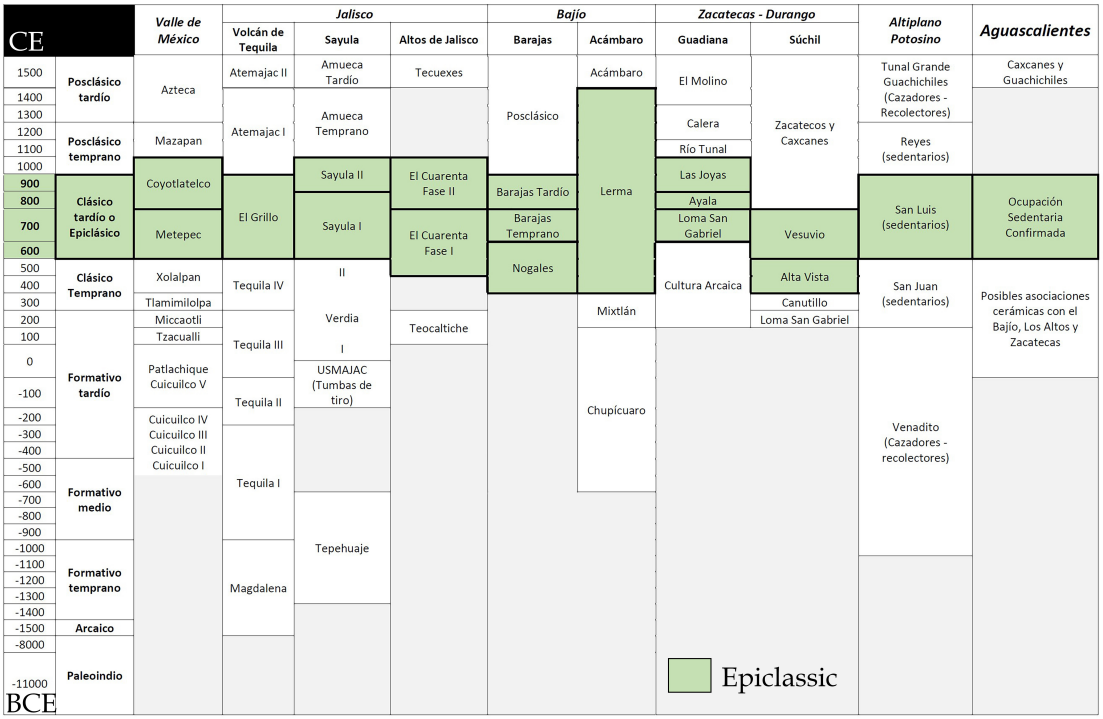


Figure 22. Aguascalientes comparative chronological table (M. Dueñas).

Topographically speaking, Aguascalientes is on the border between the *Sierra Madre Occidental*, the *Mesa del Centro*, and a bit of the *Transversal Volcanic Axis* (Figure 23). Two large rivers drain this territory, the Rio Verde Grande and the Rio Juchipila, which subsequently drain into the Lerma-Santiago hydrological system. This system originates in the Toluca Valley in Central Mexico and ends in the San Blas Bay, Nayarit in the Pacific. This hydrological system connects natural corridors and essential agricultural areas throughout its basin and sub-basins.

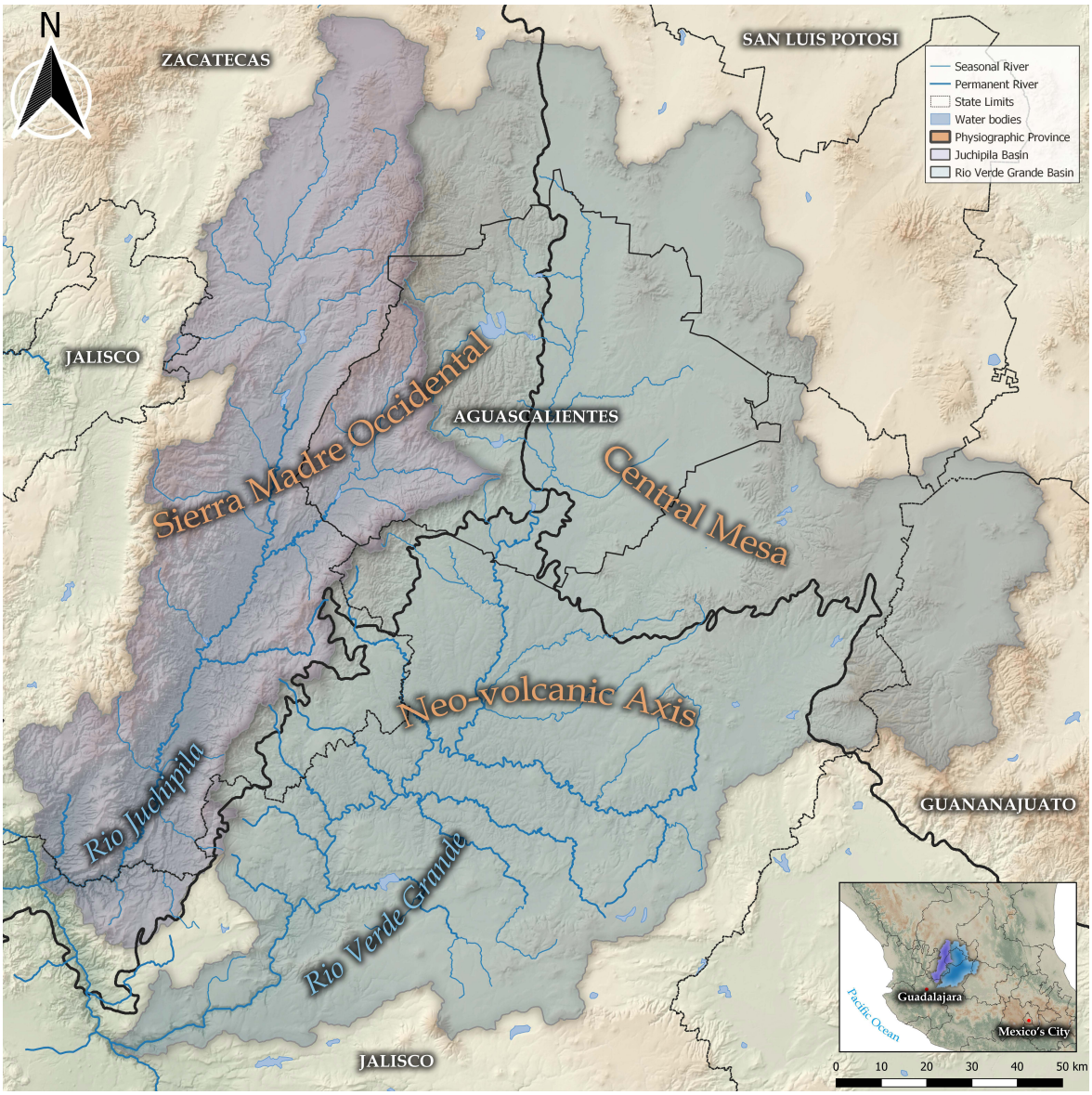


Figure 23. Rio Verde Grande and Rio Juchipila physiographic zones. (INEGI Vectorial and Raster data. M. Dueñas).

The Rio Verde Grande has its origins 20 kilometers south of the city of Zacatecas, within the Genaro Godina municipality, where its primary collector starts the river. It continues its course towards the south, crossing the state of Aguascalientes, entering Jalisco's Highlands region, and finally feeding into the Rio Grande de Santiago, a few kilometers northeast of the city of Guadalajara, to continue its flow into the Pacific Ocean.

These geographical conditions produce three internal regions within Aguascalientes: the region within the Sierra Madre Occidental, the Aguascalientes Valley region, and the Central Mesa region. Archaeological sites have been found in all three areas, and research activities have concentrated around six sites: El Ocote, Santiago, El Jaral, El Zapote, La Montesita, and Cerro de En medio (CDEM) (Figure 24).

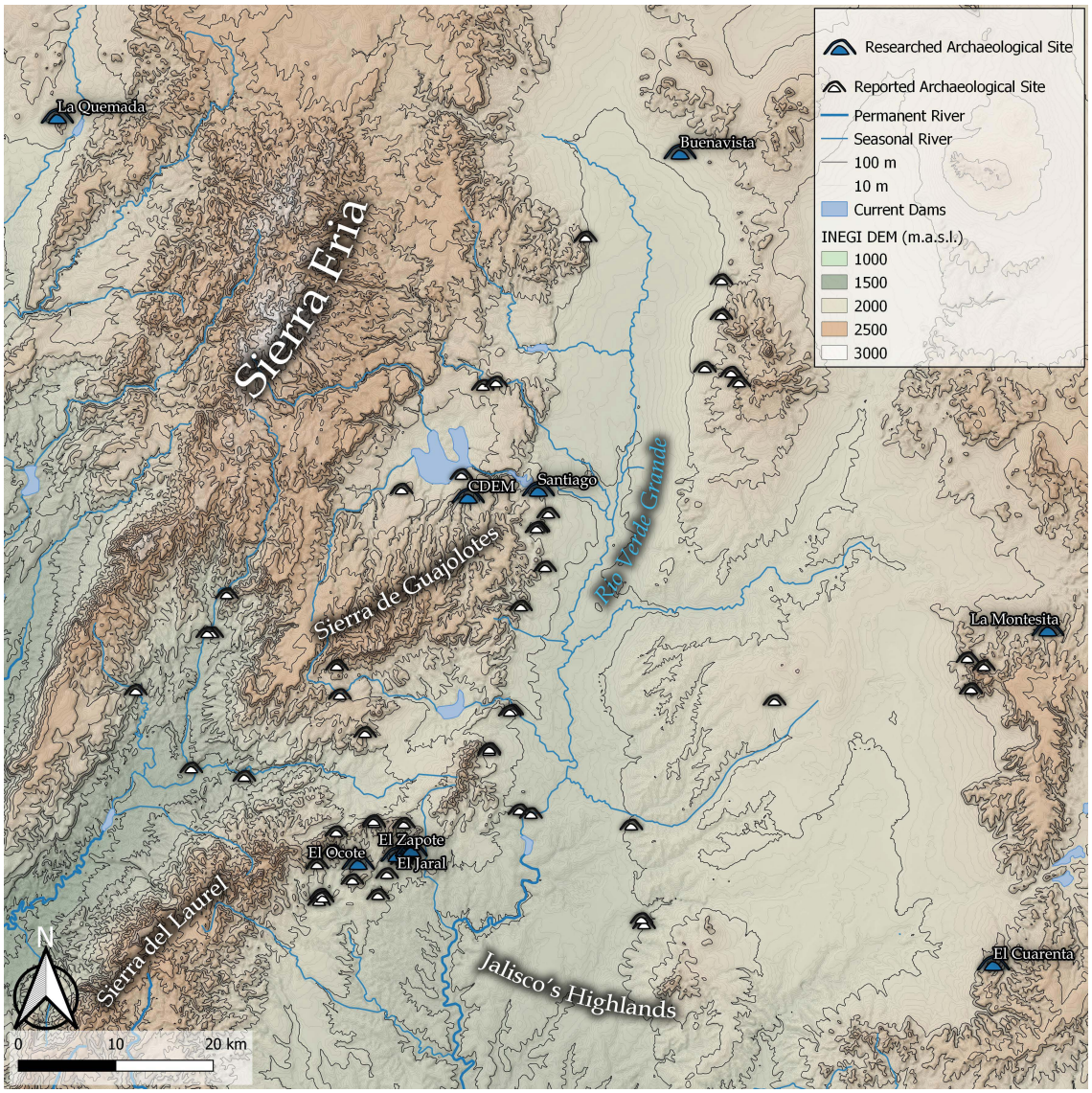


Figure 24. Map of Aguascalientes Archaeological sites. (INEGI vectorial data and Raster data / INAH Archaeological Database. M Dueñas).

In general, one characteristic these sites share is their location in the landscape. Usually, the sites consist of ceremonial areas on the top of a hill, with habitation areas located at the foothills of the mountain. This pattern is shared in Jalisco's Highlands and southwest Zacatecas sites (Araiza 2000; Baus de Czitrom and Sanchez C. 1986; Bell 1974; Lopez M. et al. 1994; Piña Chan and Taylor 1976; Porcayo 2002). The ceremonial centers at these sites are generally composed of sets of buildings arranged around open spaces or sunken plazas and generally with one or more mounds, oriented to sunrise or sunset (Lelgeman 2000).

This location has been cataloged as characteristic for the Late Classic period in central Mexico, mainly interpreted as derived from a competitive and violent political climate, which led most of the populations to take shelter at the top of the hills from possible attacks from their neighbors (Sugiura 2006).This interpretation has dominated the explanation for cultural characteristics in the Northern Border of Mesoamerica (Armillas 1951, 1969; Kelley 1971; Weigand 1982; Weigand and Garcia de Weigand 1999), although in more recent publication it

has been contested (Brambila and Velasco 1988; Solar V. 2002; Taladoire 1998). In addition to the settlement pattern, the archaeological sites of Aguascalientes share raw materials, lithic artifacts, diagnostic ceramic types, construction systems, and architectural designs, which allow us to conduct a comparative analysis and, at the very least, to establish their contemporaneity.

Another feature shared by the sites presented here is agriculture as a way of life, although I present here that an essential component of hunting has been detected in every site. One of the main questions in the Northern Border of Mesoamerica is how the populations subsisted in an environment which, at least during colonial times, was described as an unfavorable environment for agriculture (Armillas 1964; Palerm and Wolf 1957).

The dominant soil type in the Aguascalientes valley is a lithosol of medium texture (Nicolas C. 2006). The main characteristic of these soils is that their thickness is not greater than 10 cm; they are very shallow soils limited by a close rocky contact, which makes roots unable to penetrate deeply. It is partly for this reason, in conjunction with annual rainfall (526 mm) and temperature (17.4 °C) in the valleys, that the plant cover is mainly composed of xerophilous vegetation, in which flat-stemmed cacti like those of the *Opuntia* genus, predominate with species known locally like the nopal durazno (*O. leucotricha*, nopal cardon (*O. streptacantha*), nopal concha (*O. hyptiacantha*), that provide fruits, next to yuccas (*Yucca brevifolia*) palm trees, although it is also common to find vast pockets of small leguminous trees species such as huizaches (*Acacia shaffneri*.), mesquites (*Prosopis laevigata*) and different types of grasses, like Sheep grass (*Erioneuron sp*.) or flowering plants like dragon blood (*Jatropha dioica*) (Mares-Guerrero and Ocampo 2020) (Figure 25).

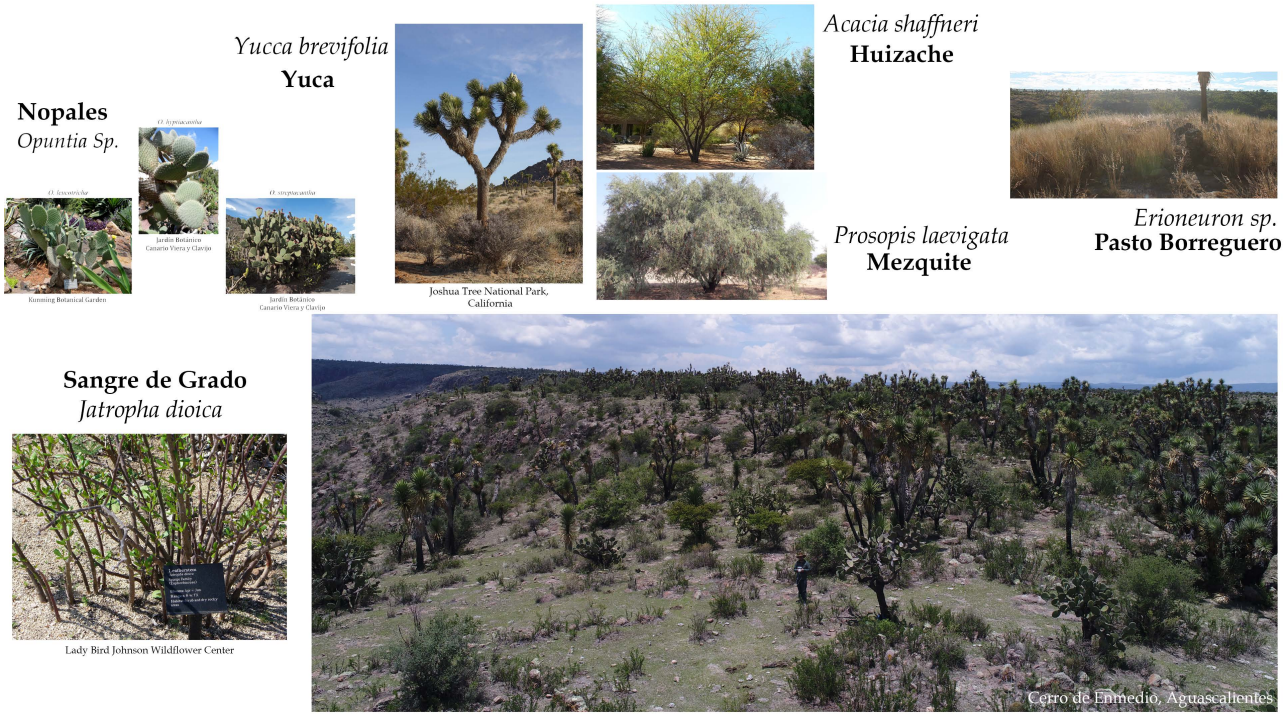
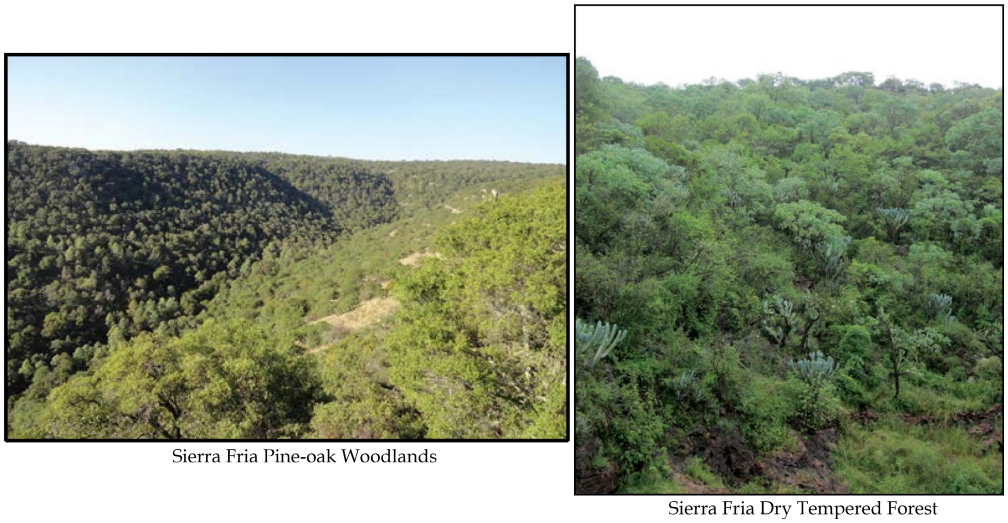


Figure 25. Aguascalientes Xerophite vegetation. (Photos Wikipedia Xerophite Vegetation and M. Dueñas).

Besides these shallow floored valleys with xerophyte vegetation, local tectonism produced abundant hot springs, which gave the state its name (from *Aguas [water] + calientes [hot]*), allowing constant water availability throughout the year down the valley. Though some

archeological materials have been found, no settlements have been located yet on them. These Sierra and foothills ecosystems have been ignored when discussing northern pre-Columbian sedentarism, but I argue they are a crucial resource catchment area. La Sierra Fria comprises a mountainous region of several mountain ranges, valleys, plateaus, and glens; pine-oak forests are the most widespread plant community in the Sierra Madre Occidental, occurring from 1250 to 3200 meters elevation (Siqueiros D. 2008).

The vegetation that covers the temperate forests of the Sierra Fria is dominated by communities of oak (*Quercus sp.*), pine (*Pinus sp.*), táscate (*Juniperus sp.*), and shrubs such as the manzanita (*Arctostaphylos pungens* and *A. Polifolia*) and the strawberry tree (*Arbutus glandulosa* and *A. Arizonica*). It can also find groves of cedars (*Cupressus lindleyi*) in some humid ravines or on the banks of streams, and there are also three species such as ash (*Fraxinus papillosa*), poplars (*Populus tremuloides*), willows *(Salix bonplandiana*), and laurels *(Litsea glauscescens*) (Siqueiros D. 2008) (Figure 26).



Sierra Fria Pine-oak Woodlands

Sierra Fria Dry Tempered Forest

Figure 26. Pine-oak Forest close to the Aguascalientes foothills (Siqueiros D. 2008).

The area is rich in native mammals, including white-tailed deer (*Odocoileus virginianus*), pumas (*Puma concolor*), collared peccary (*Dicotyles tajacu*), ringtail (*Bassariscus astutus*), and gray fox (*Urocyon cinereoargenteus*); 109 species of birds have been recorded in the Sierras, of which 67% are year-round residents and 33% are winter visitors, including the golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), Harris's hawk (*Parabuteo unicinctus*), Mexican spotted owl (*Strix occidentalis lucida*), great horned owl (*Bubo virginianus*), Montezuma quail (*Cyrtonyx montezumae*), lesser scaup (*Aythya affinis*), and northern pintail ducks (*Anas acuta*) (Sosa R. et al. 2014).

Water availability increases with the abundant springs in these sierras, with the subsequent advent of fauna accompanying this environment. In pre-Columbian times, these locations seemed favorable for the available game, water for cultivation, and minerals necessary for toolmaking. In this chapter, I present all archaeological evidence for the biodiversity found at these sites.

In comparison to México's demography during the same period, the northern frontier settlements were not densely populated, but dispersed, occupying strategic positions based on the availability of resources. Hence, these independent, self-sufficient communities constitute the northernmost inland limits of sedentarism.

3.2 El Ocote

Located southwest of the current state of Aguascalientes, on the border with Jalisco's Highlands, the El Ocote site is located in a transition zone, having access to resources from a forested area (which in the past was indeed larger) and low deciduous forest (Mares-Guerrero and Ocampo 2020). The human settlement is distributed on and around Los Tecuanes hill with an approximate area of 17 hectares; in its vicinity, some springs can be found (Pelz M. and Jimenez M. 2007) (Figure 27).

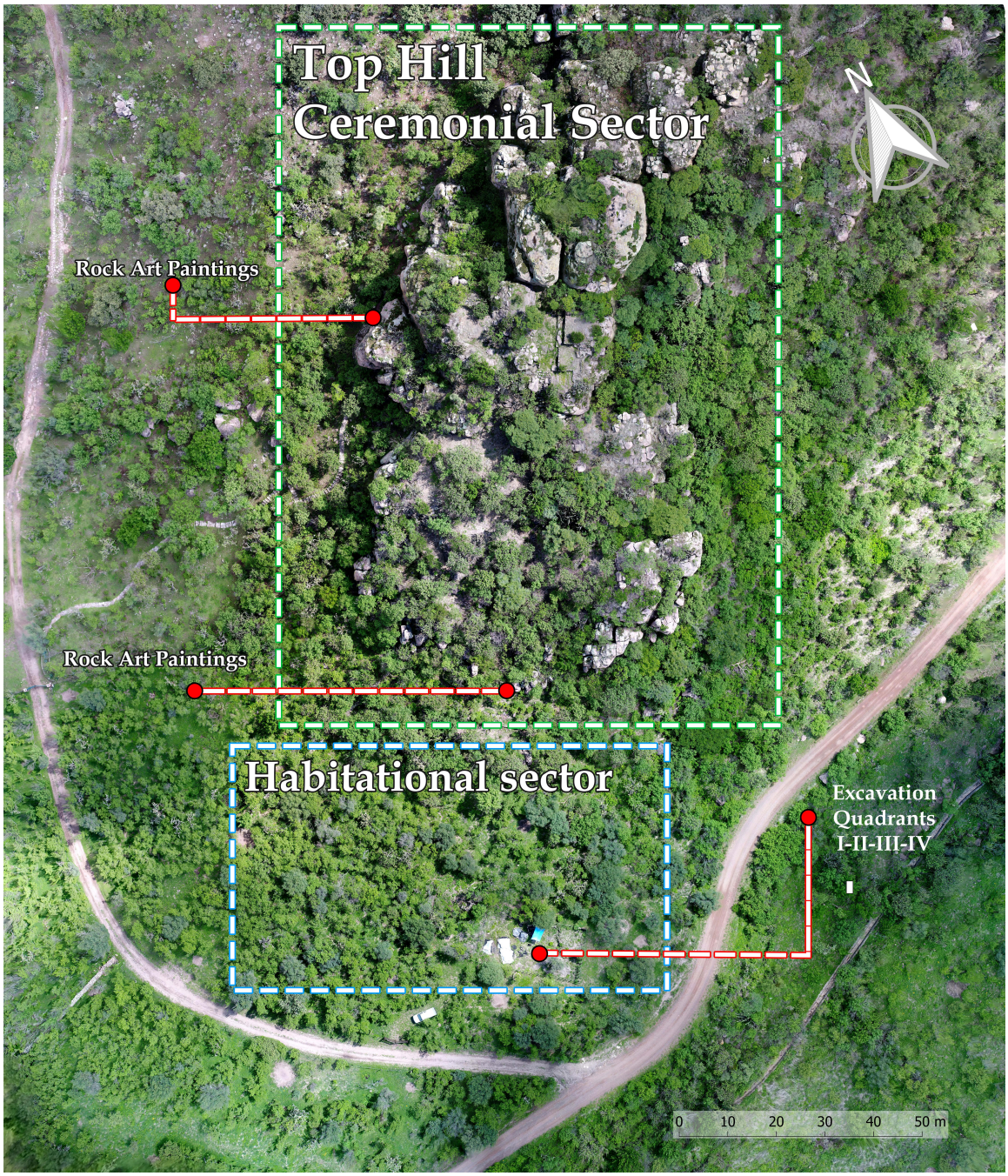


Figure 27. Orthophoto of El Ocote, noting the different areas that compose it (M. Dueñas).

Cerro Los Tecuanes is an extrusive volcanic rock formation identified as ignimbrite, with consolidated tuff and rhyolite. This rocky substrate was used for different purposes, such as extracting raw materials for stone toolmaking or as the foundations for temples and houses. The site has a construction area at the top of the hill whose functions were probably ritual. It is a natural platform with an area of 360m^2 (Figure 28).

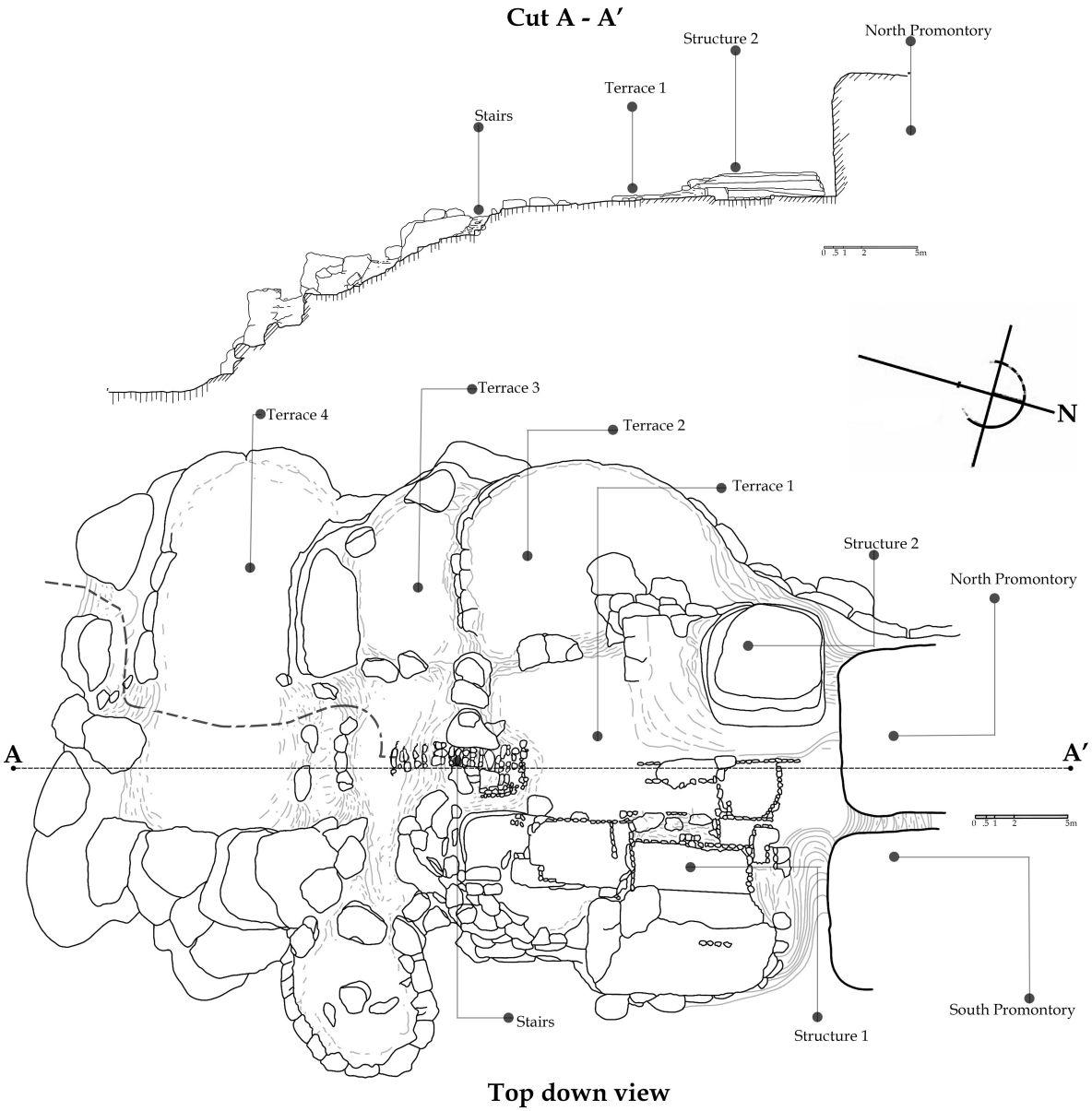


Figure 28. Top Hill ceremonial Sector. Redrawn from Pelz and Jimenez 2007 (M. Campos and M. Dueñas).

Both to the east and the west, structures are oriented towards sunrise and sunset. Between the buildings there is a free space as an esplanade. The descent from the top to the base of the hill is reached through four natural terraces located mainly on the southern and western slopes with stepped areas of intercommunication, alignments corresponding to possible constructions located on top of each of them.

Excavations have been carried out at the top and in the southern area at the foot of the hill. Many architectural elements were discovered in this last area, such as column bases, fireplaces, post holes, mud floors, and walls, corresponding to a space designed for activities related to daily life (Pelz M. and Jimenez M. 2011). The raw material for the construction was the local ignimbrite, which was used to construct foundation walls and steps. Remnants of mud plastered walls were recovered during the excavations, (Arellano G. 2014) (Figure 29). Adobe was also used to erect walls, but the most common construction technique was wattle and daub (walls built with branches of local vegetation covered with mud plaster) painted in white, yellow, or red (Figure 30).

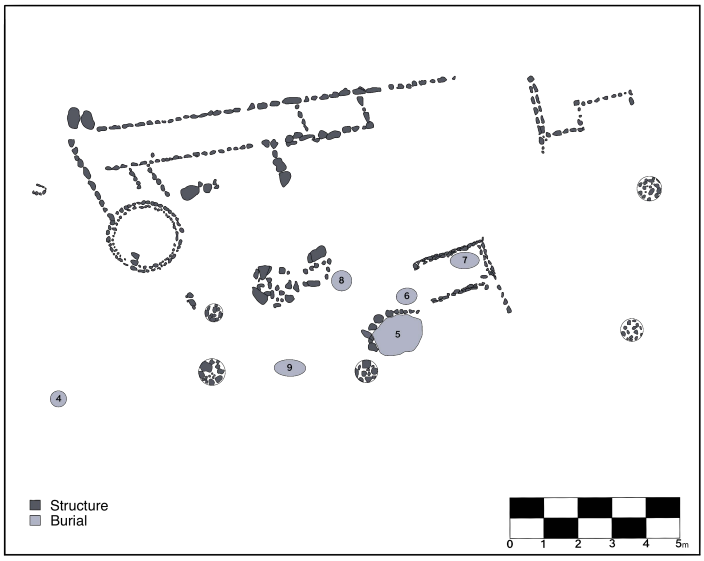


Figure 29. Top-down view of Quads I-II-III-IV. Redrawn from Pelz and Jimenez 2011 (M. Campos and M. Dueñas).

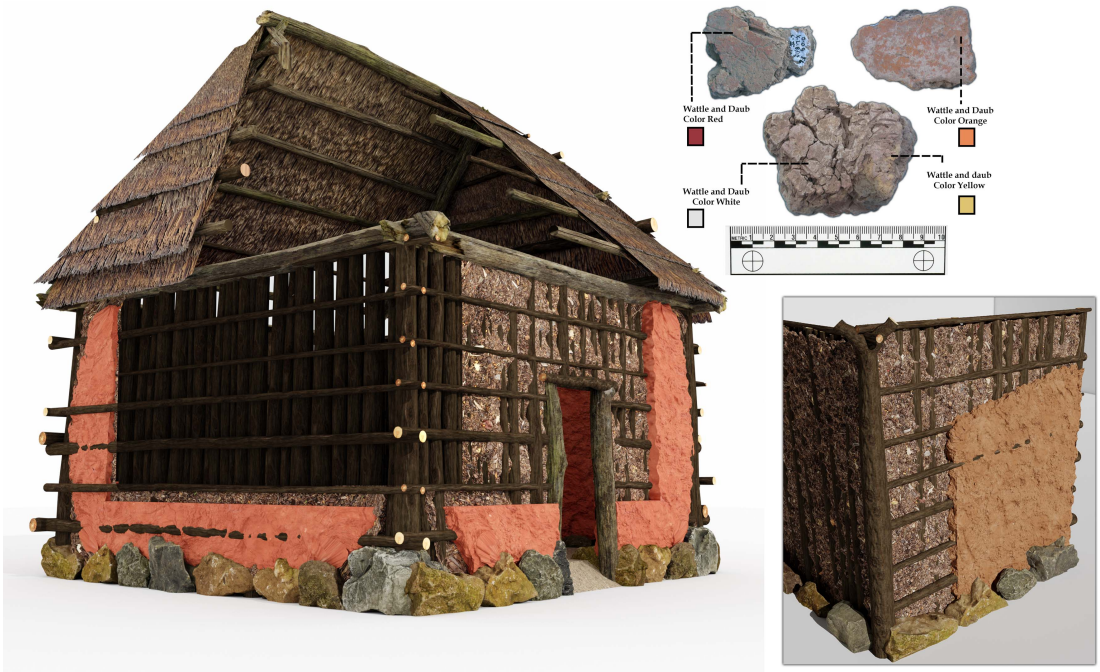


Figure 30. Waddle-and-daub located at El Ocote (Arellano G. 2014) and Hypothetical building reconstruction (M. Dueñas).

Archaeological explorations have made it possible to date the occupancy of the settlement to the Late Classic which, was confirmed with radiocarbon dates (600-900 CE done by INAH and BetaLab laboratories (Pelz M. and Jimenez M. 2006), and to establish participation in cultural dynamics with other social groups in their immediate and distant surroundings in West Mexico.

The most frequently found cultural remains are those made with clay. The versatility of the material allowed a variety of objects to be manufactured, such as containers, ornaments, utilitarian objects, or objects designed for worship. Some characteristics in ceramic objects have been identified as diagnostic features in these regions; among these are the *pseudo-cloisonné type* decorations (in pots, bowls, and ear flaps) Figure 31), *the resist-painting type* (Figure 32), as well as annular bases (Figure 33), the engraved decorated ceramics (Figure 34), tablets (Figure 35), pipes (Figure 36), and some figurines, particularly the "Cerro de García Subtype F" (Figure 37) diagnostic for the Epiclassic Center Jalisco.Figurine Type I, diagnostic for the same period all along the Northern Border of Mesoamerica is also present in El Ocote.

Figure 31.El Ocote Pseudo-cloisonné type decorations. (J. Jimenez.)

Figure 32. El Ocote the resist-painting type decorated ceramics. (J. Jimenez).

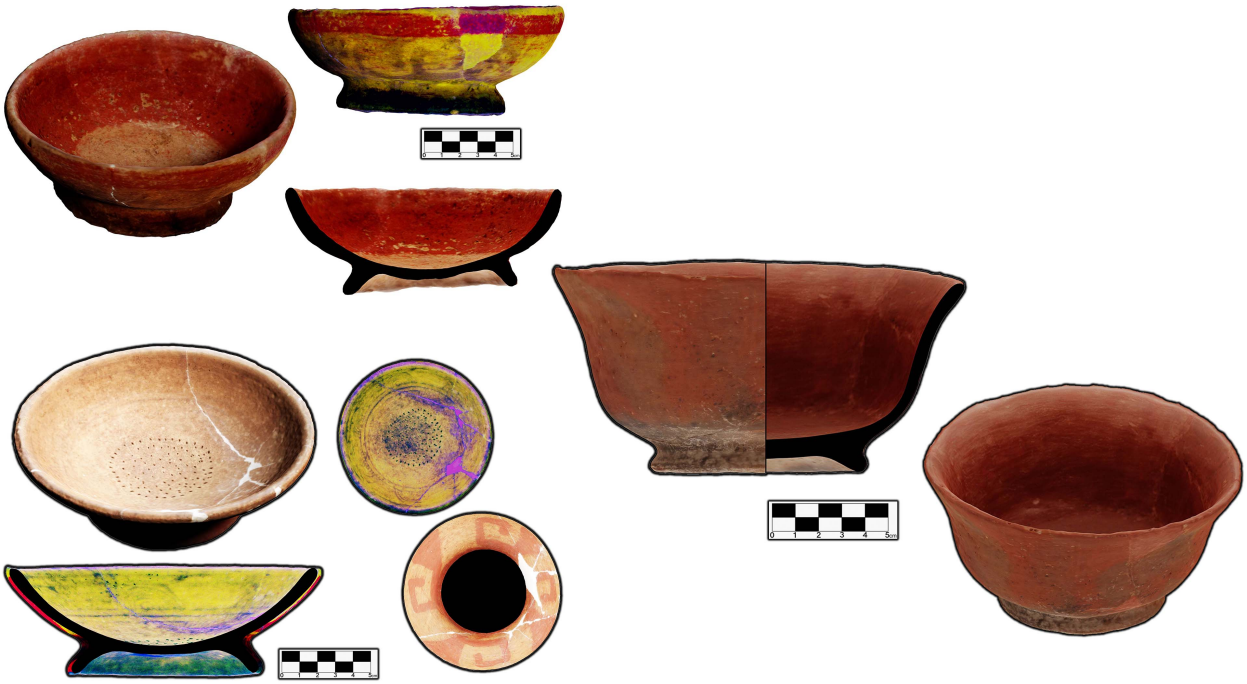


Figure 33. El Ocote the resist-painting type on annular bases. (M. Dueñas).

Figure 34. El Ocote Tablets. (J. Jimenez).

Figure 35. El Ocote Engraved type decorated ceramics. (J. Jimenez).

Figure 36. El Ocote Ceramic pipes. (M. Dueñas).

Figure 37. El Ocote Diagnostic Figurines. Cerro de Garcia Figurines are commonly found in central Jalisco, around the Sayula Basin, where their manufacture is related to the production of salt. Type I is commonly referred to as the diagnostic figurine in northern Mesoamerica, being Rio Verde Subtype A variation only found along the Rio Verde Grande basin. The other two figurines are not identified outside Aguascalientes, but they resemble some of the West Mexico coastal figurines of Nayarit or Sinaloa during the early classic. (J. Jimenez and M. Dueñas).

Bone remains of animals were also recovered, and they can tell us a lot about the environmental conditions during the occupation time and the uses that the population had for them. Even species not currently found in the area were detected; many were burned, roasted, or boiled, mainly for food, but also some were used as ornament, tools, and perhaps clothing (Perez R. 2015) (Figure 38).

Leather and fiber work (basketry and textile) associated with artifacts such as scrapers, perforators, needles, awls (*punzones*), polishers, and shredders manufactured using local rocks and bone were identified. Based on the vestiges of different production processes, other possible activities were related to the work of polished stone to manufacture grinding devices, axes, flatteners, chisels or mortars, or lapidary (Figures 39, 40).

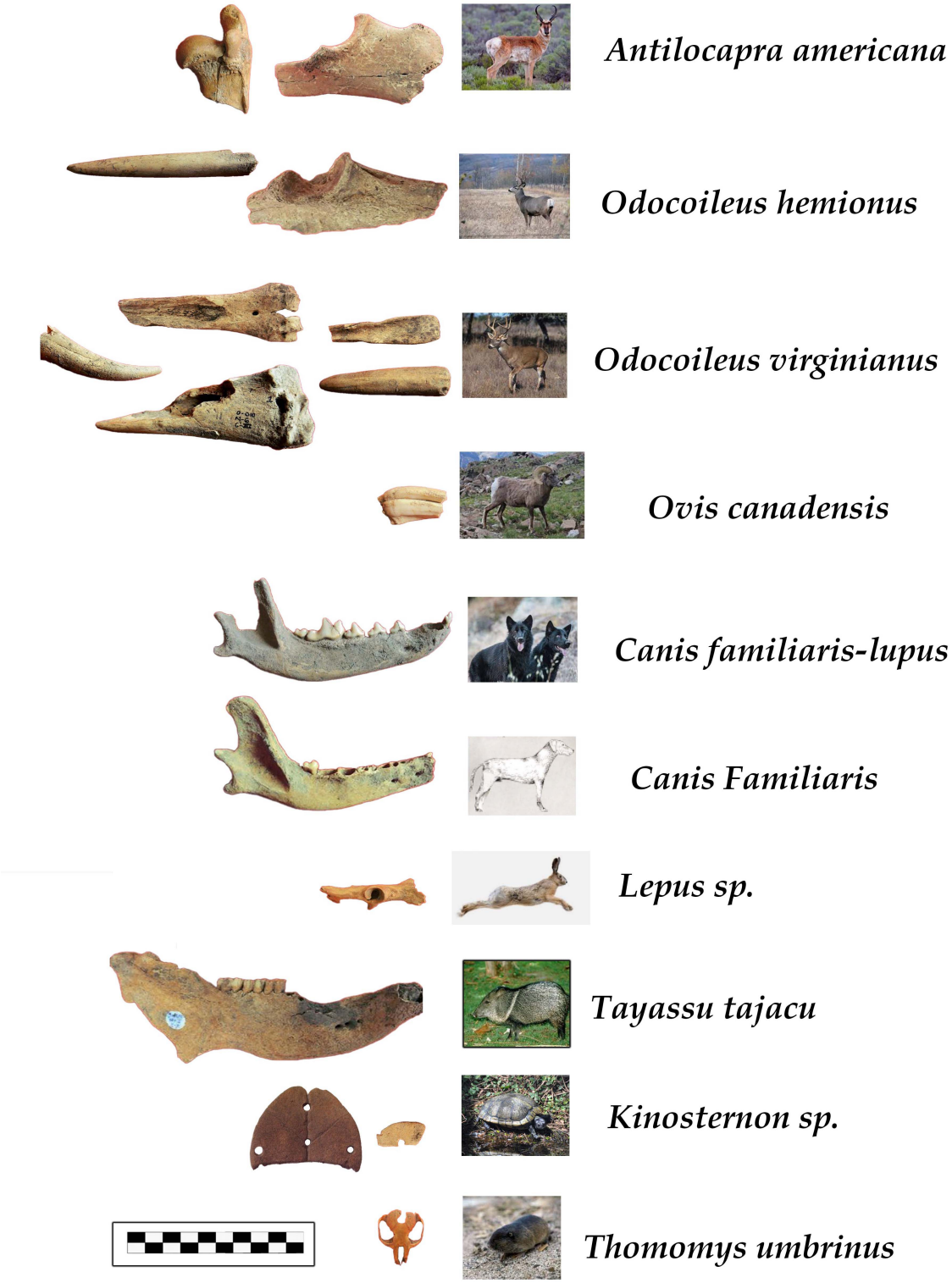


Figure 38. Ocote fauna identified in archaeological context. (Perez 2015).

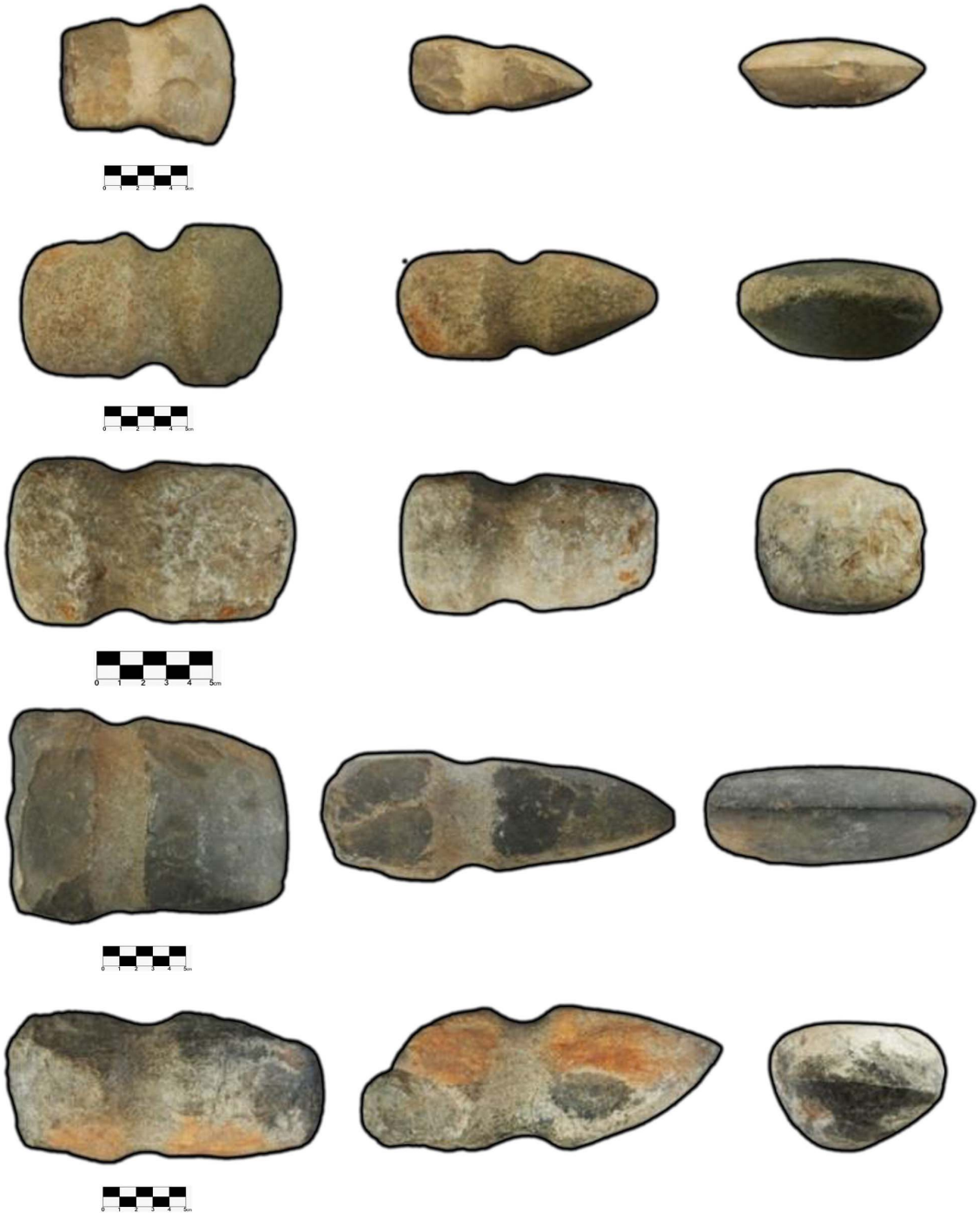


Figure 39. Ocote Axes and hammers, and metate. (C. Sanchez and B. Lailson).

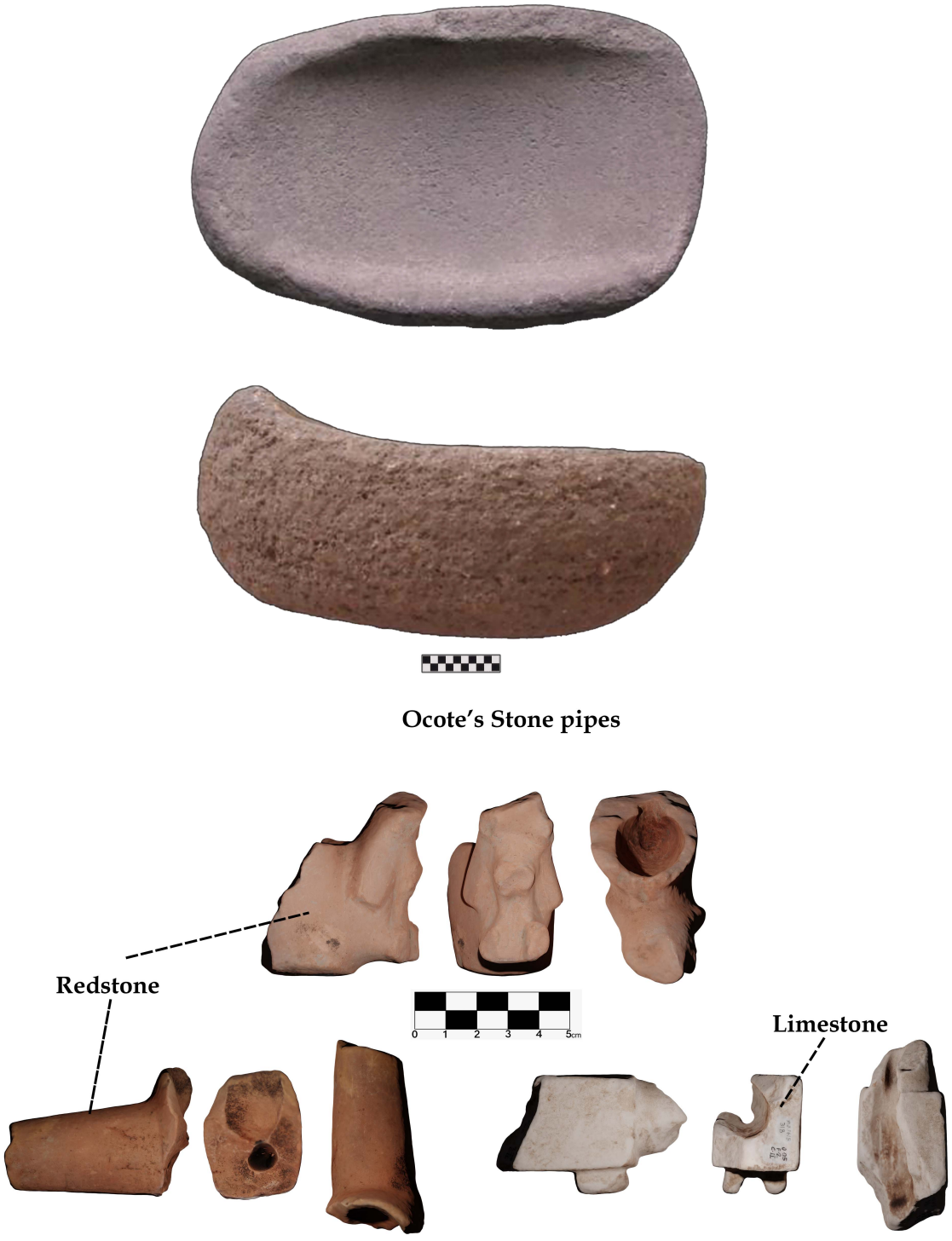


Figure 40. Ocote Metate and Stone pipes. (M. Dueñas).

Agriculture and hunting were the sustenance of the population that inhabited the site. Around the pre-Hispanic settlement are areas destined for cultivation today that possibly had the same use in previous times. Organic materials are difficult to preserve in environments similar to those excavated; however, due to having been burned, it was possible to identify remains of corn grains and other seeds that were part of the diet of this group, and food remains have also been identified in containers for domestic use, as well as fibers of cotton (Palacios D. 2016).

Burial patterns changed between the Early and Late Classic periods in regions around El Ocote (Pereira et al. 2005; Pollard and Cahue 1999). The extended supine body position changed to the flexed position, which is the most common at the site. In the limited area explored, the remains of 46 individuals were identified, the majority of which were infants and adolescents, a few females, and fewer males. Some deposits were individual and others collective. Erect tabular deformation was detected in two of the skulls. They were not buried in any specific structure; instead, they were buried directly in the natural ground, wrapped with textiles or fibers that disintegrated over time.

In the osteological analysis nutritional deficiencies, oral pathologies, and problems associated with the development of some activity could be identified. For example, grinding is one of the necessary activities to process seeds and grains as well as to process other raw materials in the production of ceramics, construction and paints, and this activity leaves its mark on the vertebrae and bones of the wrists due to their position at the time of grinding; at El Ocote, four female burials were found that presented these traces (Palomo G. 2015); another of the burials presented marks of wear on the incisors of a female individual, which is related to the work of fibers such as palm and agave (*ixtle*) (Palomo G. 2015). The inhabitants of El Ocote had access to cotton (Palacios D. 2016) and fibers such as agave and leather to create clothing and other utensils such as baskets, bags, sandals and ropes in general. The tools used for such activities were needles,bone awls, and *malacates*. Several infant burials were associated with ornaments made of worked mollusks and miniature ceramic vessels (Figure 41).

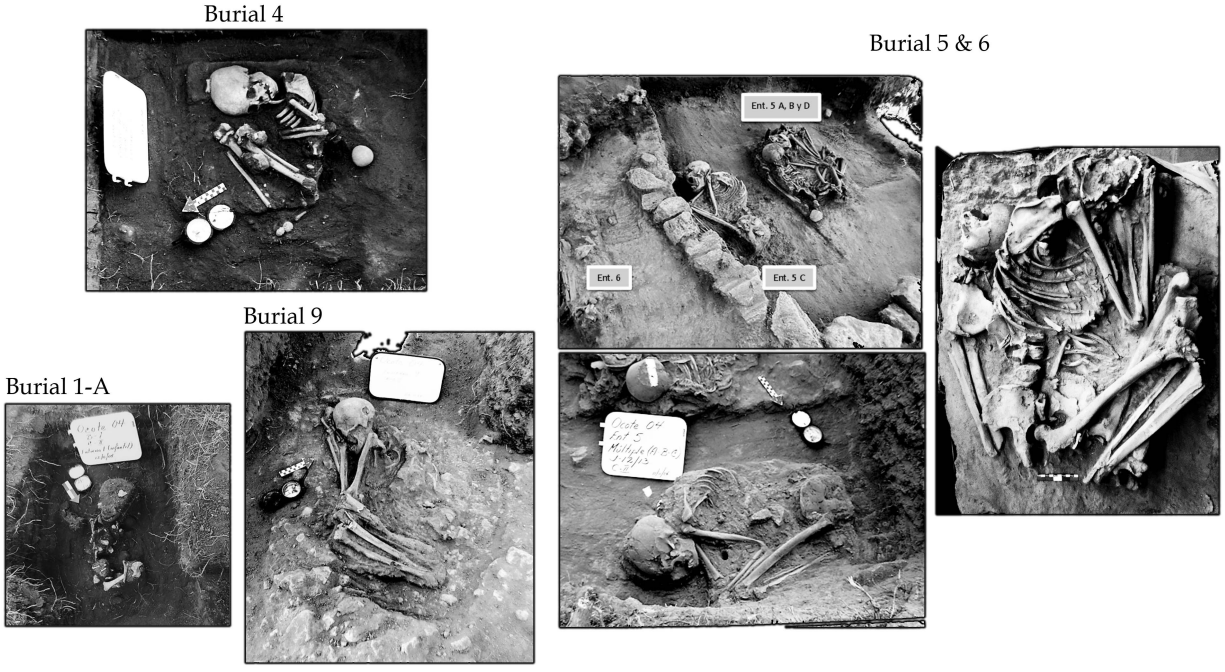


Figure 41. Ocote Primary burials. Burial 5 is composed of four individuals. (A. Pelz).

The presence of prestige goods suggests El Ocote's elite group participation in the regional political social recognition network. This kind of goods range from a variety of items made of precious materials, including mollusk shells from the Panamic Province (Pacific coast), the Caribbean Province, and the Gulf Coast, all of which were detected in the site (Gutierrez R. 2016). Other prestige goods present include the green-stone ornamental pieces, some of which could be turquoise although more analysis is needed.

Other prestige goods are identified not because of the rarity of the raw material, but because of the iconography and relationship with certain ritual contexts, as is the case with the pseudo-cloisonné decorated ceramics as explained in the last chapter.

An essential cultural feature at the site is the presence of rock-art paintings, with at least five panels in different spaces. In all of them, the main color present is red, and the motifs combine anthropomorphic, zoomorphic, and geometric elements. Their chronology has not been established and it is unknown if they were painted before, at the time, or after the sedentary occupation, although it is evident that their existence is linked to spaces related to cosmovision and landscape. This type of manifestation is widespread in the Bajío area (Palacios D. 2016) (Figure 42).

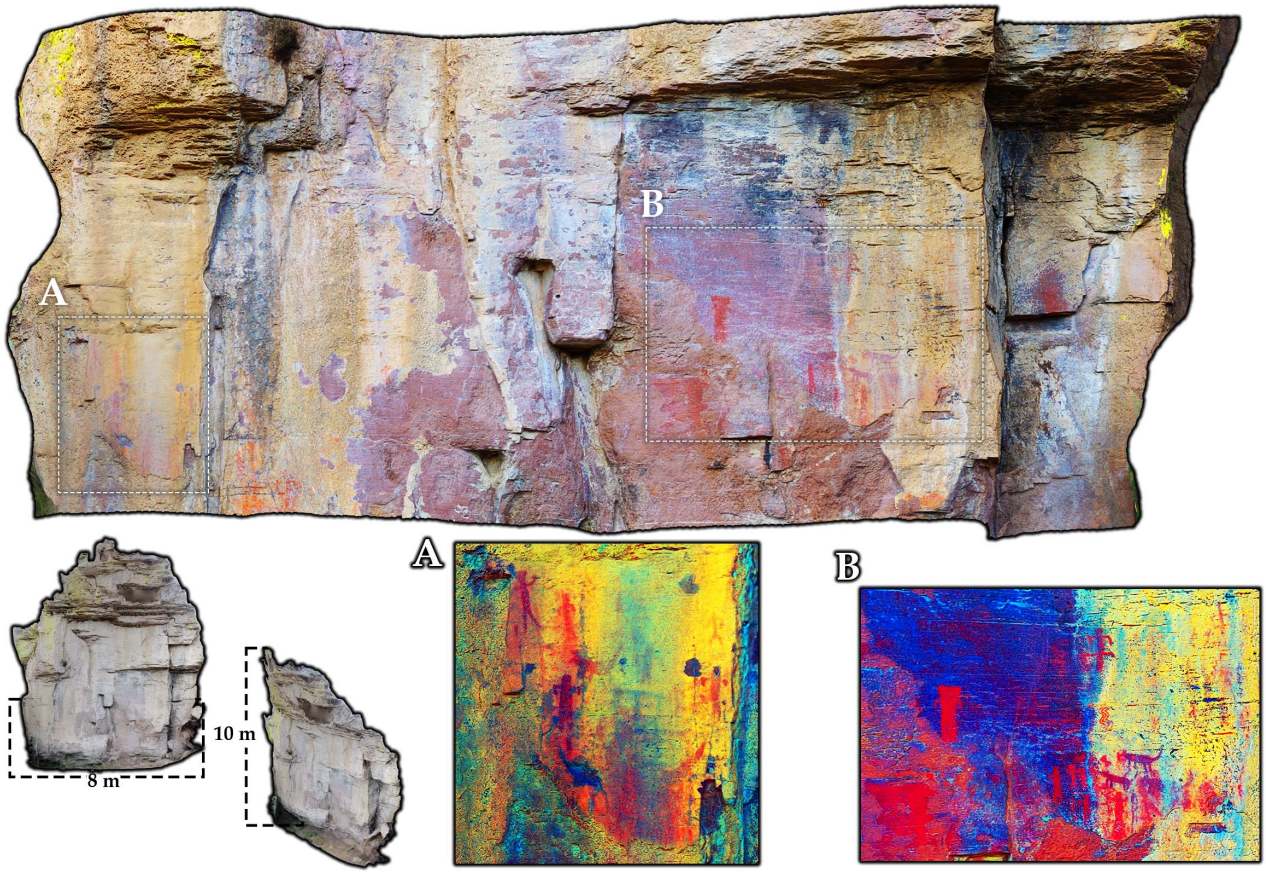


Figure 42. Orthophoto of a Rock Art panel. Some sections were filtered through Dstretch. (M. Dueñas).

3.3 Santiago

The site was registered first by the archaeologist Eloy Castellanos in 1991. Two other registration cards appeared from this same site in 1992 along with some reports with general observations. Subsequently, the site was visited by the archaeologist Ana María Pelz of the INAH Aguascalientes Center, because the state government intended to build a road that would cross part of the archaeological zone. As a result of this threat to the site, survey work was carried out, which ultimately helped change the road layout further away from the site. Subsequently, The Santiago Archaeological Project (PAS) was born in 2004 under the direction of Nicolás Caretta and currently continues working.

The archaeological settlement of Cerro de Santiago is characterized by both monumental and residential architecture, with more than 200 architectural elements registered. The site is associated with the fluvial current of the Río Verde Grande, specifically the northern slope of the Río Aguascalientes. Recent research has revealed that it was occupied during the Epiclassic, between 600-900 CE, based on the North Central regional ceramic chronology (Nicolas C. 2006). The initial research divided the settlement into three areas: A, B and C (Figure 43).

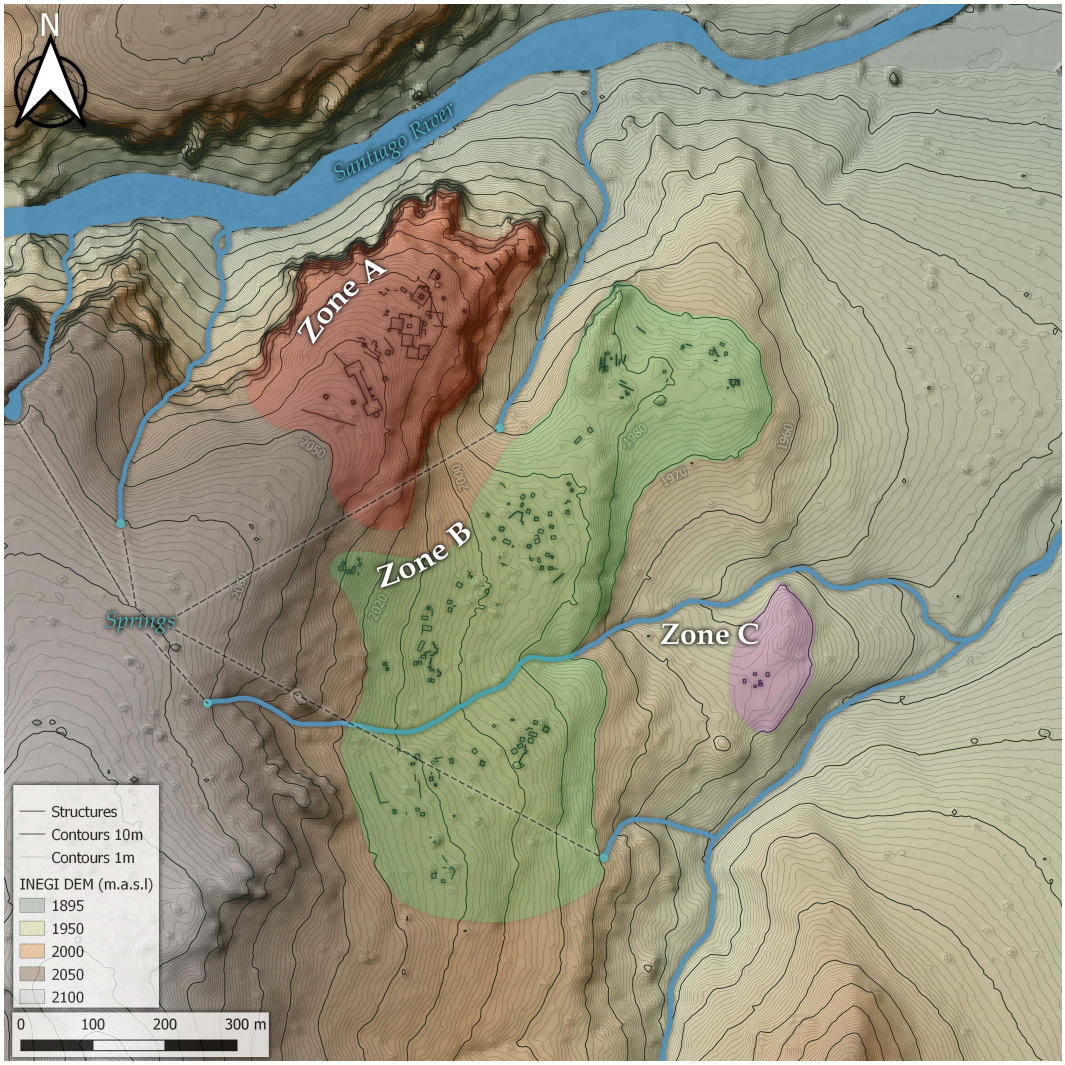


Figure 43. Santiago archaeological map. (M. Dueñas).

Sector A: the area with the highest concentration of architectural elements, considered as the ceremonial area of the site, is located on the top of the plateau, south of the ravine, where there are mounds, platforms, altars, patios, and a possible ball court. This area was named *The Acropolis*. This religious, civic zone attests to the ritual life of the settlement, its hierarchical organization, and the specialization of its inhabitants. Here we can identify spaces designed for specific rituals such as mounds and sunken patios, fundamental for public civic-religious practices in the pre-Hispanic indigenous worldview. Additionally, some structures could be defined as residential for the site's elites (Figure 44).

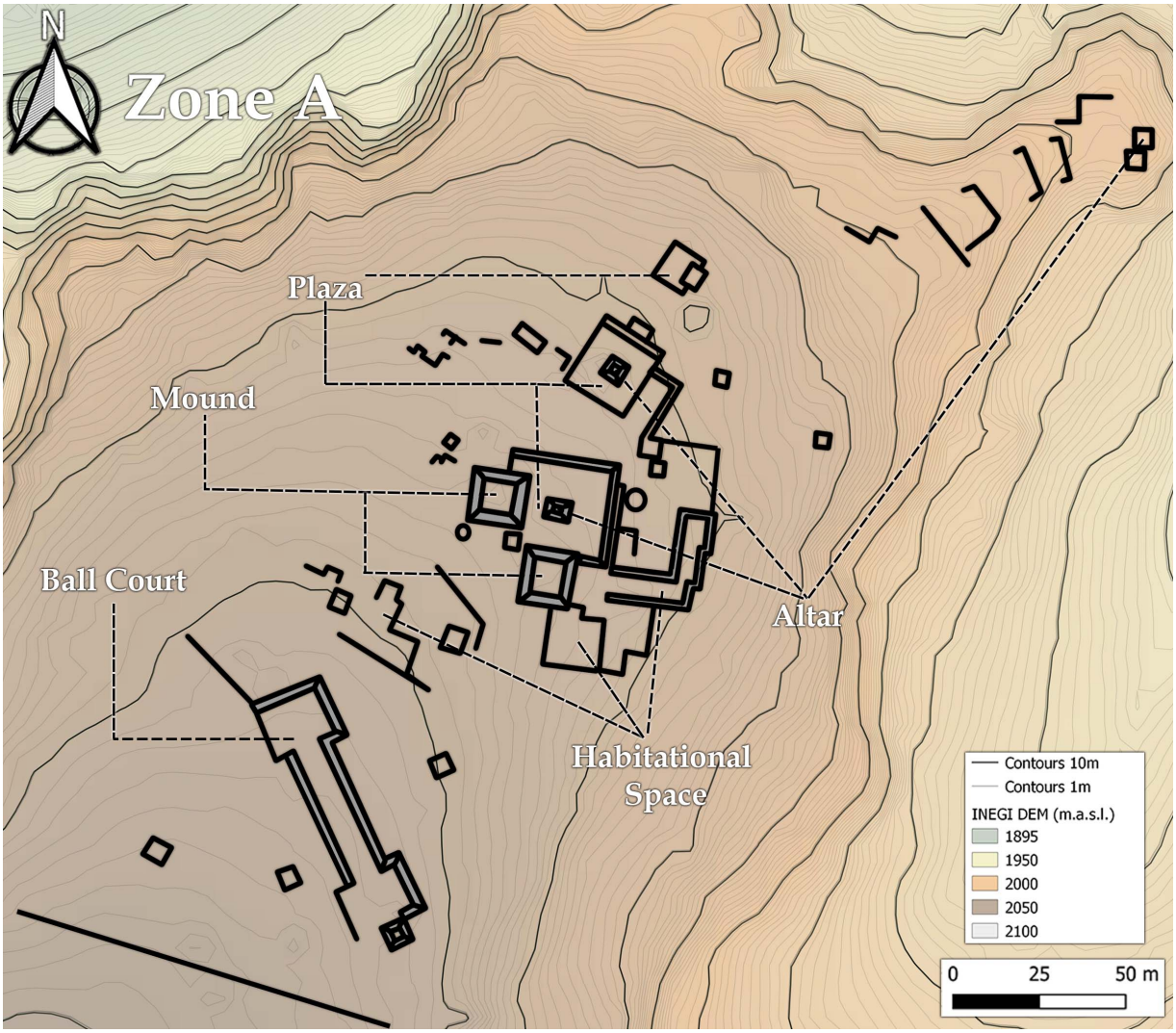


Figure 44. Santiago Sector "A" Map. (M. Duenas).

Sectors B and C: based on their architectural components, these are residential areas in the middle and lower parts of the center. They comprise more than 190 elements between terraces, retaining walls, and residential structures located on the surface, highlighting the presence of mounds of simple platforms. These sectors extend within an area of about 20 hectares.

The archaeological site of Santiago is a remarkable archaeological case to understand the political and economic climate of the Epiclassic. Its ceremonial area shows apparent similarities

with its neighbors south and west, mainly because of sunken patios, the architectural canon, and diagnostic elements for the Classic period. This may indicate that, on the one hand, the site preserves possible southern architectural patterns, being connected to these since the Classic (200-600 CE).

It is impossible to state anything categorically; however, with the above information, we can focus on different lines of research. The few explorations at the site have only revealed the stage of greatest Epiclassic effervescence and interaction. Its origin and decline have not yet been evaluated and remain to be programmed in subsequent investigations directed at the nuclear and ceremonial area of the site.

During its development, the Santiago site was incorporated into the trade networks of prestige goods, among which we can more clearly identify pseudo-cloisonné pottery and *Type I* figurines. In the political domain, we know that the power base is not only strength but also legitimacy and the fact that great political families typically turn to ideological and religious foundations to legitimize their right to rule (Beekman 1996; Fernandez V. 2004; Nelson et al. 1993; Price 1977; Stein 1999, 2002).

The ceramic comparative analysis in Santiago gives us an idea about the commercial relations and cultural influences that occurred in the Mesoamerica Septentrional Sphere, including South Zacatecas and North Jalisco sphere, Valle de San Luis sphere, and El Bajío, during the Epiclassic (Figure 45). Lithic implements are present in various flakes and artifacts such as projectile points, scrapers, knives, metates, manos, and axes. These implements are part of the subsequent phases of selecting and exploiting raw materials in the fields (Figure 46).

Figure 45. Santiago Pseudocloisonne Type ceramics. Figurine Type I and Rio Verde Subtype and Engraved type vessel. (M. Duenas).

Figure 46. Santiago's metate, axe, arrowheads and scrapers. Photos PAS project.

Although Santiago was one of the first sites to be identified by archaeologists at the beginning of the 21st century, it is the least studied. Complications with the land tenants have prevented further research. Most of the information is still from surveys and preliminary analyses. Nevertheless, the monumentality of the ceremonial architecture and the extended habitational zones lead us to believe that it had specific relevance among the rest of the sites.

3.4 La Montesita

Located east of the current capital of Aguascalientes is La Montesita. In 2011, in response to the discovery of archaeological materials, archaeologists of the INAH Aguascalientes Center went to the scene and identified an archaeological site with intense looting. Fragments of pottery, bones, and lithic implements were found on the surface around some looter's pits. In addition, remains of structures were located, some exceeding the size of simple houses. Most of the site is in Las Negritas, municipality of Asientos, in the extreme east of the state of Aguascalientes.

To follow up on these discoveries, La Montesita Archaeological Project (PALM) was started (Pelz M. et al. 2013; Schulze and Perez R. 2015, 2016), which is being led by professors and students from the Autonomous University of San Luis Potosí (UASLP), in close collaboration with the INAH Aguascalientes Center. A review of the archaeological literature showed early references to a site at this location, identified as one of the largest in the region and named primarily in connection with its cave paintings (Figure 47).

The hill of La Montesita itself, which gives the site its name, is a rocky outcrop with a maximum height of 2246 meters above sea level. The region has a temperate semi-dry climate

with thorny desert forest vegetation. Today the site is a place of passage for shepherds who go to the springs for water.

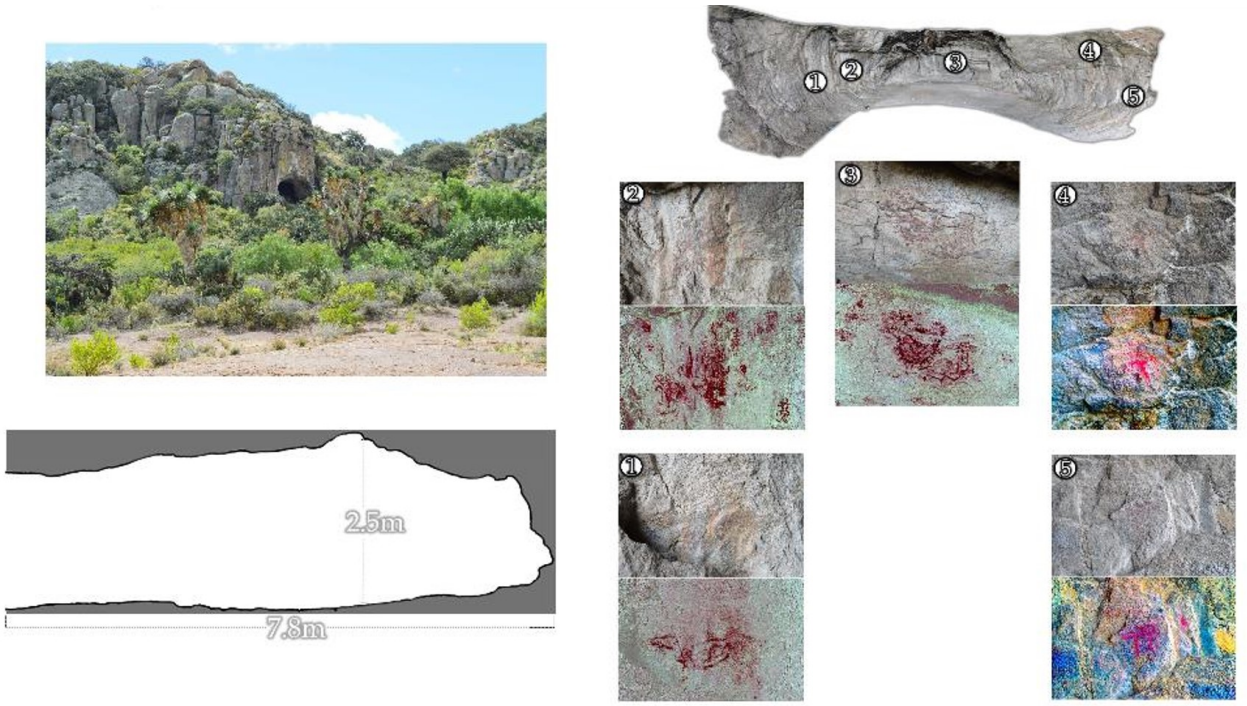


Figure 47. Rock Shelter filled with Rock art motifs. (M Dueñas).

According to the topographic partitions of the area and the concentrations of archaeological remains, the archaeological site was subdivided into five sectors named alphabetically from A to E. Sector A comprises the slope of the La Montesita and La Mesa hills. Large quantities of ceramics (polychrome, resist-painted, and fragments of figurines), lithics, and bones have been found in this part of the site. Some of the bones found in this sector are of human origin, which is the reason the local people call this part of the site "Cemetery of the Indians" (Pelz M. et al. 2013). Excavations found the burials of two children associated with a structure (Martinez C. 2016). The first is from an infant younger than one year old and the second is from a child between 6 and 8 years of age (Figure 48).

Figure 48. Montesita Child burial. (Martinez C. 2016).

Sector B is a hill that bears the name of La Montesita, where ceramics and lithics were also found. During surveys, the plans of rectangular structures, a platform, and mounds were identified. There were three walls at the entrance to Sector B. Two rectangular structures were excavated and tentatively identified as housing units (Figure 49). Sector B, with parts of Sector D, has the highest construction volumes on the site. Apart from a few rock alignments and a possible structure, mainly large amounts of lithic (projectile points, scrapers, and flakes) were found in sector C. Sector D is the northwest slope of Cerro La Montesita that reaches the plain of current agricultural use. There is a sloped terrace, on top of which a large-volume building was erected. This space's use has not yet been established with certainty. Finally, Sector E encompasses the upper part of the Cerro de La Mesa, which forms the site's eastern end. This part of the site has some small architectural remains, maybe small huts, and only lithic projectiles have been found, making us doubt the contemporaneity with the rest of the settlement. Or maybe it had a different use, as a place for hunting or range practice (Figure 50).

On the periphery of the site, outside the sectors described above, the concentration of finds decreases, but traces of human activities from different time periods are still found. For example, at the entrance to the La Montesita valley, several structures were found, withwhich pre-Hispanic ceramics and lithics are associated. One of the structures was excavated and shows very similar features, for example, some “boxes" or cists without content (Schulze and Perez R. 2015, 2016), to those found at the core sites, in Sector B (Figure 51).

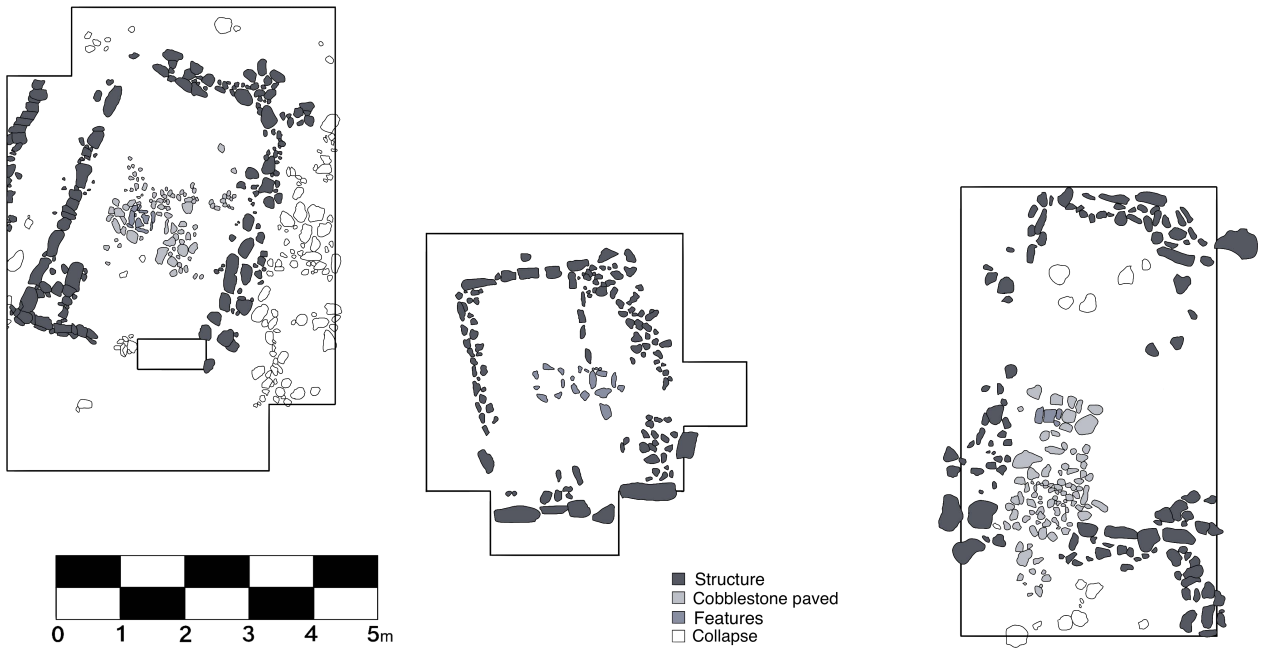


Figure 49. Montesita Excavated structures. (M. Campos).

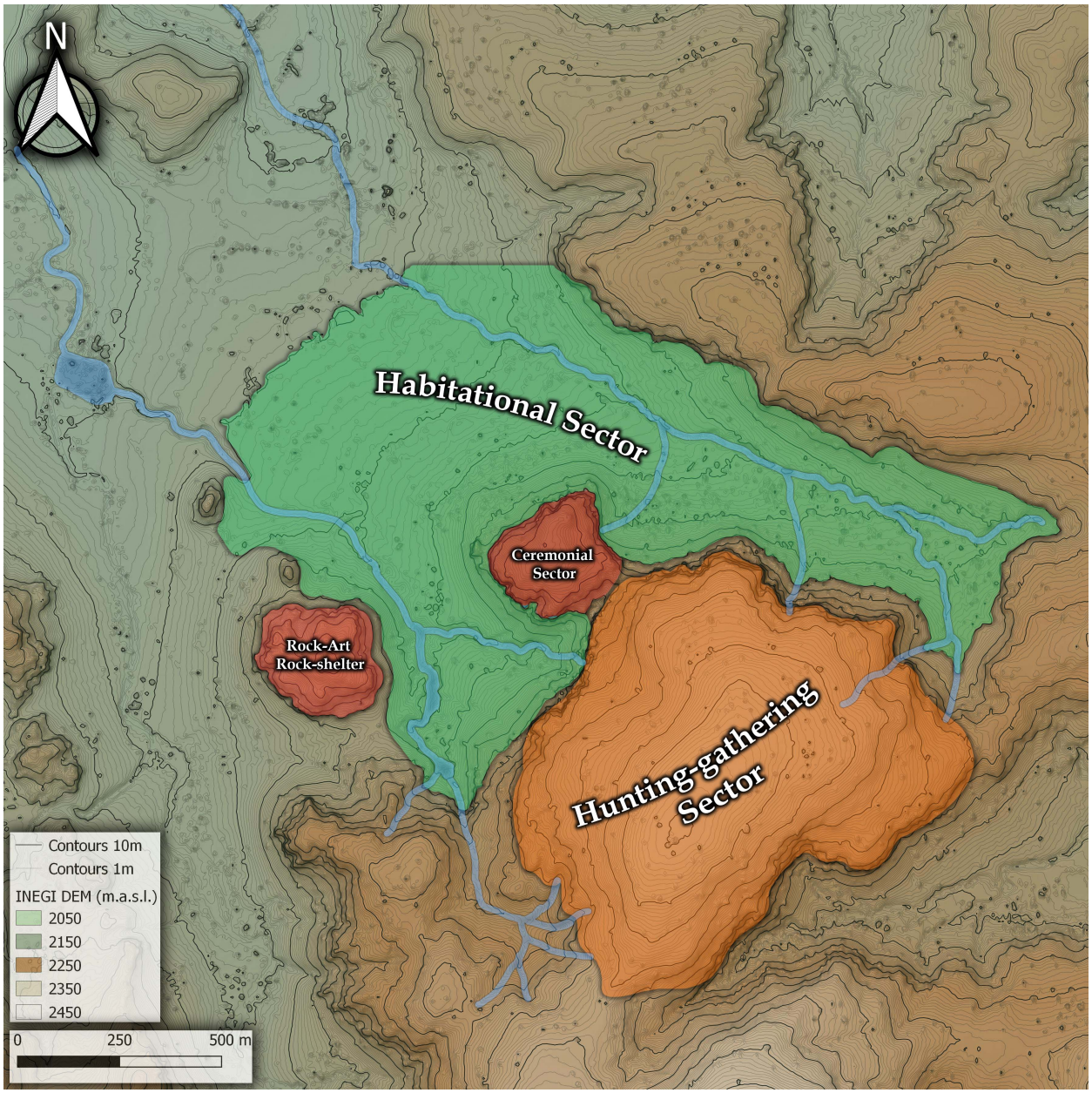


Figure 50. Montesita sectors map. (M. Duenas).

Figure 51. Montecita's Cist. (Schulze and Perez R. 2015).

Most of the structures found at the site are rectangular, measuring approximately 3 x 4 m. The foundations are made of stone slabs that served as a base for adobe or wattle and daub walls; the roofs were probably made of perishable materials; some structures seem to have an internal division. Several of the structures at the site appear to be arranged in groups of three around a courtyard.

The excavations carried out to date generally do not show different construction phases, indicating a single and probably brief occupation for most of the site (Pelz M. et al. 2013; Schulze and Perez R. 2015, 2016).

Even if the site has not been independently dated, the similarity of the ceramics with El Ocote and Santiago allow us to propose a similar chronology during the Epiclassic (600-900 CE). A large part of the pottery found at the site is for domestic use, thick and undecorated. However, fragments of decorated vessels have also been found, likely to be used in ceremonies or by people with the highest status. The decorations are the resist-painted (polychrome with red band, black on brown), pseudo-cloisonné, engraved, and Valle San Luis type, among others (Figure 52).

Fragments of vessels with annular bases and reversed edges were also found. These elements testify that La Montesita took part in regional development and actively participated in extensive exchange networks to the south and east. Comparison with other sites shows it was located in a transition zone between various spheres of interaction, located to the east and west of the site (Lopez N. 2019).

Figure 52. Montesita's Ceramics. the resist-painting type, reversed border type, a monochrome vessel with reinforced border and Coffee-bean Eyes Type Figurines. (Photos G. Lopez and Drawing G. Aguilar).

Although the study of lithic materials is in its early stages, the results obtained so far indicate that their production has occurred mainly at the local/domestic level (Lopez R. 2016); however, one possibility is that some of the finer and more elaborate artifacts may also have been useful for trade. Some of the "rarer" types in the collection are examples of pieces that probably came from elsewhere (Lopez R. 2016) (Figure 53).

The investigations at La Montesita illustrate that the ancient community had a marked social stratification, and practiced and depended on agriculture, even if they significantly complemented their diet with meat from game animals, for example, hares, rabbits, and deer (Pelz M. et al. 2013), and that was closely linked with its neighbors. However, this development does not appear to have lasted long: an overturned metate found in one of the excavated structures may signal a ritual of abandonment, celebrated when the site was vacated (Figure 54).

Figure 53. Montesita lithics and ground stone. Arrow heads, scrapers, burin, metate and hand stones. (Photos Lopez R. 2016 and Campos M. 2017).

Figure 54. Structure excavated. (M. Campos).

3.5 El Jaral

Located near El Ocote in the southwest part of Aguascalientes, El Jaral has only been researched on the surface (Macias Q. 2009). The structures that make up this settlement are distributed on an isolated mesa surrounded by small valleys drained by temporary rivers. The structures and other cultural manifestations are distributed throughout the orographic formation. The estimated extension of the settlement is around 60 ha.

Following the same description on other sites from Jalisco's Highlands, the site consists primarily of terraces and retaining walls on the slopes of a hill. In total, six sets of terraces were detected. The retaining walls of the terraces measure an average of 20 to 25 m long (the longest) and the smallest ones from 10 to 12 m, and their height does not exceed 50 cm on average. The construction material consists primarily of rhyolite stone slabs, mostly very coarse; this construction system is repeated in most of the hill structures. Some smaller structures defined by stone courses of the same rock slabs arranged vertically on these leveling terraces were detected. Some materials were recovered, like ceramic supports and shards and some rhyolite flakes.

The construction systems observed are similar to other Rio Verde Grande sites, like the short double wall and the simple wall composed of 50 cm tall rocks. Small mounds were detected at the top of a terrace (named Terrace 7), and due to its dimensions, this structure is clearly distinguished from any other building so far registered in the region. The approximate area (which includes the upper part where the minor structures are located) covers a surface greater than 1400 m^2, while the altitude of this terrace is approximately 7 m, whose slope covers 14 m long.

The northeast access to the top is delimited and controlled by a wall. Ten meters higher is another retaining wall named North Wall 2. The upper part of the Jaral mesa is divided into platforms that follow a stepped unevenness from the top; the first subsets contain a rectangular platform (about one meter high) with various structures. One of these structures, a small rectangular-shaped building with an attached bench and a step, was located on its west side. Similar to structures in Santiago and la Montesita, there is a possible square box, or cist, in the center of this structure made up of four slabs that delimit it; these boxes are similar to those reported by Trombold (2003) in the MV-206 site of the Malpaso Zacatecas Valley. This platform is delimited by two other buildings in a southeastern direction, with similar dimensions and conformation.

At the top of the hill are three closed platforms and one L-shaped platform containing small rectangular-shaped structures. The last of these platforms are connected to a staircase that leads to a quadrangular enclosure. Finally, a low-height quadrangular platform (no greater than 50 cm) stands at the mesa.

Next to El Jaral plateau, another hilltop named El Colorin has architectonical remains too, part of the same geological formation that makes up the Jaral plateau; both peaks are linked by a port between them; 5 structures and a platform were detected in said port, surrounding a plaza. The plaza has an approximate extension of 64 m from east to west and 36 m north-south (2304 m^2).

3.6 El Zapote

This settlement is another hill, nearby to El Jaral, and it may be an extension of the same settlement, measuring 42 ha. (Macias Q. 2009). There are three main areas where buildings were detected on the surface. The first area is located southwest of the central hill. This flat land is

currently used as crop fields, where several archaeological materials like ceramic shards, lithics, and building materials were found.

Another zone with buildings is located south, comprising a series of mounds arranged on an extensive low-rise platform surrounded by cultivated fields. In total, seven mounds were recorded. Three of these mounds are located around a small patio; ceramic and lithic remains were found in the vicinity of this complex, especially rhyolite flakes and debris.

The rest of the settlement is located at the top of the hill, between two sectors. South of the mesa, eight platforms and two terraces were documented whose truncated conical plans are adapted to the topography of the land, which rise in levels in the manner of "terraced enclosures."

The heights vary between one level and another of the platforms from 50 cm to 2 m. A unique platform with a rectangular shape stands out, measuring approximately 15 x 15 meters, and above it is a mound located towards the west of this platform. Surveys also detected a second architectural complex consisting of a platform and a terrace on the southern part. A small number of associated materials consists of some flakes and scrapers.

Finally, the northern portion of the mesa consists of a rectangular-shaped platform fitted with perceptible retaining walls in some of its lateral portions (these measured 25 x 77 m, and bears seven quadrangular structures composed of flat, vertically positioned stone slabs.

Both el Jaral and el Zapote have only been partially surveyed, and much of the information comes from what is visible on the surface. Nevertheless, surveys identified the same Epiclassic materials at each site; moreover, the buildings have similar construction systems to the other Rio Verde Grande sites.

3.7 Aguascalientes archaeology summary

The recovery of a diversity of diagnostic elements in all Aguascalientes sites, and others located in neighboring regions allows us to see an interrelation among them. The populations might be dispersed but the similarity of the assemblages from each site suggest a high degree of intercommunication, contradicting the idea of a perpetual state of warfare and aggression.

Unfortunately, all research conducted in Aguascalientes has been the product of individual projects on specific sites rather than coordinated efforts to study the region systematically. Despite this condition, it is possible to conduct comparative analyses. All sites have a significant presence of Epiclassic materials, putting them at least in the same cultural horizon, alongside the rest of the northern border of Mesoamerica. The sites share a similar location in the landscape, at the top of hills. La Montesita has a defensive wall, making it even more difficult to access the ceremonial zone. Therefore, if violence affected the location of the sites, a more in-depth analysis is required to test in what sense this was a significant factor for the settlement pattern.

All sites had both a ritual core sector and a habitational sector, suggesting that the subsistence activities for daily life were conducted similarly on every site. Where animal remains were found, similar species have been detected: domesticated dogs and turkeys, and similar game like venison, rabbit, and river turtles are common species consumed on all sites.

The next chapter will present the results of 10 years of research conducted at CDEM. Together with the information presented in this chapter, Chapter 4 will lay out the knowledge base for the Meaningful Divulgation of CDEM.

Chapter 4
Cerro de Enmedio Archaeological project

4.1 Introduction

The Cerro de en Medio archaeological site (CDEM) is exceptional in more than one way. The archaeological site is located on a hill surrounded by ravines (Figure 55) at an approximate distance of 3.61 kms in a southerly direction from the municipal seat of San José de Gracia at the foothills of Sierra Fria.

Figure 55. CDEM North to south (M. Dueñas).

The site is first mentioned in the nineties, when initial explorations interpreted the site as a camp of semi-nomadic societies (Castellanos C. 1994), based on a partial exploration of the settlement and some test pits but mainly inspired by the accounts of the chronicles of Spanish invasion during the 16th century. It would not be until 2012 that this project would update the maps, record the remains of surface construction in detail, and begin to analyze materials recovered on systematic surveys and archaeological excavations.

Research conducted at the CDEM archaeological site and presented in this chapter has focused on defining the parameters of the prehistoric settlement and investigating the lifeways and the social hierarchy of the site, as the previous assessment classified it as a hunter and gatherer site. The primary methodology revolves around recording the architectural findings and

analyzing archaeological ceramic and lithic materials to inquire about lifeways, subsistence and exchange economy, and cultural interactions with neighboring regions and sites and to better understand the site's chronology through typological comparisons of ceramics and lithics and architectural styles.

4.2 Geographical Settings

The environment is an important factor contributing to the configuration of social organization and other human institutions, in particular those related to the distribution of resources and power in a society. This work considers the sphere of human culture not as separate from but as interdependent with and transfused by ecological processes and natural cycles. The archaeological site is located on a hill surrounded by ravines within the municipality of San José de Gracia, in the state of Aguascalientes (Figure 56). Its geographic coordinates at the center of the site are 766013.67 m E and 2447762.26 m N.

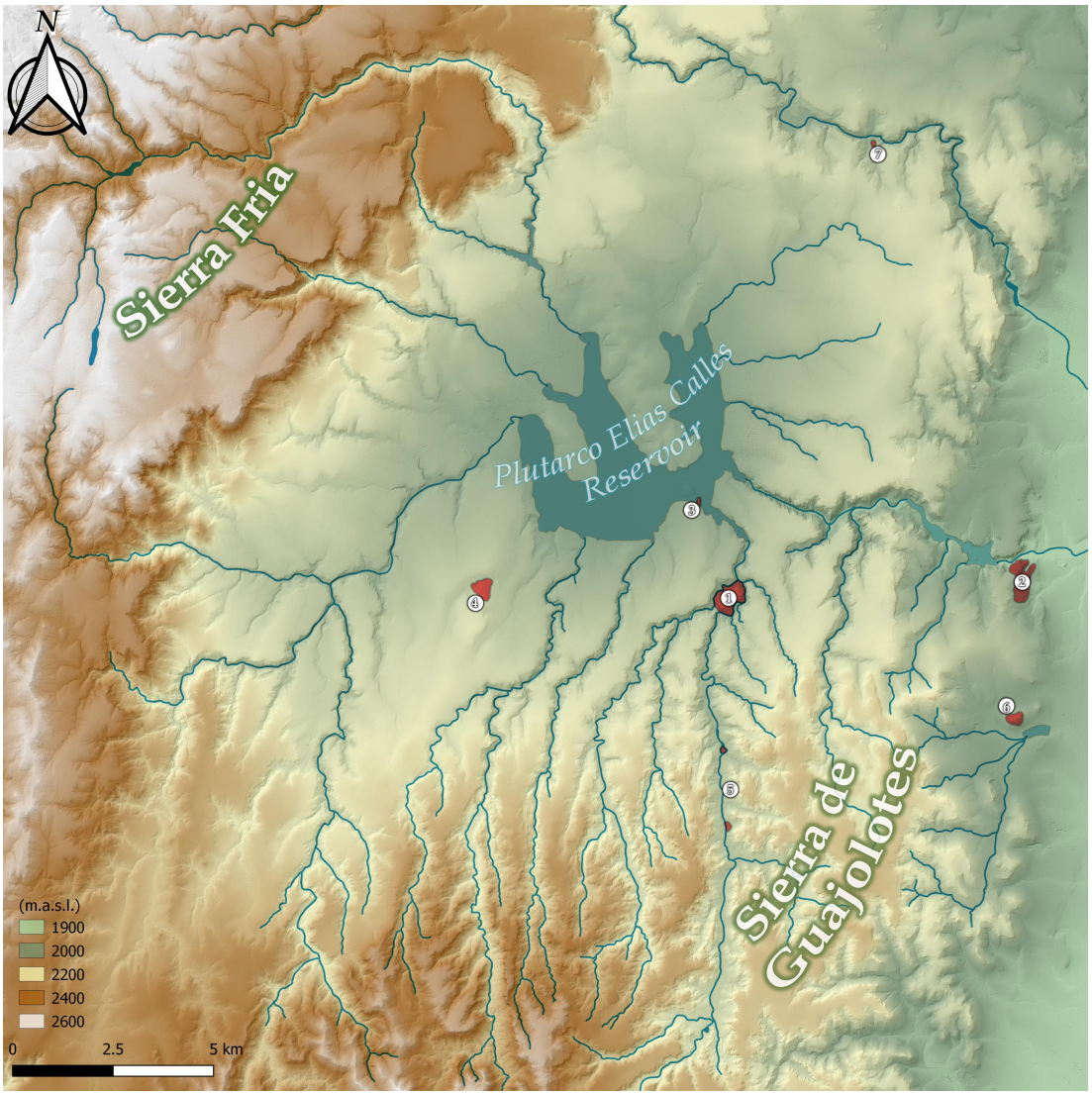


Figure 56. San Jose de Gracia Map and archaeological site's location: #1 CDEM; #2 Santiago; #3 Casa de Indios; #4 Mesa de los Apaches; #5 Barranca de las Cabras; #6 Garabato; #7 Tunel de potrerillo (M. Dueñas).

The municipality of San José de Gracia is located in the northwest of the state, and within its territory is the Sierra Fría, whose maximum elevation is 3050 m.a.s.l. It is also the maximum elevation in the state, located on the Cerro de la Ardilla. It is located within the physiographic sub-province of Sierras y Valles Zacatecanos. These mountain ranges are formed by rhyolites that alternate with extensive horizontal banks of tuffs, forming a series of stepped plateaus (92.6% of the territory complies with this topoform) due to the differential resistance to erosion of each class of rocks (Valencia 1991:6).

In the municipality of San José de Gracia, four types of soil have been identified: Luvisol, Feozem, Regosol, and Planosol, according to the edaphological chart of the National Institute of Statistics and Geography (INEGI). Soils at the archaeological site itself are Planosols (Figure 57); this type of soil has a median depth of between 50 cm and 100 cm. Planosols are characterized by an infertile, thin, and highly erodible soil layer (INEGI 2015).

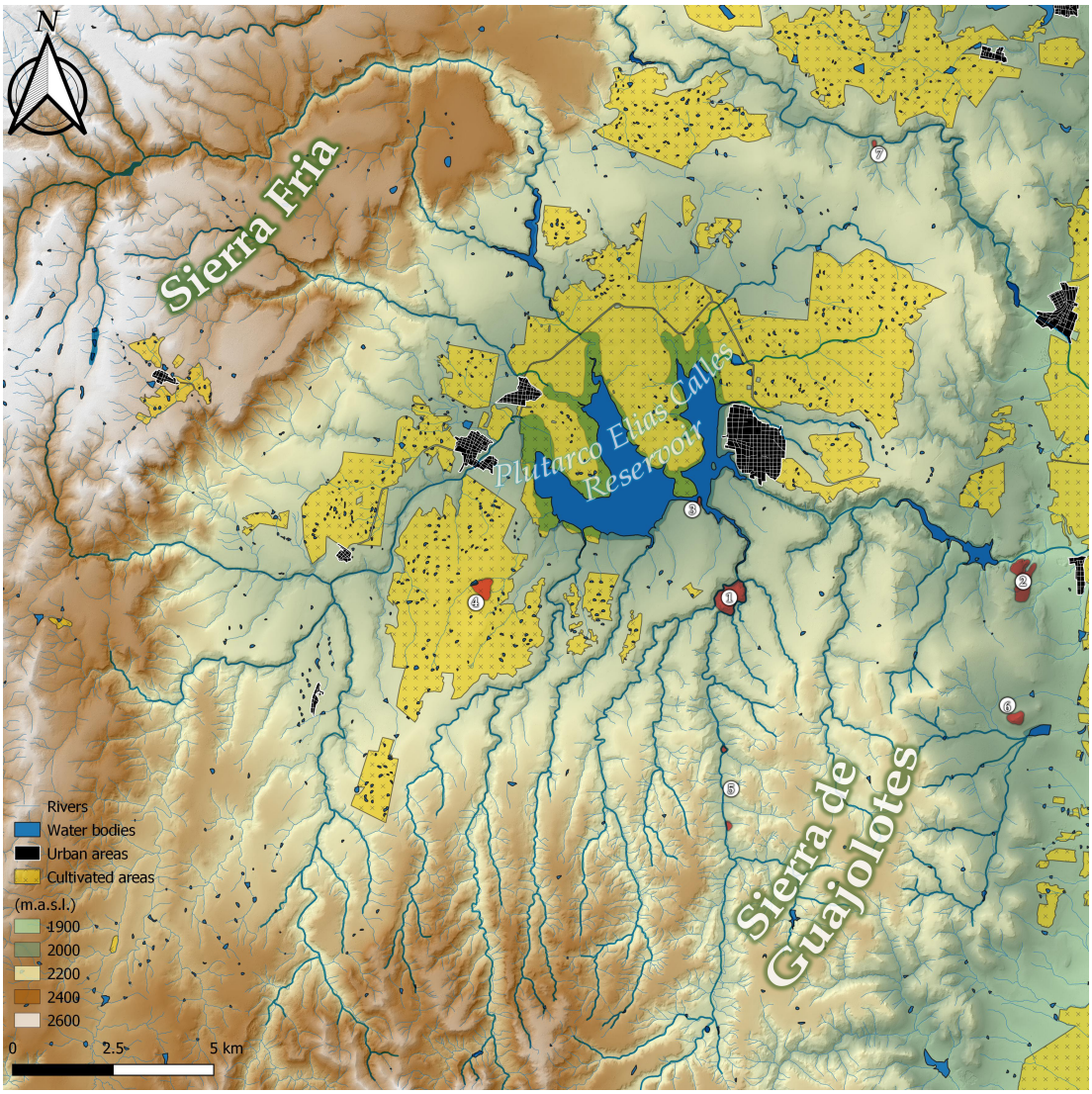


Figure 57. San Jose de Gracia use of land Map and Archaeological site's location: #1 CDEM; #2 Santiago; #3 Casa de Indios; #4 Mesa de los Apaches; #5 Barranca de las Cabras; #6 Garabato; #7 Tunel de potrerillo (M. Dueñas).

The site is distributed on a mesa of ignimbrite between two surrounding ravines, giving rise to a table surrounded by two rivers that run to the north in the rainy season, making access to the settlement difficult for at least part of the year. Currently, the land use around the archaeological site is divided into two types: the northwest is used for rainfed agriculture, and the southeast part is natural grassland, characterized by shrubs, mesquites, and huisaches, at an altitude from 1100 and 2500 m.a.s.l. (Sarukhan 2008, INEGI 2015).

The prevailing climate in the municipality is semi-dry (BS1kw) with a degree of humidity greater than 22.9%. There is also a temperate subhumid climate in the northwest of the municipality, corresponding to the Sierra Fría. The archaeological site is located within a semi-dry climate; the average annual temperature is between 12 and 18° C, the average of the coldest month is between -3 and 18° C, and that of the warmest >18° C. The months with the highest rainfall are between May and October (INEGI 2000).

The natural environment provides the basis for the survival and becomes central to the analysis of a society. Through the means of production, which includes technology, environment, population pressure, and work relationships, people are able to take from nature what they need to reproduce social life.

4.3 Household Archaeology: A Marxist Approach

In order to address research questions regarding the social structure and to better understand the nature of the site, work at CDEM focuses on households and social archaeology. Taking a Marxist perspective this work emphasizes social production and social inequality in the study of a small-scale agricultural settlement (Grier and Kim 2012).

Marxist studies typically emphasize the importance of the role of households as organizing units for cooperative work, production, consumption, exchange of resources, the transmission of property and rights from one generation to another, and the creation and maintenance of ties and alliances with other units through marriage and other forms of exchange (Rathje and McGuire 1982). Social inequality is a basic premise of Marxist models in archeology. In contrast to the classic Marxist classification of pre-urban households as egalitarian, many of the Neo-Marxist models adopt the idea of an ephemeral inequality based on ever-changing pattern of household growth and decline cycles (Godelier 1975; Goody 1958; Meillassoux 1978).

The inequalities that result from differences in the cycles of demographic and economic evolution may be difficult to define, but they are nonetheless very real. Thus, at any given time, households in a settlement will demonstrate differences in membership, workforce composition, and dominance structure within the co-resident group and within the settlement (Moore 1986). They can also reveal differences in relations with groups outside the village and, more importantly, differences in access to products and production processes. This concept of small-scale social inequality is the basis for a number of archaeological models that use the emerging importance of households as a unit of social reproduction to explain larger social and economic transformations, such as the intensification of production, the increase in labor and increased cultural complexity, including urbanism (Frankel and Webb 2006; Tringham 1990).

To achieve historical understanding, social archaeologists reconstruct the economic processes (production, distribution, exchange, and consumption) that constitute the means of production and investigate the activities that allow for social reproduction and the labor force, including the activities of superstructural institutions. To explain concrete historic development,

social archaeologists infer daily activities and with this as a base, seek to understand the fundamental regularities that rule production or the relationships between the material base and the superstructure in a hermeneutic way (Bate 2012). They lift the household out of its previous supposed position on the borders of the great events of history to allocate it at the center of social life.

Here, households are contextualized within an overall settlement pattern and more specifically researched through excavation and artifact analyses. These data are integral to understanding the role of the site in the regional socio/political organization as well as articulating local environmental and cultural adaptations that will be integral in creating a Meaningful Divulgation.

4.4 Results

Fieldwork investigations consisted of ground-truthing surveys over and around the mesa, looking for structures, material concentrations, and suitable excavation candidates that could reveal information about the settlement patterns and subsistence strategies.

4.4.1 Surveying Methodology

Ground truthing surveys have been a fundamental part of the project. The initial work was carried out using a measuring tape and a compass; subsequently, these drawings were digitized and georeferenced using a precision GPS in order to create a final planimetry map using GIS (using Quantum Geographic Information System (Qgis)) (Figure 58).

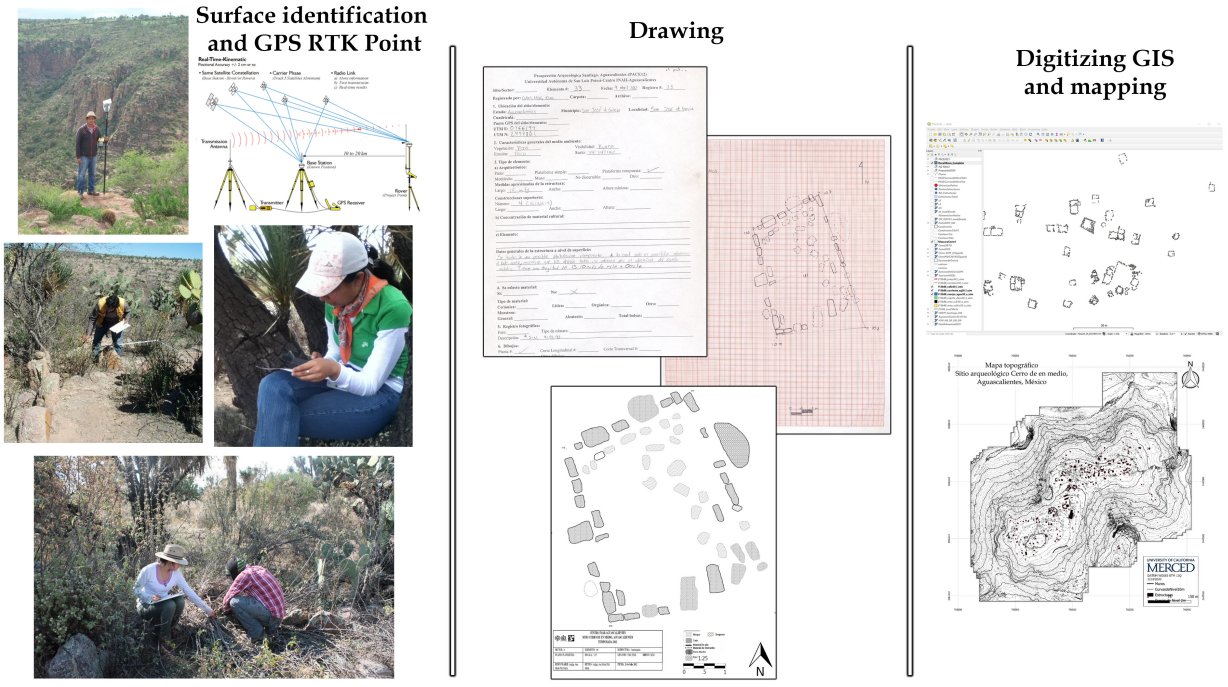


Figure 58. Digitization Process images (M. Dueñas).

4.4.2 Remote Sensing Methodologies

To acquire high-resolution digital elevation models and record the CDEM landscape, the project opted to conduct low-altitude remote sensing photogrammetry using a UAV (Unmanned Aerial Vehicle, known informally as a "drone"). This system has better position control and better precision in topographic coverage.

Landscapes figure strongly among UAV applications within archaeological studies. The ultimate goal in these instances is to achieve detailed maps or 3D models of local landscapes and the archaeological sites found within them. This landscape scale has proven to be an elusive target for archaeologists until recent times. In the past, total station surveys, then GPS, and finally laser scanning have provided successive approaches to recording such massive areas. Unfortunately, landscape mapping using these devices proved to be very time-consuming and expensive; furthermore, the results often lacked sufficient detail. However, traditional aerial photogrammetry, in addition to being very expensive, was not always able (depending on the size of the sites involved) to provide sufficient detail for the detection and representation of archaeological sites.

In this context, the UAV-based 3D photogrammetry record fills a methodological gap within the archaeological mapping process. Numerous case studies have been reported from around 2005 onwards in the literature. Initially, the main objective was to test new technological developments and verify the technical quality and precision of the survey results (Bendea et al. 2007; Caldarelli and Ceccaroni 2013; Fiorillo et al. 2013; Lambers et al. 2007; Remondino et al. 2012). Recent publications show a mature approach, especially in the composition of research teams, which are no longer composed almost exclusively of scientists and engineers but also benefit from the presence and participation of the archaeologists. Furthermore, current implementations of UAV systems tend to be part of a complex strategy aimed primarily at answering archaeological questions (Brenningmeyer et al. 2016; Sonnemann et al. 2016).

UAV systems provide the opportunity for low-level remote sensing at both "site" and "landscape" levels, thanks to the dynamic nature of the platform and the absence of cables or other physical connections to the ground. Although the prices of UAV systems have been lowering, it should not be taken for granted that UAVs are always the best option. For example, if the goal is to obtain beautiful or high-quality aerial photographs of archaeological excavations for public illustration purposes rather than technical records, then a simple ladder can do the job just as well without wasting money and time learning to use a drone. For our case study, a drone from the DJI Inspire 1 RAW brand was available, with a Zenmuse X5 FC550RAW camera (15mm), with a resolution of 4000 x 2250 (4k), flying at an average height of 50 m.

The survey process starts with designing a flight plan. This is done by generating a grid in a GIS that covers the area to be surveyed. To calculate the size of our quadrants, three factors needed to be considered: ground resolution, time of flight, and flying altitude. Ground resolution is affected by the camera's sensor resolution and the flying altitude. Higher sensor resolution and lowest flying altitude will render the best results, but the time of flight (conditioned by the battery life) will be extended. If the aircraft is closer to the ground, the speed needs to be reduced for the camera shutter to be activated fast enough to ensure 80% to 60% overlapping between photos, making longer flights.

The flight time is conditioned by the battery life limit, and most current aircraft models' specifications allow no more than 25 min to ensure a safe return. Moreover, weather conditions such as strong winds or rain can potentially decrease flight time. Finally, flight altitude needs to

consider (besides ground resolution), the height of expected obstacles on the ground to avoid collisions. For the CDEM survey, we created a grid of 150m x 150m quadrants as the area to cover per 20 min. of flight at a 0.5 cm ground resolution (Figure 59).

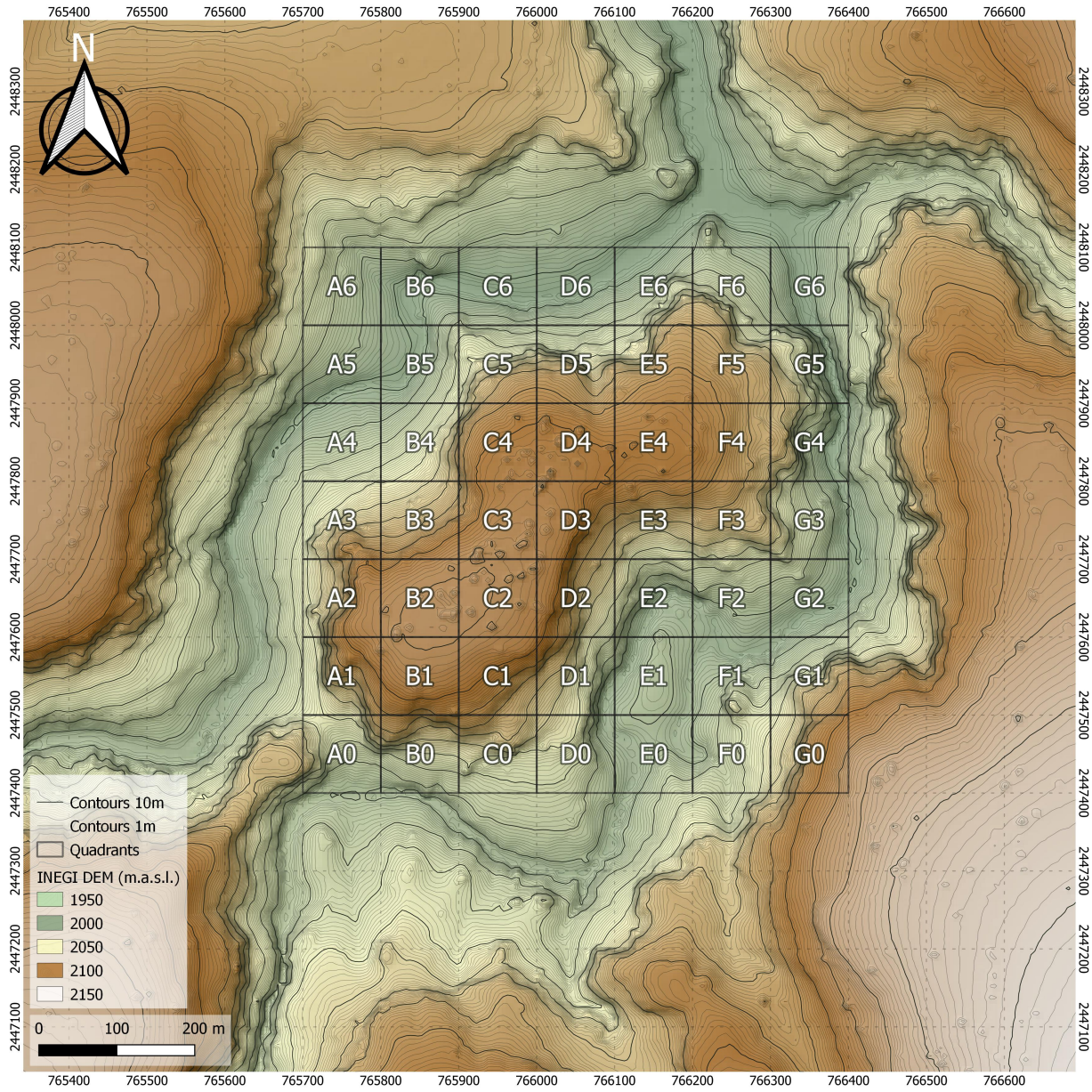


Figure 59. Map of quadrants. (M. Dueñas).

Subsequently, the quadrants are exported and imported into flight planning software, where the characteristics of overlap, height, speed, and type of camera are introduced to optimize the flight plan while generating an automated route for the drone that covers the desired area (Figure 60).

Finally, the drone is brought to the visible takeoff area, ground control points plus color checkers are placed, and precision GPS readings are taken. Afterward, the automated flight plan is initialized, and photographs are collected (Figure 61).

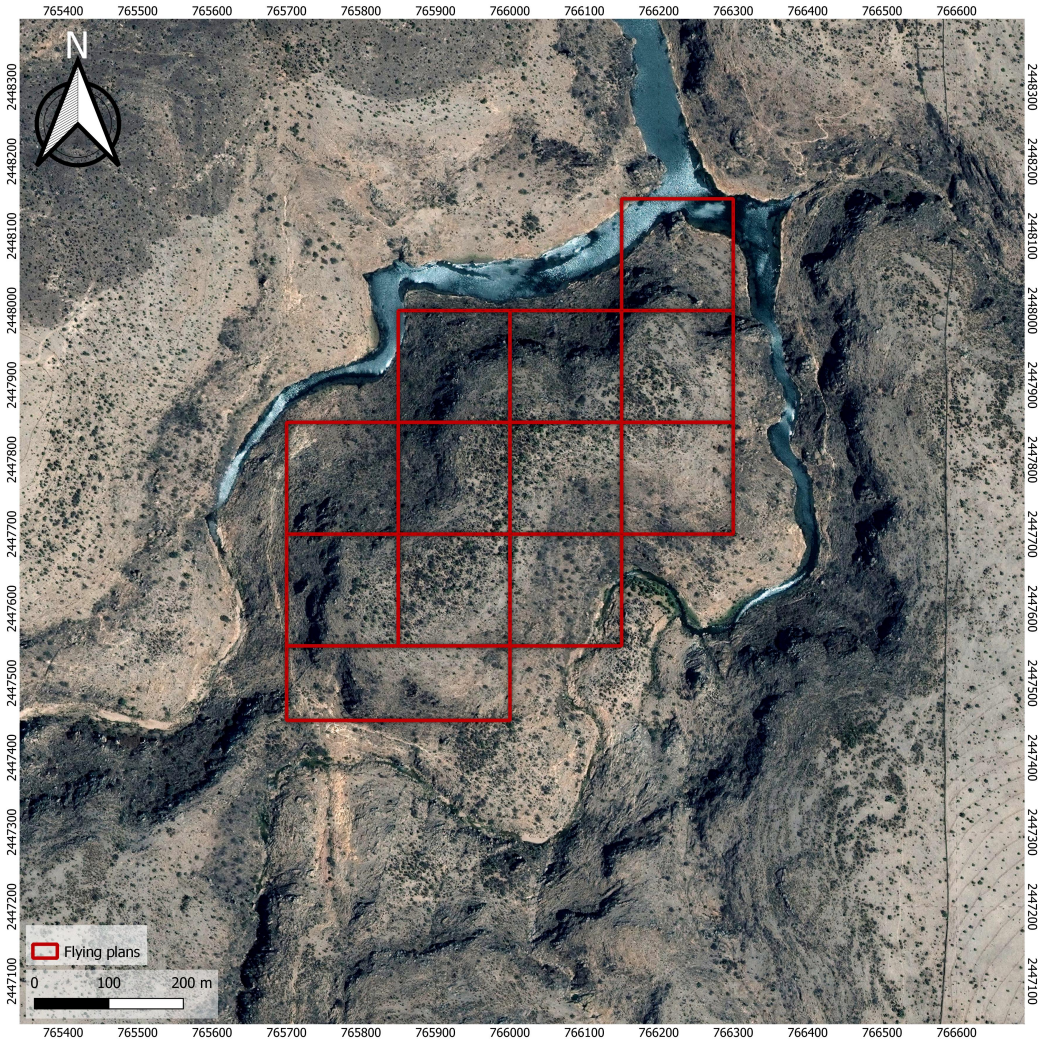


Figure 60. Image of Flight plans quadrants (M. Dueñas).

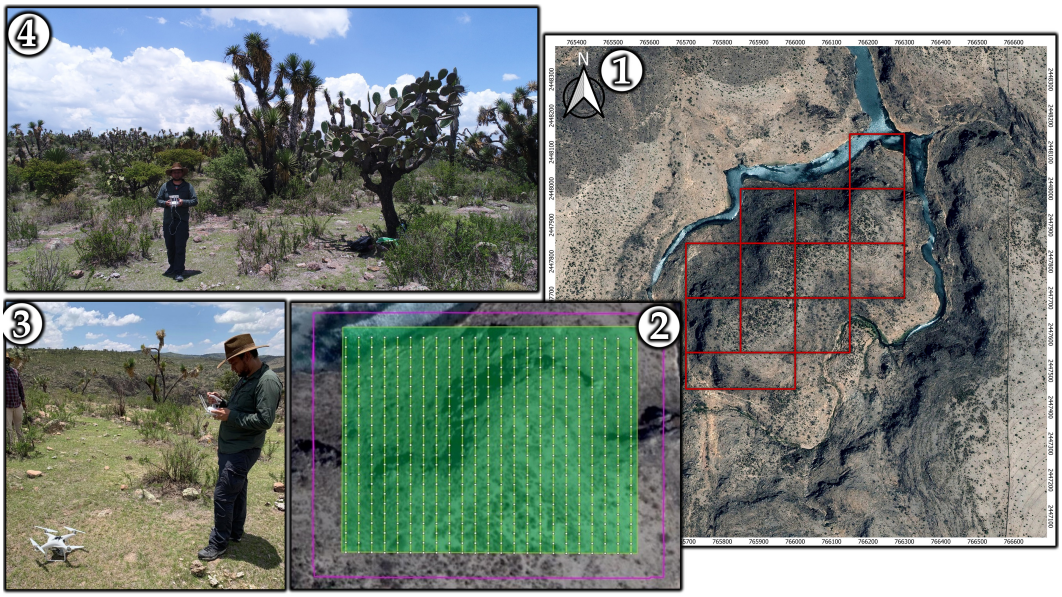


Figure 61. Photo Collage of flight process (M. Dueñas).

The images collected with the drone were processed using the AgiSoft Metashape Pro photogrammetric package (http://www.agisoft.ru). The software requires complete coverage of the study area with at least 60% overlap between photographs, ensuring that each part of the area is covered with a minimum of three overlapping images and geolocation of ground-level landmarks located with a precision GPS. The point cloud was first "cleaned up" by removing points from the areas overlapping each other. Identifying the markers is done automatically, and the GPS data is added using a CSV (comma delimited) file with the coordinates and corresponding datum.

The next step in the workflow involved texture mapping on the polygon meshes and creating orthophotos of each area. The orthophotos were imported into a GIS used to store and manage all archaeological information collected during the successive stages of the survey. The high fidelity, precision, and resolution of the aerial images allowed the topographic and architectural features of the sites to be made in detail and in less time than would have been possible with traditional on-site measurement and drawing. However, it is essential to emphasize that the work has always reflected close integration between work on-site and work in the laboratory. This should not be a linear and sterile relationship but rather involves continuous feedback in both directions. The archaeologists involved in the project can thus explore the archaeological data in 3D and consult the GIS project (for a detailed description of these operations, see Sordini et al. 2016). Based on UAV and ground photogrammetry, this workflow can also facilitate traditional 2D mapping and GIS data management and 3D vector tracing (see, for example, Dell'Unto 2014).

4.4.3 Surveying Results

Identifying architectural elements over the mesa has been completed, and the mapping s covers 215 structures, some arranged around 14 patios over approximately 7 hectares (Figure 62). The mesa extends from north to south, and through the surveys, the project identified four possible access points to the site. Two had staircases. In some sections these were carved into the rock. In other sections, flat rocks were positioned in order to make steps. A small wall flanks the east, southeast, and southwest access. The Northeast access conducts directly to patio #3 (the largest of the site) (Figure 63). The site can be divided into three sectors: the core ceremonial center, the habitational spaces, and the surrounding structures (Figure 64).

Surveys detected 215 structures, some arranged around open spaces that the project denominated as "patios." Although these patios share similarities, such as having multiroom structures and storage units, their differences are substantial. Some patios are circular, some have central altars, and some have perimeter walls (Figures 65, 66, 67).

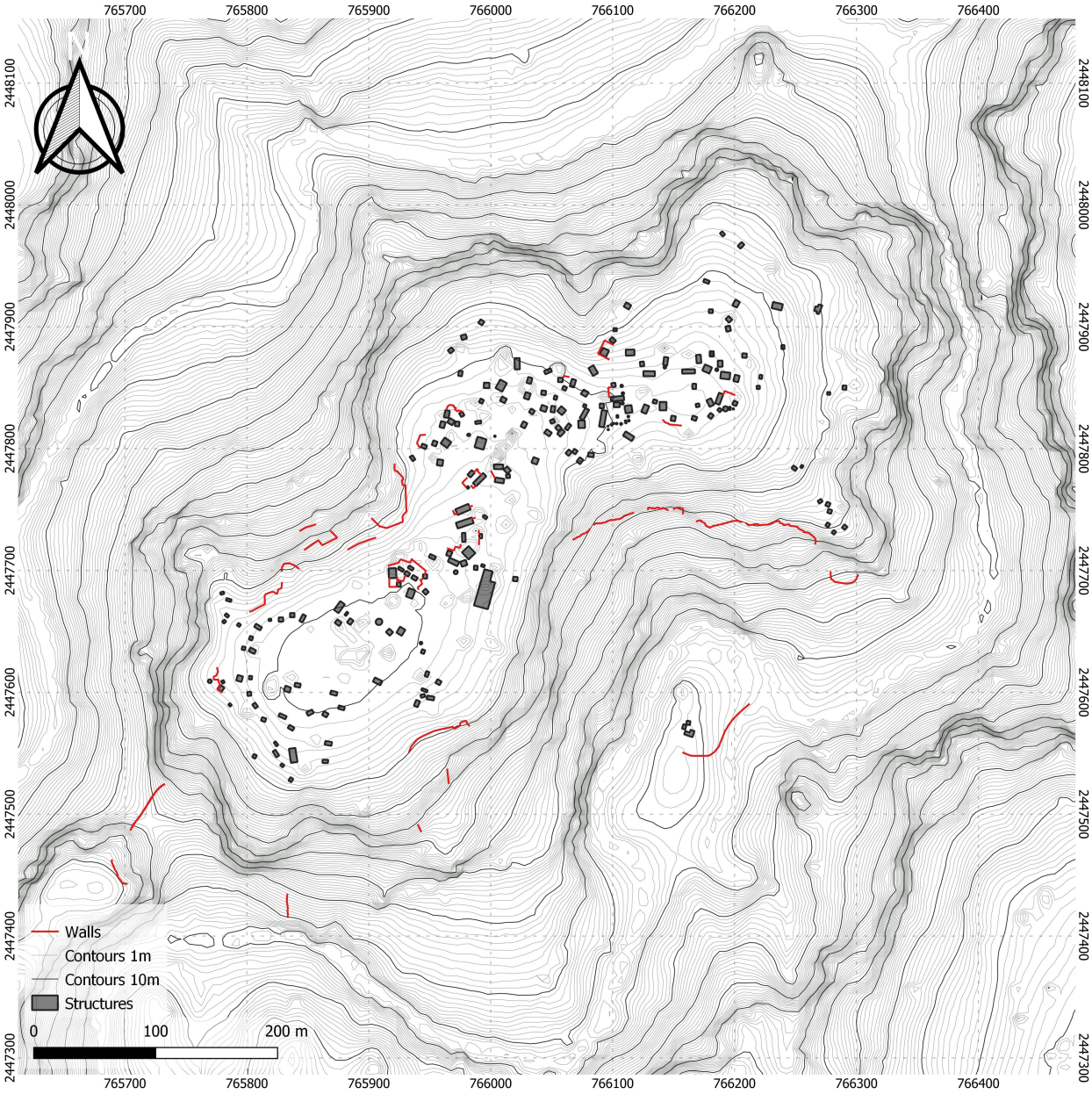


Figure 62. CDEM structure map (M. Dueñas).

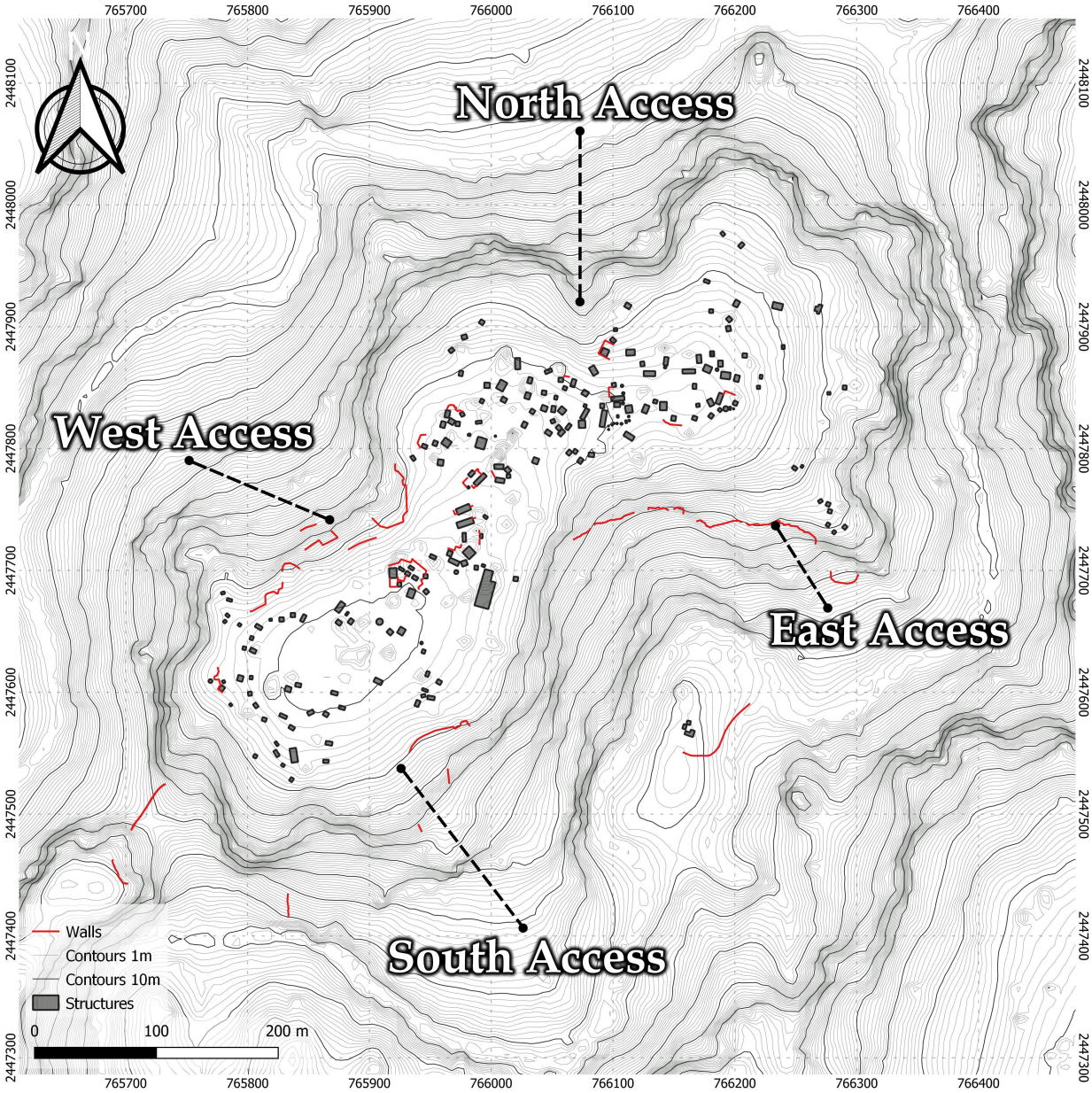


Figure 63. Map of access (M. Dueñas).

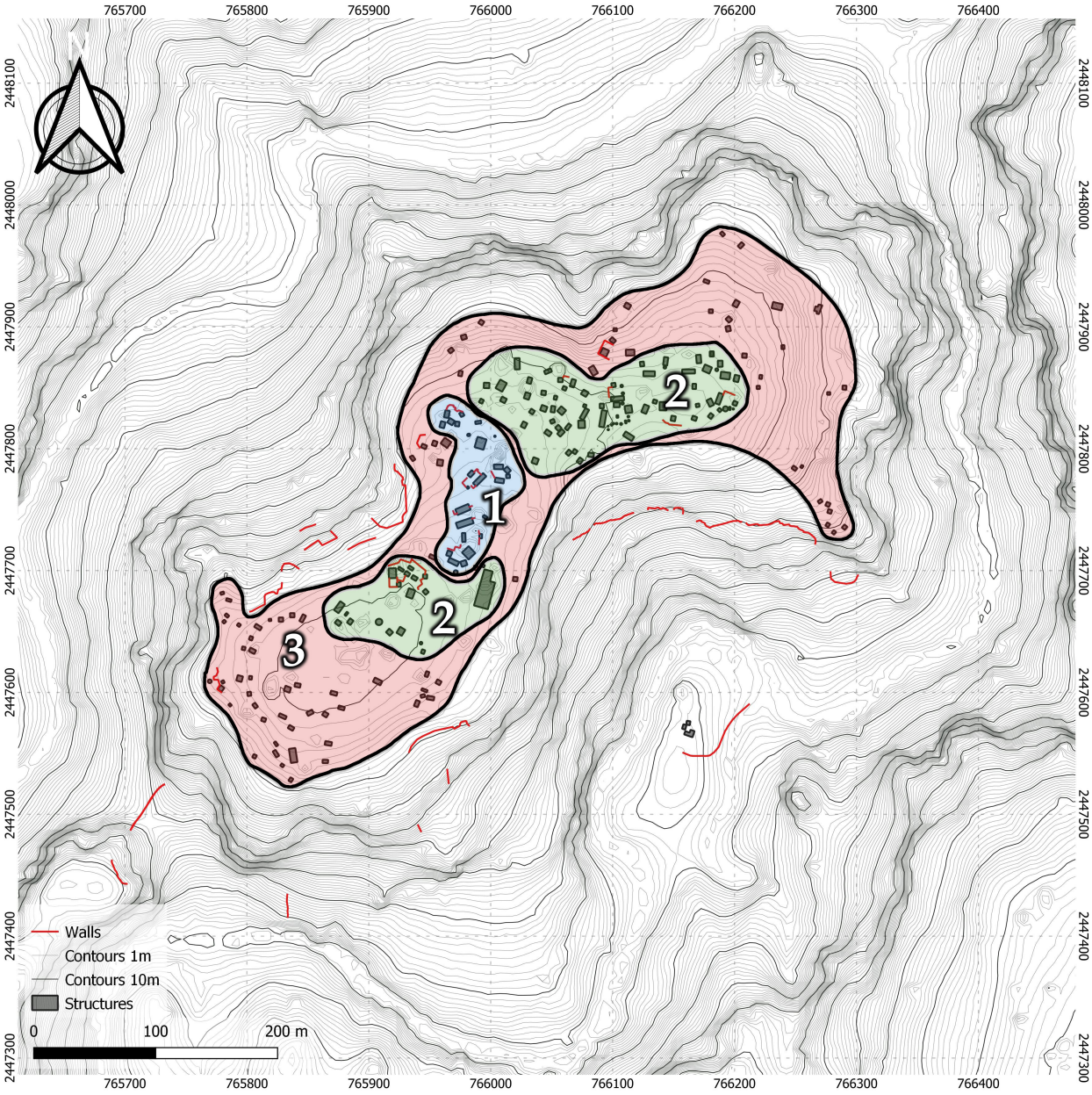


Figure 64. Map Sectors: Sector #1 Ceremonial center; Sectors #2 habitational spaces; Sector #3 peripheric structures (M. Dueñas).

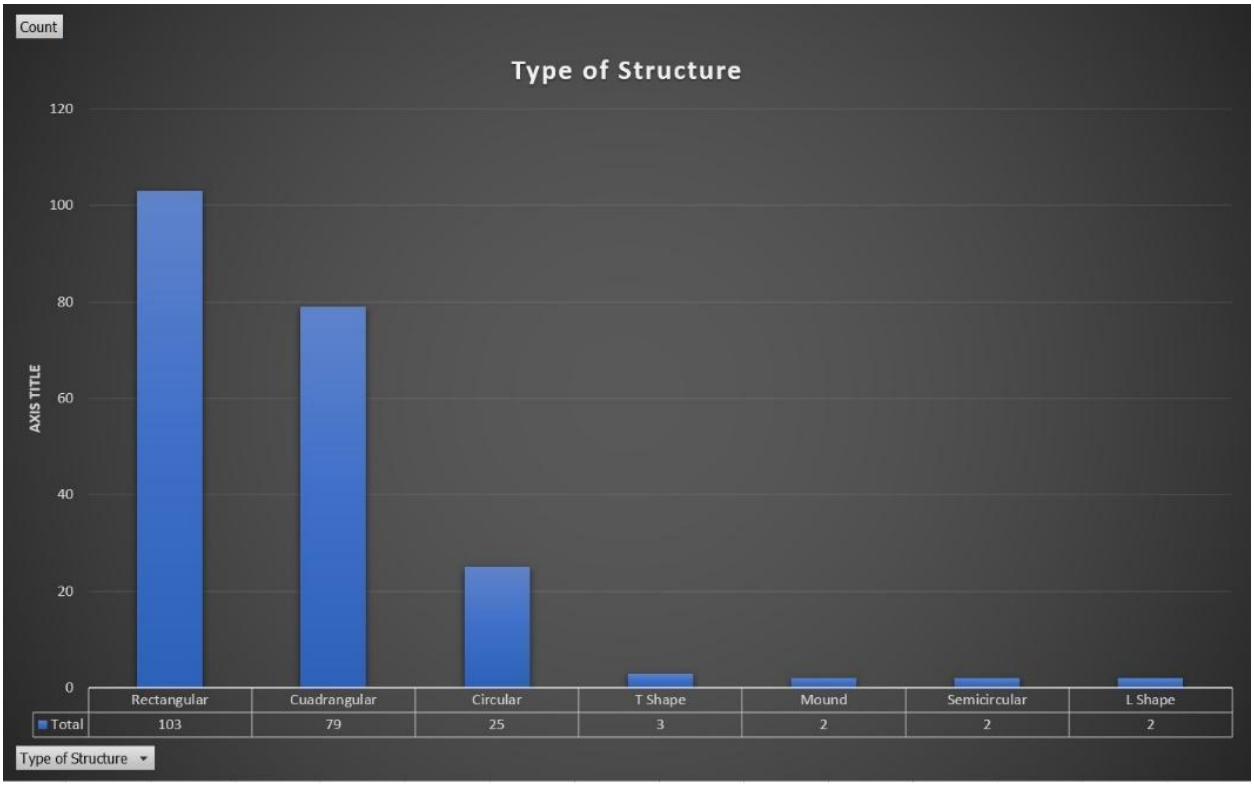


Figure 65. Structures.

No. Patio	Number of Structures	Floor plan	Axis Orientation	Mound	L Shape	Est. Rectangular	Est. Quadrangular	Est. Circular	Central Altar	Delimited by wall		Area patio m2
										S/N	Location	
1	5	Quadrangular	N-S	1		1	2	1		No		189.307617
2	6	Quadrangular	NE-SW			1	1	4		Yes	N	174.932007
3	16	Rectangular	N-S			1	3	11	1	No		370.828491
4	4	Quadrangular	N-S			1	1	2		Yes	W	99.2553711
5	4	Rectangular	N-S			2	1	1		No		188.007324
6	5	Rectangular	NE-SW			2	3			No		96.1906738
7	3	Rectangular	N-S			1	2			Yes	N	471.668701
8	4	Rectangular	E-W		1	1	3			Yes	NW	127.407349
9	4	Circular	E-W			2	2			Yes	W	77.630127
10	3	Rectangular	NE-SW			2	1			Yes	N-S	102.447998
11	3	Rectangular	N-S			3				Yes	E	229.695679
12	4	Circular	N-S			1	3			Yes	N	130.325684
13	6	Rectangular	NE-SW			4	2			Yes	N	458.457153
14	4	Rectangular	NE-SW			1	2		1	No		171.417969

Figure 66. Patios.

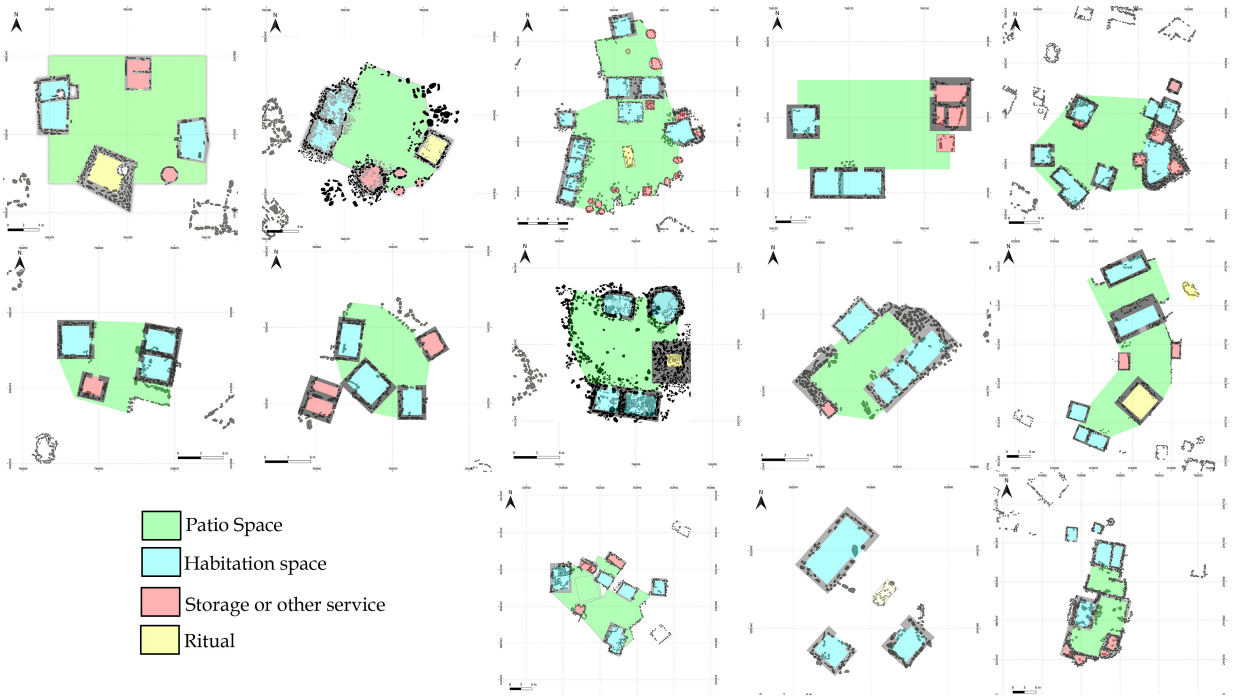


Figure 67. Collage of all patios (M. Dueñas)

The southern access is the most accessible and is controlled by a wall and a small complex of buildings next to the entrance of the site (Figure 68). Archaeologists have long believed that the Northern Frontier of Mesoamerica was a region characterized by fortified settlements and laden with unstable social organization. This belief was most likely promoted by the Spaniards' 16th-century accounts describing their conflict with the Caxcanes in the Juchipila canyon and neighboring areas (Santa María 1999; Weigand and Garcia de Weigand 1996).

The term used by the Spanish viceroy Antonio de Mendoza and other chroniclers to describe this defensive strategy was *empeñolarse* (to climb, fortify and make a stand on a hill). According to this tactic, the indigenous populations were entrenched on the steepest hills with available spring water or mesas with direct access to mountainous systems that allowed escaping, as needed (Yanez R. 2001).

However, the mischaracterization of the local indigenous cultures as barbaric and bellicose that permeates the 16th-century accounts had the long-lasting effect of influencing the archaeological interpretations of the Northern Frontier of Mesoamerica until the twentieth century. For example, archaeological studies focusing on the Rio Verde Grande basin in Western Mexico have identified settlement patterns at the top of mountains and foothills (Baus de Czitrom and Sanchez C. 1986; Lopez M. et al. 1994). They describe hilltop sites characterized by steep slopes and access to spring water sources. The harsh terrain providing access to these sites was often modified by constructing terraces, platforms, and possible defensive walls; all features were interpreted as typical of the violent Epi Classic period (Baus de Czitrom and Sanchez C. 1986). These settlement patterns in the Northern Frontier of Mesoamerica have been attributed to a defensive attitude due to their locations on top of hills or mesas, but most of the sites previously described as defensive in the Rio Verde Grande Basin region were just partially surveyed. Therefore, this project proposes another possible explanation in the conclusions section.

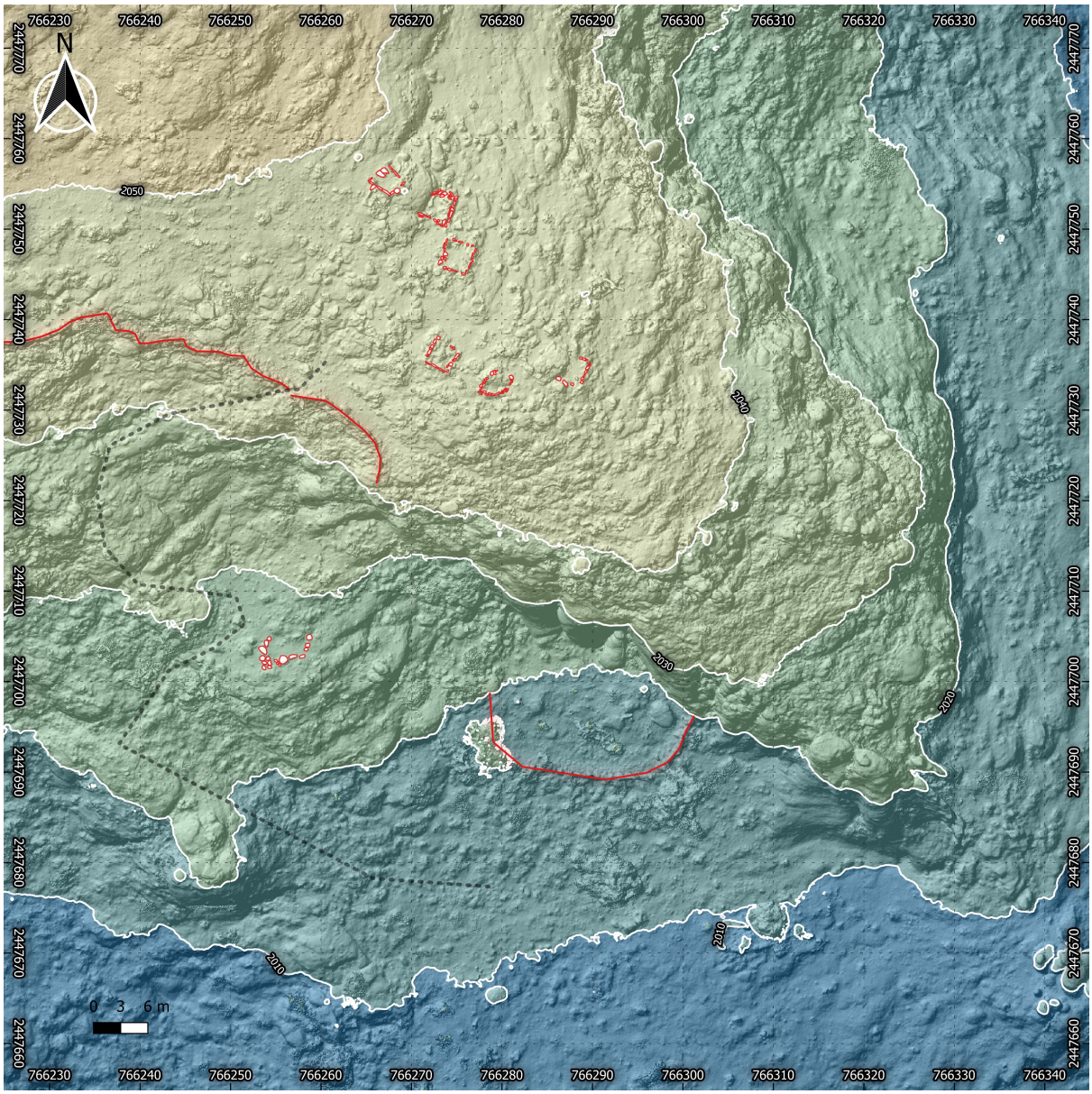


Figure 68. Southeast access Map. Dotted line is the actual path to access the site (M. Dueñas).

4.4.4 Building Classification Analysis

On the surface, surveys observed four basic construction patterns: square, rectangular, circular, and platforms. The square structures have two subtypes, named L-shape and T-shape, because they seemed to have one or two added small spaces, respectively. A set of unique structures have more complex irregular shapes. Further excavations are planned to classify these shapes.

To begin understanding the settlement configuration, using Qgis, the project calculated the areas of each structure. To analyze the information of the 215 structures, the sample was divided according to five natural breaks to observe the frequencies more clearly. We see a structure that stands out for size in the central part of the site, while the square structures have a consistent range in area between 24.1-29.6 m^2 and the rectangular structures are between 29.6-36 m^2 (Figure 69).

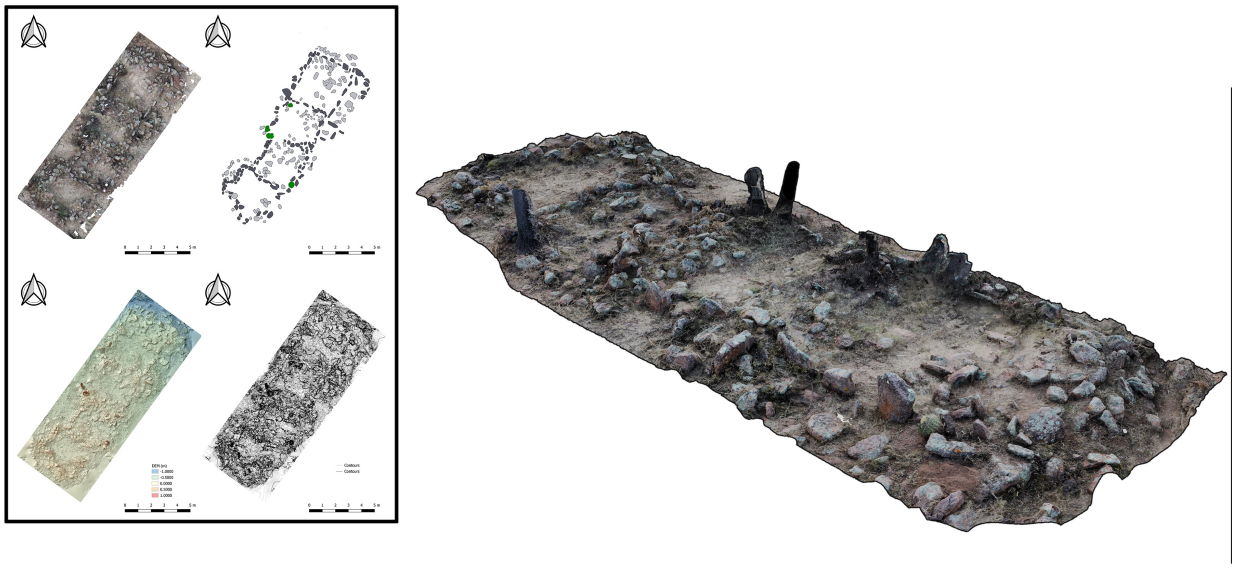


Figure 69. Example of rectangular structure documentation (M. Dueñas).

4.4.5 Demography

In recent years, analyses of population density and spatial distribution make up core issues on the development of societies. Having used ethnoarchaeology, in the case of Mesoamerican studies it has allowed obtaining flexible coefficients according to the characteristic factors of the study site (Blanton 1978; Clarke 1971; Cook 1972; Cook S. and Heizer 1968; Haviland 1969; Parsons 1968; Puleston 1973; Sanders 1962; Redfield and Villa Rojas 1934). In the Maya area, ethnographically populations tend be estimated based on 5-6 persons per structure (Casselbary 1974; Kolb 1985). Therefore, for CDEM this is the number per household structure used for the population estimate.

In most archaeological population estimates, not every structure is considered a dwelling. Out of 250 structures recorded in the CDEM survey, 166 were considered to be habitational. Round structures were eliminated from estimate because they were either ritual venues or were used for storage. Rectangular and quadrangular structures were classified as dwellings if they did not belong to a patio, because the eastern structure of patios seemed to have ritual or storage functions as well. To compute the population estimate, structures classified as residential (103 rectangular + 79 quadrangular – 16 quadrangular in patios), were multiplied by 5 according to the model of Casselbary (1974) and Kolb (1985), which renders a total of 830 people within the site (approximately 7 hectares or 7,000m^2) at its peak occupation.

In comparison, Santiago and la Montesita have around 150 similar housing structures identified on the surface, population with similar population sizes. El Ocote's demography is difficult to infer, because not many structures were detected on the surface. Although it appears to be the smallest site, the data obtained through archaeological excavations demonstrates that the site has all the elite markers (turquoise, seashells, salt, etc.) identified for the region during the Epiclassic (Jimenez B. 2020).

4.4.6 Excavations

The excavation objectives were to understand the construction systems and find evidence of lifeways, along with datable material (relative or absolute). We chose to excavate Patio #2, Patio #9 and a structure in Patio #12, covering three different spaces along with the site. Patio #2 is located north of the site, has previous surface records that will allow us to compare interpretations, and a square floor plan with little looting evidence (just a small hole in one of the structures was identified).

Patio #9 seems to be intact (showing no signs of looting), has a circular floor plan, and is located at the center of the site. Finally, Patio #12 is located at the southern part of the site, close to what could be a ballcourt, and, although we found some evidence of looting, most of the materials recovered on the surface come from this patio (Figure 70).

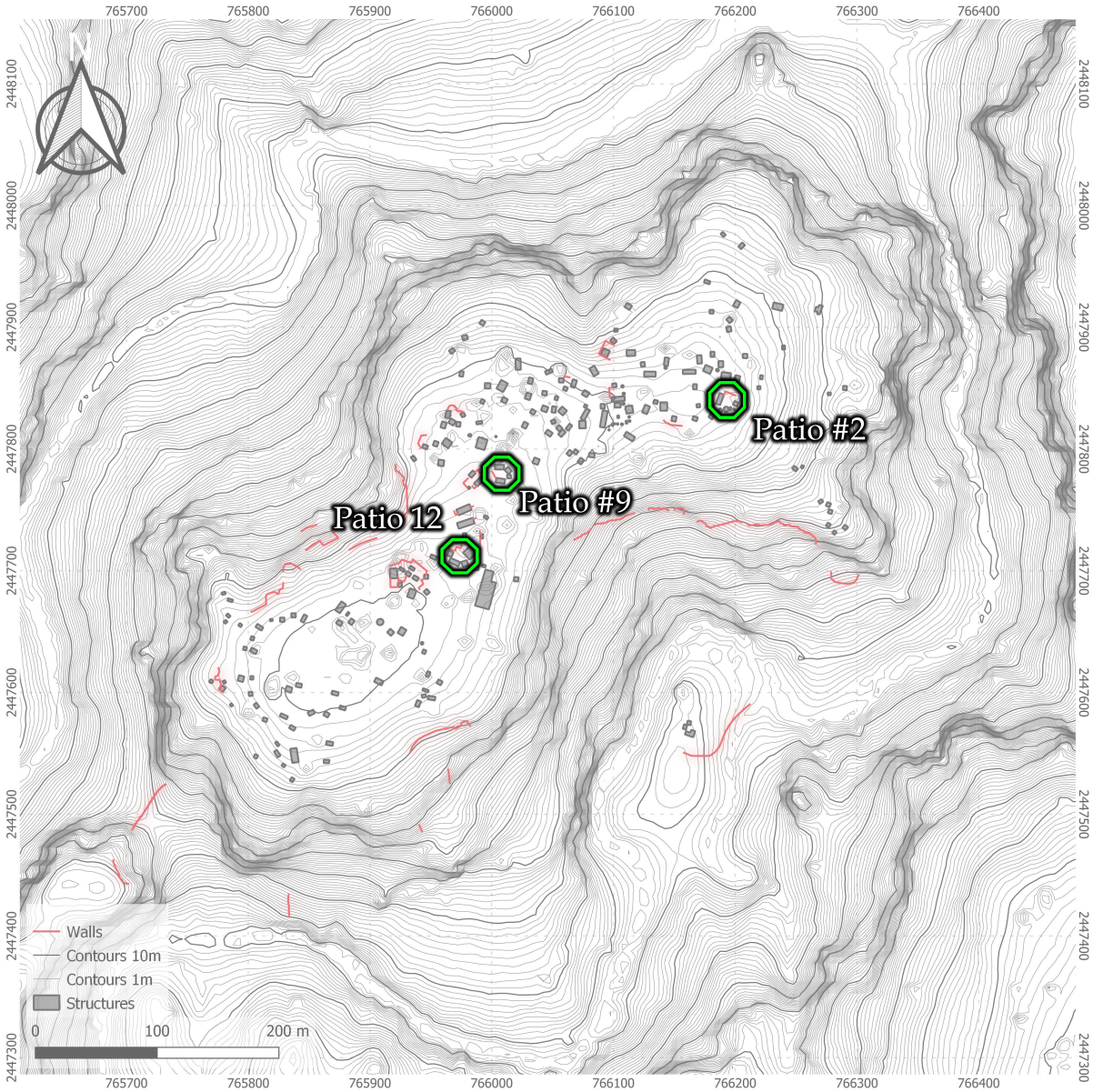


Figure 70. Excavations' location map (M. Dueñas).

The methodology and procedures by which the excavation documentation was conducted are detailed below. The basic recognition of strata during excavation is based on criteria that come from edaphology and sedimentology: depth, type of contact, structure, development, color, consistency, cementation, texture, skeletal characteristics, the existence of films, cracks or fissures, concretions, nodules, and spots, as well as the activities of animals. We employed the Harris Matrix, which is a method of stratigraphic description according to relationships with other strata and boundary contours, that is, on which the strata rest, or which interrupts them, associated materials, and relative chronology (Harris 1975, 1979; Harris et al. 1993).

Therefore, the value of excavations depends on the records generated during fieldwork and requires accurate retrieval of spatial information of the cultural property. Each excavation has its requirements for recording it, but in general, the visual record tries to recover and indicate all the artifacts' horizontal and vertical positions. We use field diaries, scale drawings, photographs, all-digital information, and the artifacts themselves to constitute the total record of the excavation.

Using Harris's methodology (1979), we define each trench as an ***operation***, and ***Stratigraphic Units*** (UE) will constitute each identifiable layer of cultural significance. The important thing is that the spatial, temporal, and cultural relationships are interpreted based on their materiality. The excavation is conducted extensively, that is, in an open area in the same stratum, following changes in stratigraphy to identify UEs. Each stratigraphic change will be recorded using photogrammetry, having a 3D detailed record of each unit. The edges of the strata must be defined with a precise line, forcing archaeologists to decide topological limits and their relationships with each other.

The contexts are numbered continuously, following the order of their survey as far as possible. The relationships between overlaps, cuts, fills, etc. are recorded using the Harris matrix. The plan is prioritized, that is, the horizontal drawing of the volume of the contexts with topographic heights individually, parallel to the registration card. However, the introduction of context planimetry requires considerable work expenditure because it increases the number of plans and thus the time needed for their documentation. It makes publication more difficult by multiplying the number of plans. The amount of information increases exponentially.

Photogrammetry has enough versatility to deal with horizontal and vertical planimetric documentation of both wide-open areas and irregular surfaces with abundant obstacles. Short-range photogrammetry offers a cost/hour ratio that saves time in excavation, is more accurate than manual drawing, and does not require highly specialized personnel. It allows all archaeological contexts to be individually documented, stopping the excavation work to the absolute minimum, and thus achieving substantial savings in working hours compared to the manual drawing. Therefore, the planimetry elaborated by photogrammetry completes our mixed Harris proposal when integrated with the identification card and the matrix.

Finally, to record the position of all materials found, the project used a total station to mark each of the archaeological materials, allowing reconstruction of the deposition patterns (Figure 71).

Figure 71. Excavation Workflow (M. Dueñas).

4.4.6.1 Excavations in Patio # 2

Patio #2 is in quadrant E4; it comprises four structures: #26 to the east, circular structure #25 to the southeast, structure #27 to the south, and structure # 29 to the west, while enclosed by a platform wall to the north. We conducted four operations corresponding to the interior of every building.

4.4.6.1.1 Operation #1

The grid was placed according to the orientation of the patio, with a deviation of 45° to the east. The grid covered the entire structure, having a dimension of 3x3 m, divided into quadrants of 1x1 m (Figure 72). This is structure #26, a quadrangular structure elevated 50 cm over the patio floor, flanking its east side. The vegetation was mainly grass and some bushes in the corners, with a yucca plant located in the interior located next to the south wall. After dividing the interior by a 1x1m grid, the quadrant with the yucca was rejected for excavation as equipment was not available to replant the yucca elsewhere.

This operation started with cleaning and profiling a small looting pit that served to explore the internal stratigraphy (Figure 73). This test pit was located at the southwestern corner of the structure, 25 cm deep, one meter long, and 80 cm wide.

After reaching bedrock at 46 cm from the surface in the test pit, excavators identified 10 EU (Excavation Units). Ordered in chronological order, over the bedrock (EU#10), EU#9 was a leveling fill of gray sand and clay. Immediately over it, EU#8 was a prepared surface where a cist rested (EU#7). Another fill of brownish clay was deposited over the cist (EU#5) and leveled

by a rammed floor (EU#4). On this surface, the foundation rocks were set (EU#6), where smaller rocks that corresponded to higher portions of the foundations were also identified (EU#3), and a layer of clay constituted adobe walls (EU#2). EU#1 corresponds to the humus layer at the surface (Figure 74).

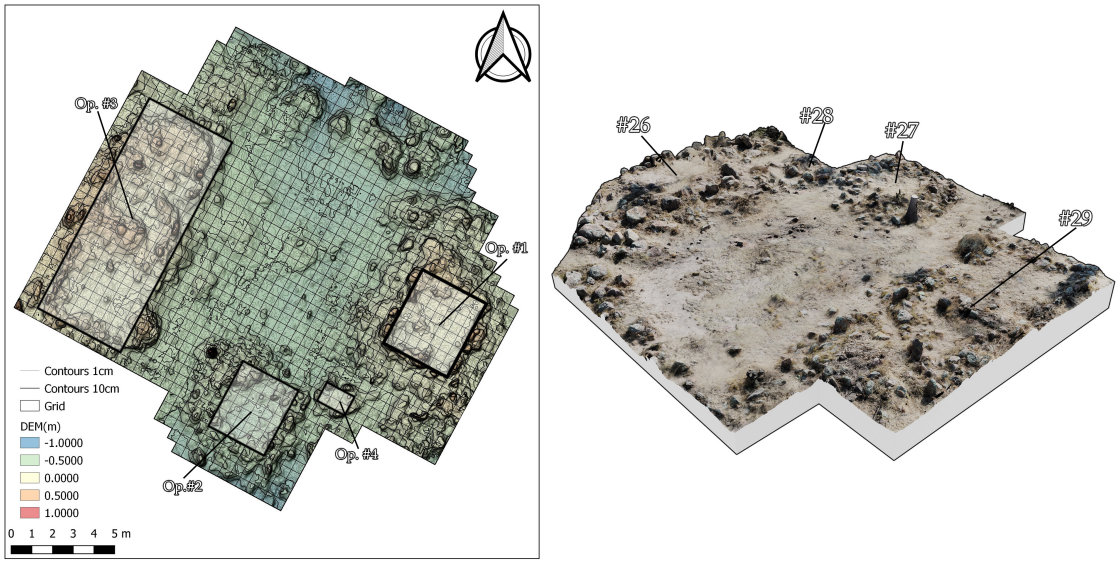


Figure 72. Grid operation #1 (M. Dueñas).

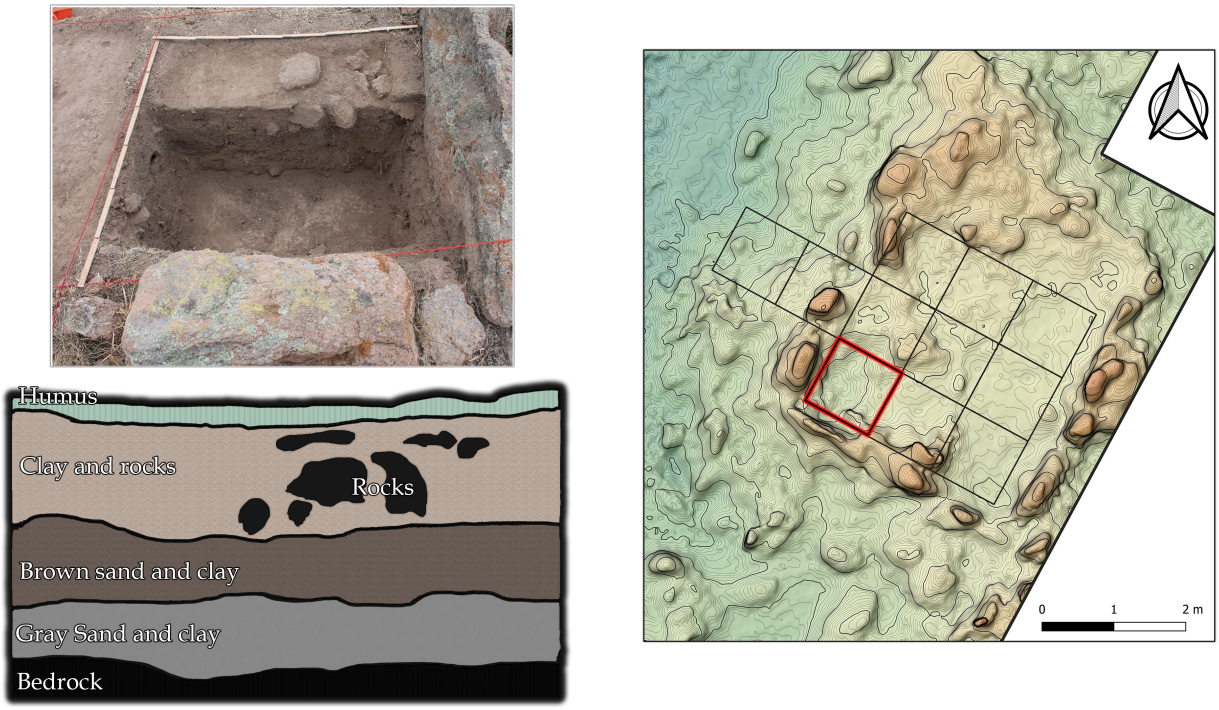


Figure 73. Stratigraphy test pit #1 (M. Dueñas).

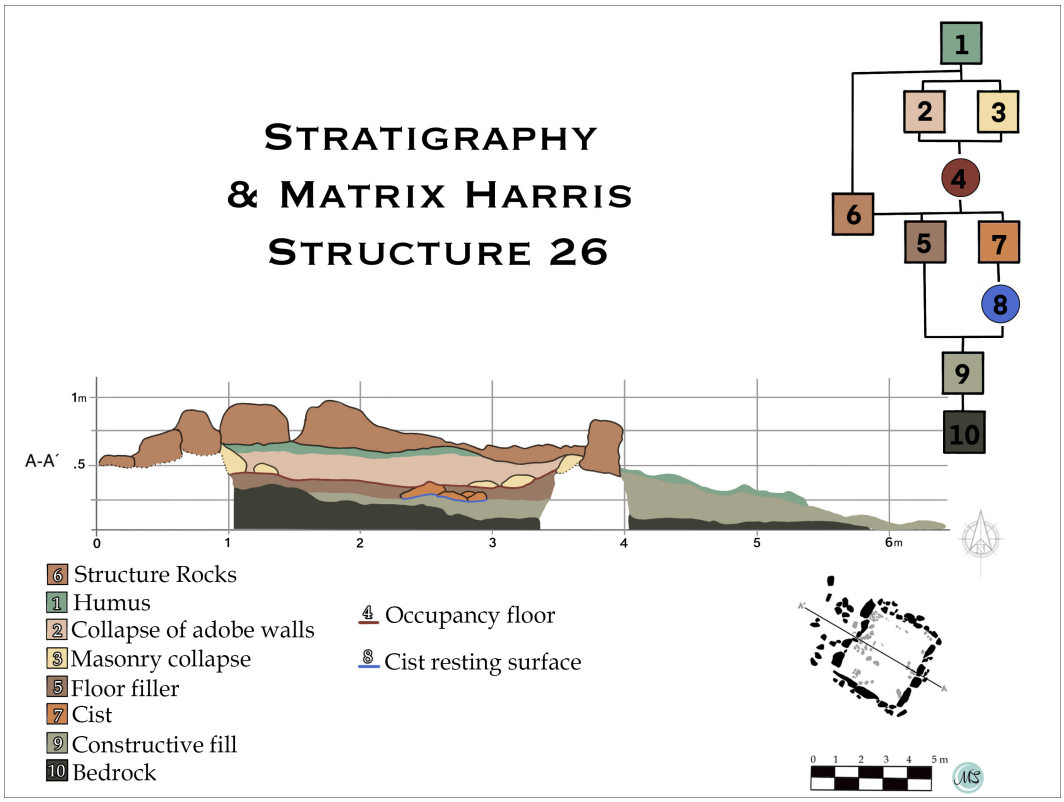


Figure 74. Operation 1 Harris Matrix (M. Campos and M. Dueñas).

The archaeological materials mainly consisted of the trash part of the fillers in walls and the landfill leveling. The ceramic shards measured consistently around 2x2 cm; knapping debitage was recovered and was of similar dimensions. Despite these small dimensions, many ceramic types and lithic raw materials were identified and will be discussed later in this chapter.

Over the grayish layer (EU#9), in the northeastern corner of the structure, artifacts were found, consisting of a mano, a silex knife, and only the rim and neck of a vessel (Figure 75). Finally, an approximation trench to the access of the structure revealed that the platform was built in one moment, piling rocks and mud to achieve the desired height (50 cm over the patio's floor).

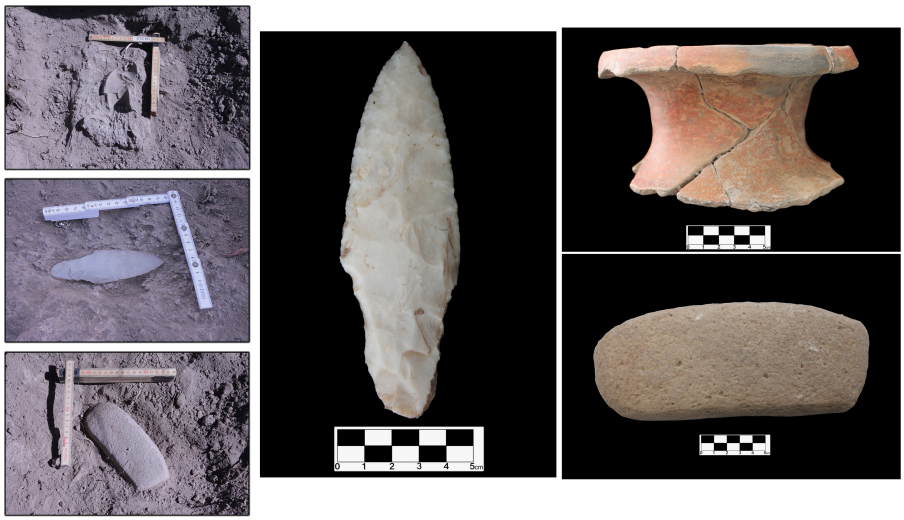


Figure 75. Photos of the offering (M. Dueñas).

4.4.6.1.2 Operation #2

This operation was undertaken at structure #27, located southwest of patio #2. Its dimensions are 4.3 m in longest diameter by 4.1 m in short diameter. During the survey, it was unclear if the floor plan was squared or circular since some of the walls had greater curvature than others, but the rubble surrounding the structure made this indistinguishable without an excavation. Understanding the floor plan shape became a particular objective for this operation.

The project extended a 3x3 m grid but could only excavate the inner 2x2 meters since the walls had a thickness of a meter (Figure 76). Despite this being the smallest excavation inside a habitation, the greatest concentration of ceramic materials of all operations were recovered in this patio. Some of the ceramics recovered were borders of vessels with a diameter of 40 cm, the largest recovered on the site.

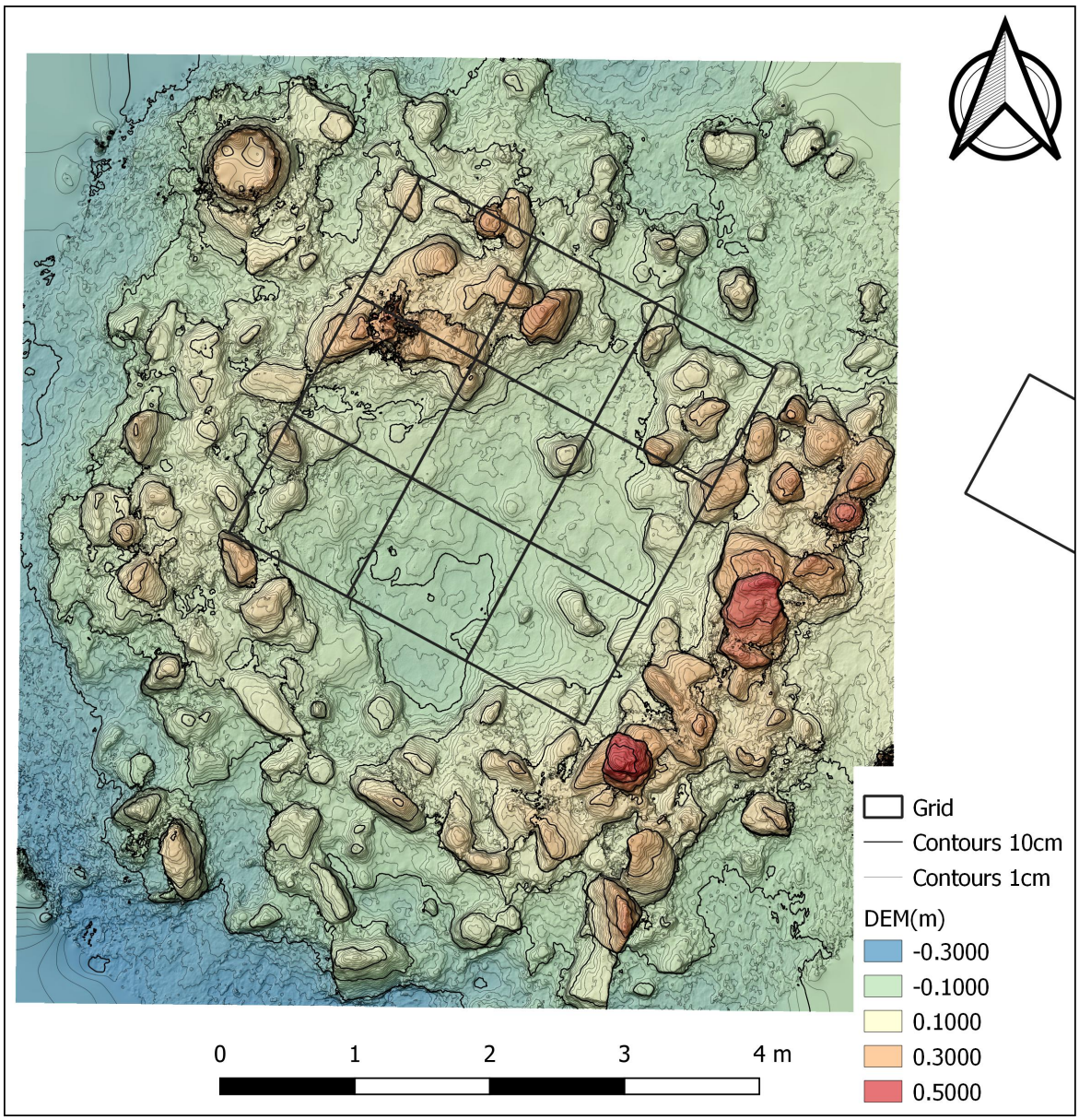


Figure 76. Structure 27 Survey plan and Grid operation #2 (by M. Dueñas).

The EU found was more straightforward since the bedrock (EU #7) is found at 20 cm in the deepest parts and 5 cm in the shallow parts. EU #6 was a thin grayish layer over the bedrock when foundations were collocated (EU#5). Immediately over it was the floor (EU #4), and over that lay a thin brown layer (EU #3) where some rocks from the walls (EU#2) were found, mixed with the ceramic and lithic materials. Over this, a humus layer extended to EU #1 (Figure 77). After removing all loose rocks, the floor plan was identified as circular, but the quantity of loose rocks suggested that the cobblestone foundations reached a considerable height, maybe over 50cm.

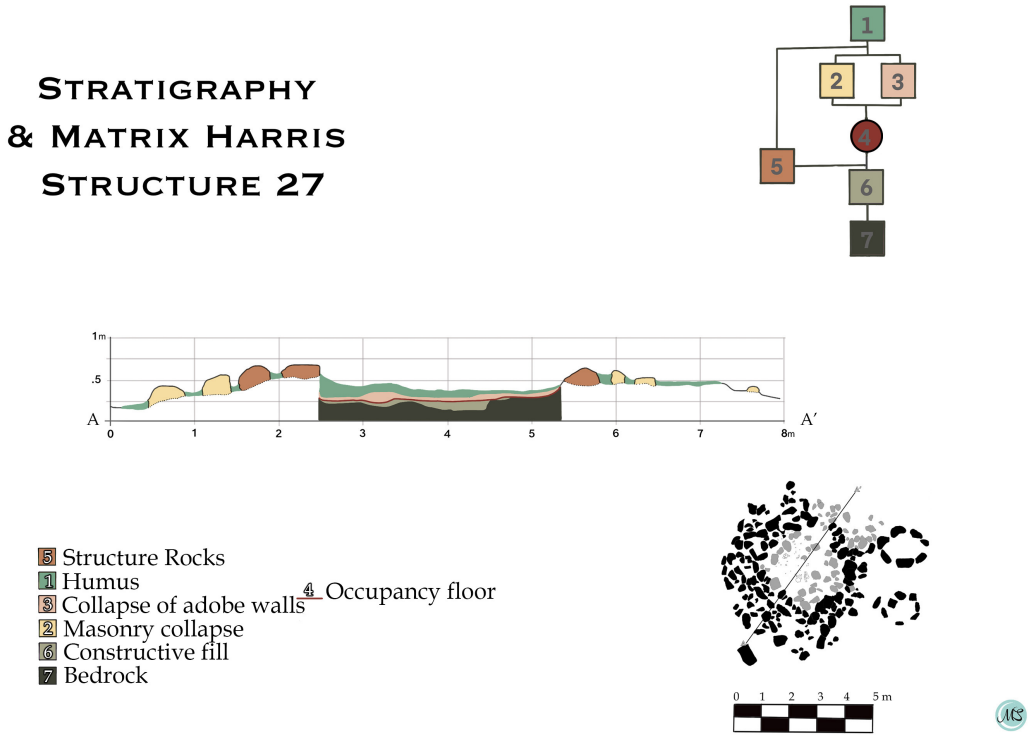


Figure 77. Operation 2 Harris Matrix (M. Campos and M. Dueñas).

4.4.6.1.3 Operation #3

Structure #29 of patio #2 has a rectangular floor plan, is the largest on the patio, and flanks its westside. The grid was mounted with an extension of 5x10 m, closely tight to the structure dimensions (Figure 78). On the surface, two rooms were identified, one to the north and the other to the south. Each one has an entrance from the patio separately. The south room is a little bigger than the northern one, measuring 4x5 m and 4x4 m. At the southern wall, we found an arrangement of rocks that could be the southern wall collapse or a feature of unknown use. The north wall was more complicated to define since it is connected to northern retaining walls that make the patio platform.

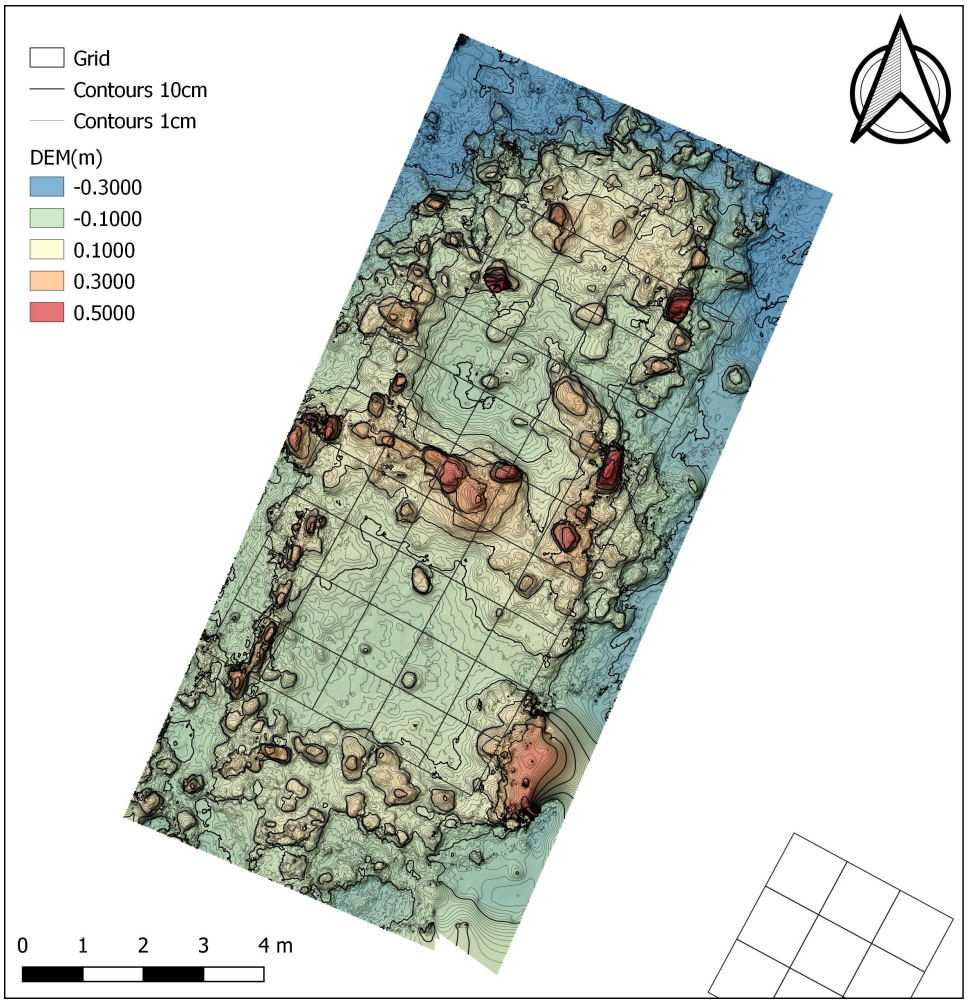


Figure 78. Grid operation #3 (M. Dueñas).

Excavation Units were defined in chronological order as follows: EU#8 corresponds to a fine grayish layer that seemed to be used to level the bedrock EU#10. In the north room, this small wall has a cist and a circular hearth (EU#7) over a prepared floor (EU#9) (Figure 79). Over them was EU#6, a brown clay fill material that becomes the rammed floor (EU#4) where rocks that formed walls fell over (EU#3). The foundation rocks (EU#5) were placed parallel to the floor fill, and finally, a humus layer (EU#1) formed over the masonry and adobe walls collapse (Figure 80).

Most of the materials recovered were knapping debris and small ceramic shards inside the fills, except for a couple of ceramic concentrations, one located at the northwest corner of the south room and another at the entrance of the same room. Like Operation #1, in the southern room, lithic material was deposited almost close to the rock bottom at the beginning of the construction, probably to commemorate this event. A pair of scrapers were recovered in the northeast corner. In the southeast corner, an obsidian projectile point was found. Additionally, the middle of the southern room contained prismatic blades that could be reassembled to a single flake (Figure 81).

Figure 79. Photo of structure #3 hearth (M. Dueñas).

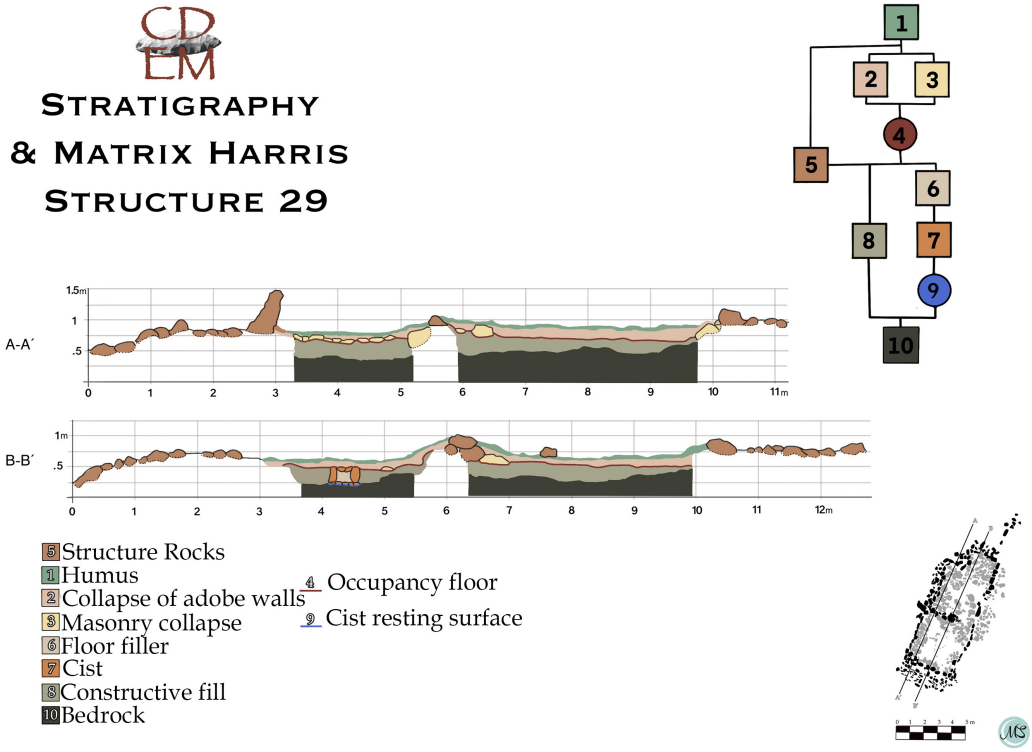


Figure 80. Operation 3 Harris Matrix (M. Campos and M. Dueñas).

Figure 81. Photos of lithic offerings from operation #3 (M. Dueñas).

4.4.6.1.4 Operation #4

Operation #4 was carried out on structure #25, a set of rocks arranged in a circular shape between structures #27 and #26. From survey records, these kinds of elements were noted to be of crucial importance to understanding the site's lifeways since the principal hypothesis is that those structures were grain silos made of clay or adobe. Alternative hypotheses to test on these circular structures were that they served as firepits or burial structures (Figure 82). The element still has seven rocks standing, filled with other small rocks.

EU #5 was a fill layer of grayish sand over the bedrock (EU #6). Above that in, EU #3 was a bed of flat river rocks. Moreover, brown clay was found over that (EU #2). The rock foundations were located alongside this laye (EU #4). Over it, a layer of humus grew, which is the current surface (EU #1).

No fire signs were detected, nor was any bone found, making the fireplace or burial hypothesis very unlikely. Very few ceramic materials were found, among which some beads for a small bracelet were the most significant.

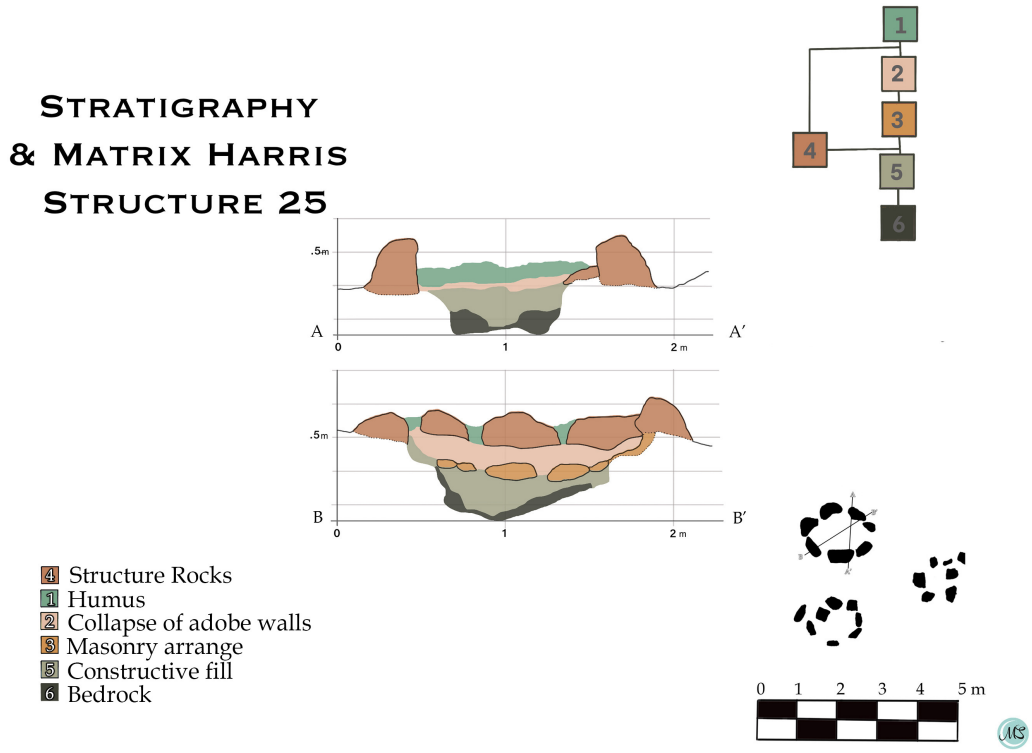


Figure 82. Operation 4 Harris Matrix (M. Campos and M. Dueñas).

4.4.6.2 Excavations in Patio # 9

Patio #9 is in the central area of the settlement (quadrants D3-C4), as part of a complex including another two architectural features surrounding a central platform. This set of structures has been named the settlement's ceremonial center due to the public ritual use that these spaces could have had (Figure 83).

The floor plan of patio #9 was characterized in 2012 as circular, so it became a particular objective to confirm this characterization that, combined with its central location, make it an excellent candidate to be the oldest part of the site. Excavators created a 1x1 m grid oriented to the north, over the whole patio, which is made up of four structures that were numbered from 152 to 155 following the previous ground- truthing survey. After removing all dead flora and cutting short grass, the access to the patio became evident. Northwest, southwest, and even southeast had stone steps, while the east access was naturally leveled to the surrounding space. It also became clear that the structures were built on a platform. This platform only presents a retaining wall to the west, towards the central platform of the ceremonial center (Figure 84).

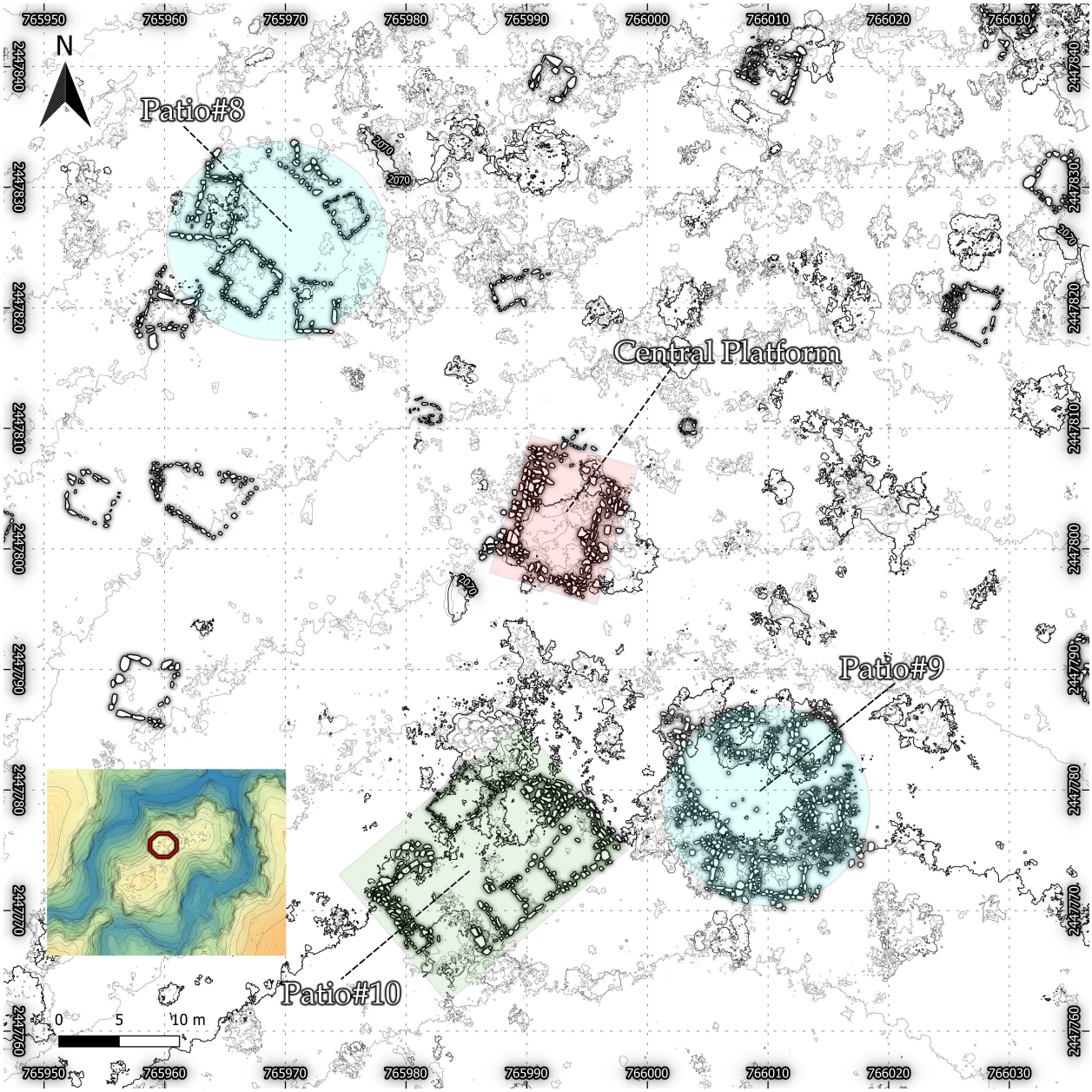


Figure 83. Location map Patio #9 (M. Dueñas).

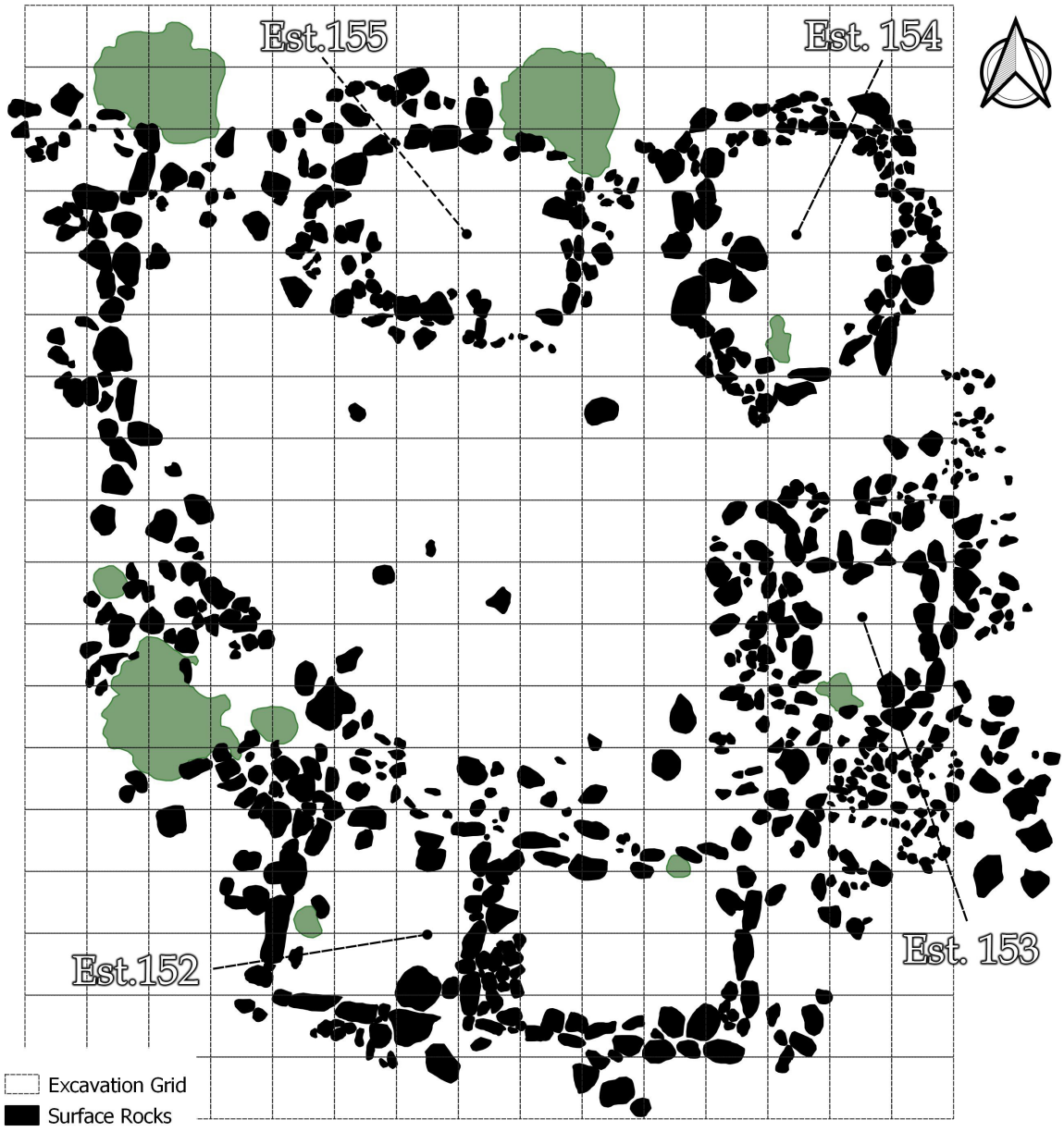


Figure 84. General map of Patio #9 (M. Dueñas).

4.4.6.2.1 Operation #5

Structure #155 delimits the patio to the north, measures approximately 12 m, and has a rectangular plan, although its northwest corner appears to be rounded (Figure 85). The foundation stones were arranged similarly to the patio #2 construction systems, but some differences were found. In chronological order, EU #8 consisted of a filler layer platform of

rocks, some sorted to create a surface (EU#9). A cist made up of 4 slabs of 40x40 cm (EU#7) was found in the middle of the structure. It was filled with brownish clay (EU #6), a set of flakes, and a tooth. The foundation rocks were placed (EU#5). Over the stone pavement, a layer of loose rocks and brownish clay (EU #3 and EU#2 respectively) were part of the walls and foundations. Finally, over this last layer, humus grew, and it is the current surface (EU #1) (Figure 86). The ceramic sherds measured consistently, as in previous cases, around 2x2 cm; Knapping residuals were recovered and measured similarly.

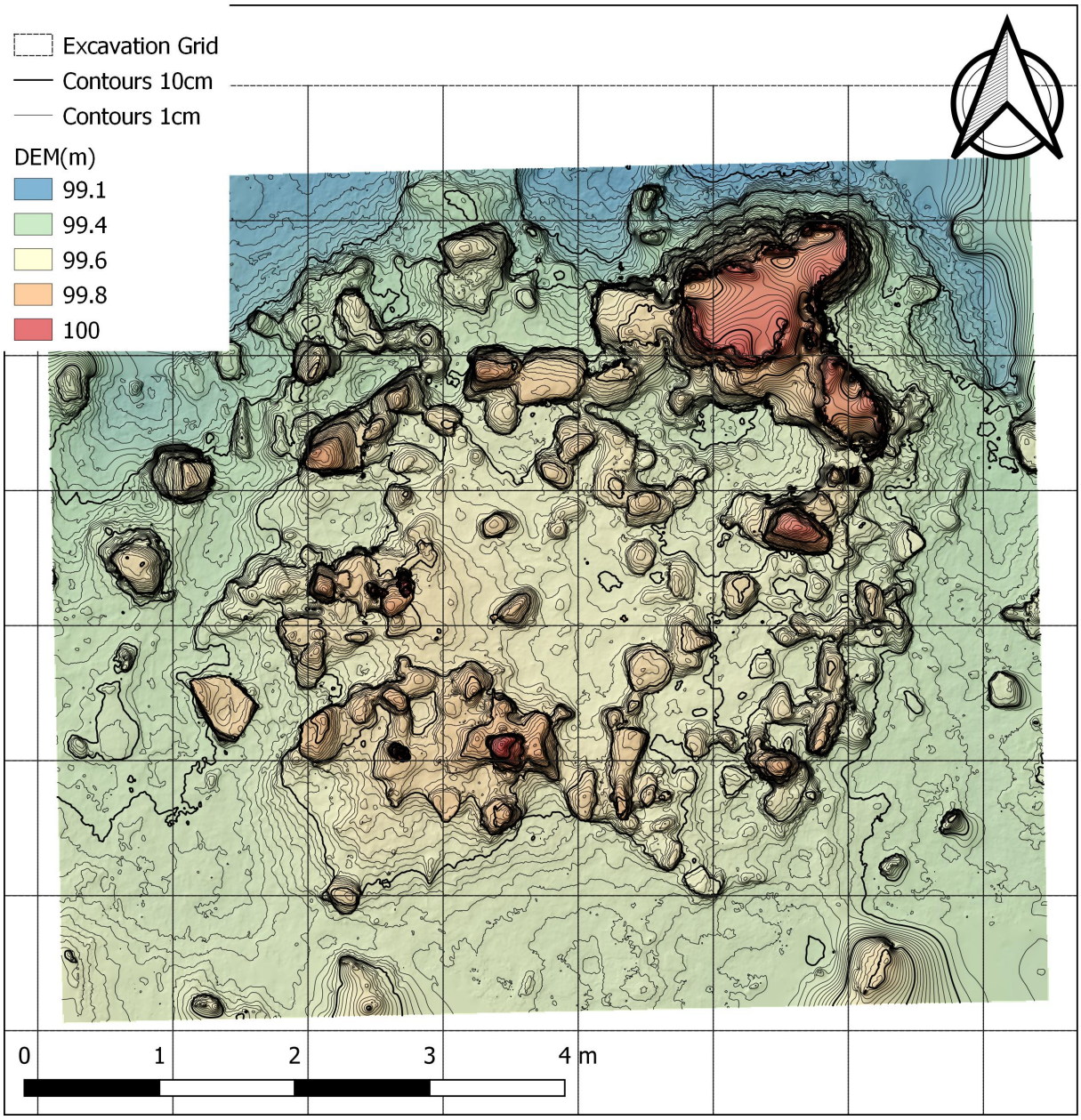


Figure 85. Surface structure #155 drawing (M. Dueñas).

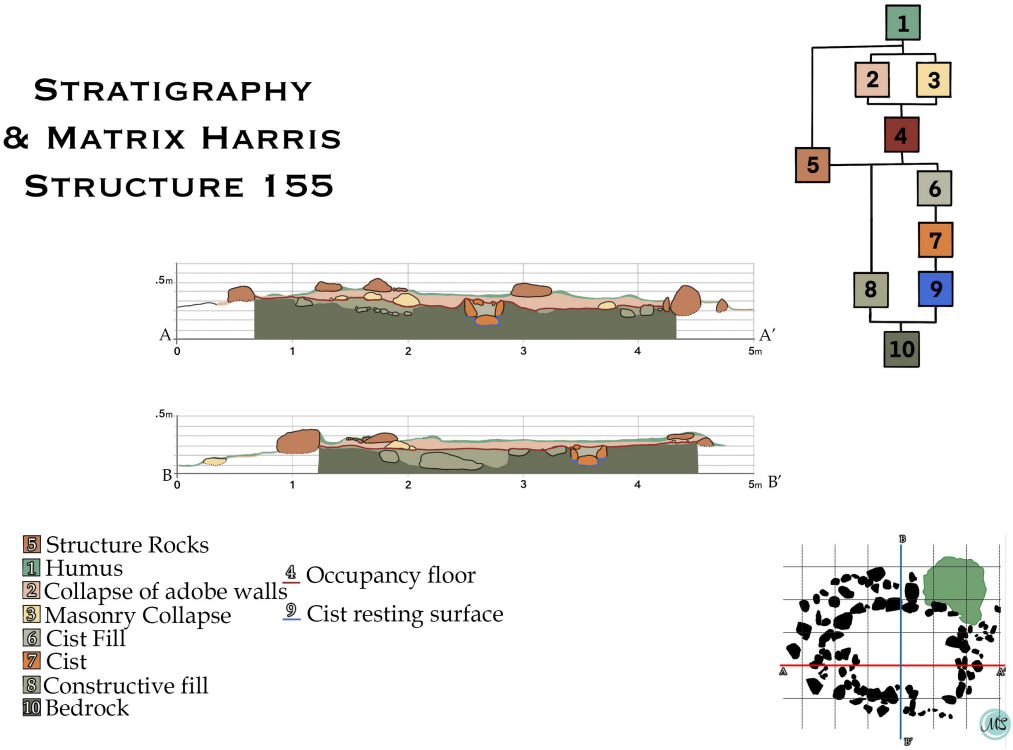


Figure 86. Operation 5 Harris Matrix (M. Campos and M. Dueñas).

4.4.6.2.2 Operation #6

Structure #154 is located east of #155, separated by a small corridor (Figure 87). The structure floor plan is complex since it is circular but has a marked entrance. EU #6 was a fine grayish layer over a shallow rock bottom (EU#3) found at 10 cm. The foundations (EU #5) were collocated directly over bedrock. A couple of steps were found at the entrance, revealing where the floor stood (EU#4). The entire quadrant was disturbed by nopal roots that grew right in the middle of the entrance. At that level, rock material was found (EU#2). Finally, a layer of humus marks the current surface (EU#1) (Figure 88).

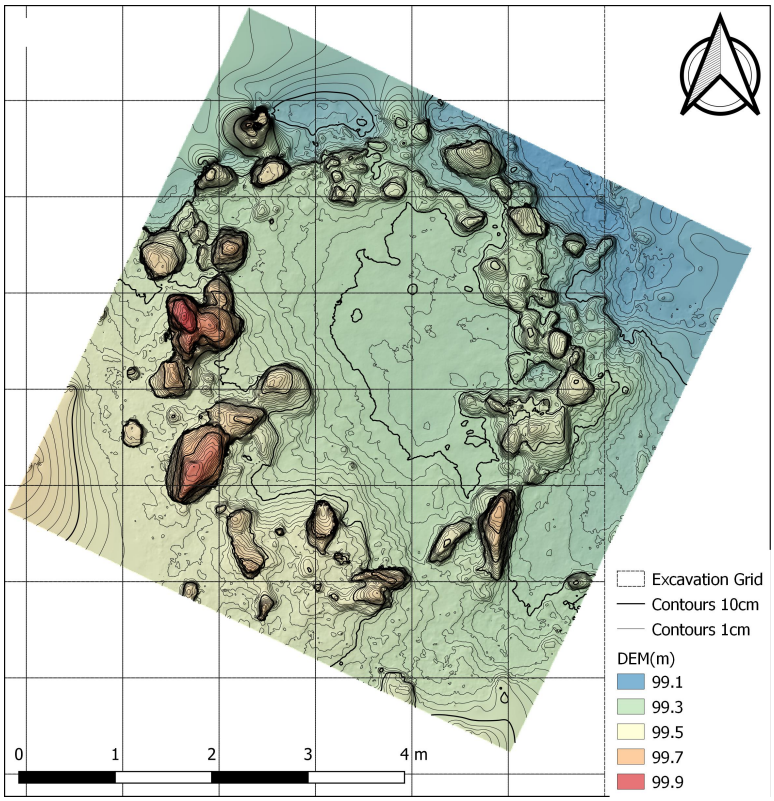


Figure 87. Surface Structure #154 (M. Dueñas).

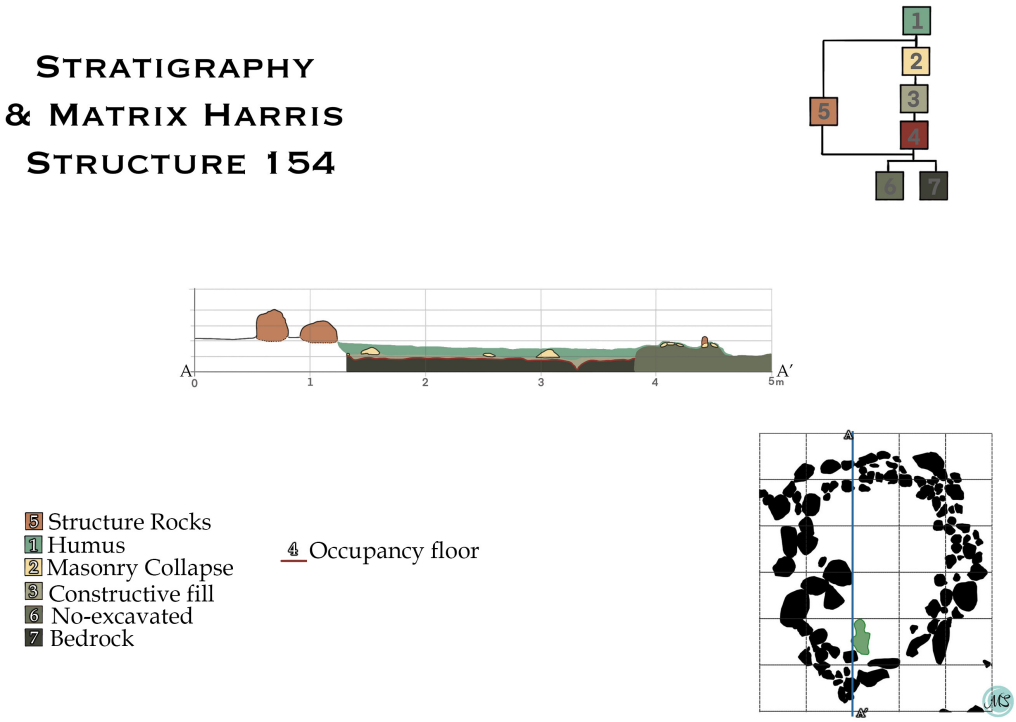


Figure 88. Operation 6 Harris Matrix (M. Campos and M. Dueñas).

4.4.6.2.3 Operation #7

This structure flanks the patio to the east over a 40 cm high platform at approximately the patio's floor level. The structure measures 2x2 m, and its foundations were arranged in the same way as the other structures, that is, stones between 20 and 40 cm high, so the construction system was identical (Figure 89). EU#4 was a rock fill. Some of those rocks were reused, as we found a metate and some other worked stones. For this reason, during the excavations, it was difficult to discern where the occupancy floor might have been, so it was designated as a thin layer of the brownish rammed floor over the rock fill (EU#3). Alongside the floor, the foundation stones for the small structure were set (EU#2), where humus grew EU#1. Due to time limitations, excavators could not explore the structure more extensively, but the use of recycled stone material suggested that this structure was constructed at a different time than others on the patio or that there are older patios on the site that are yet to be found (Figure 90).

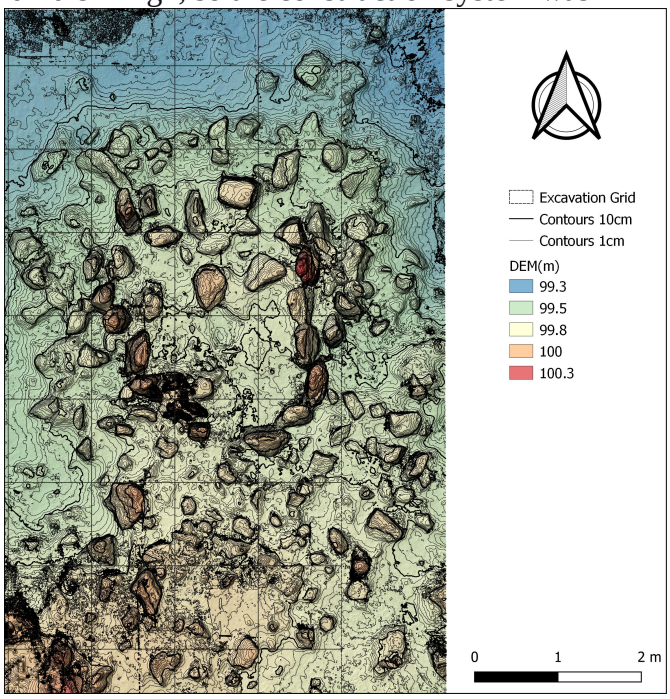


Figure 89. Surface Structure #153 (M. Dueñas).

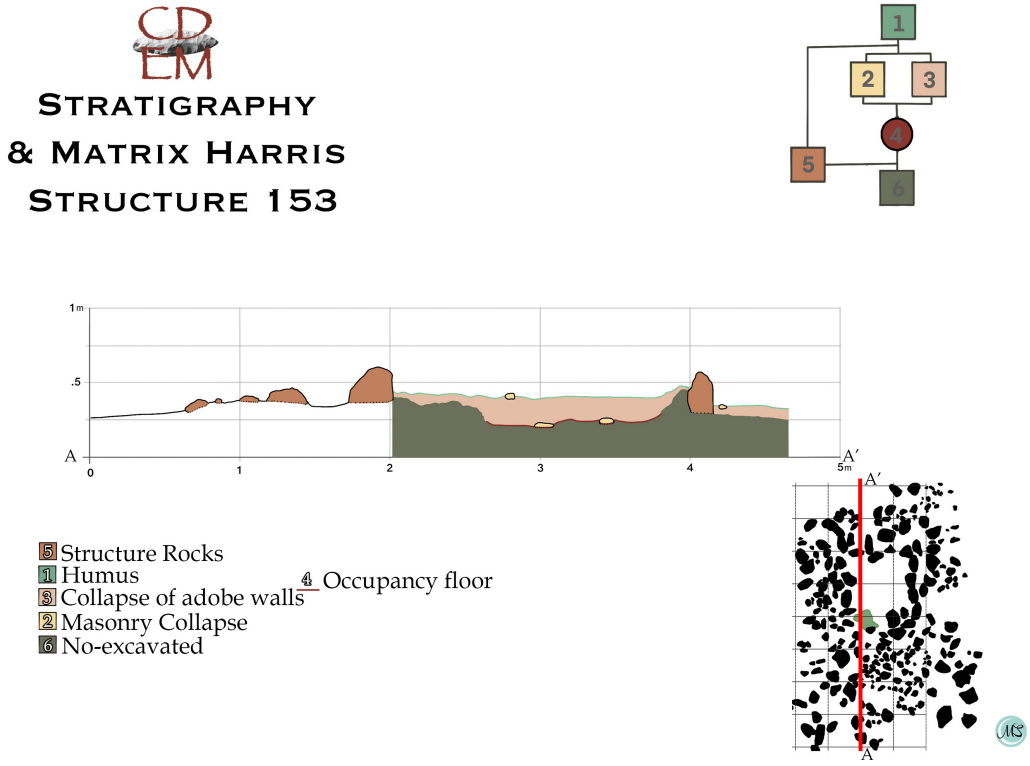


Figure 90. Operation 7 Harris Matrix (M. Campos and M. Dueñas).

4.4.6.2.4 Operation #8

Finally, operation #8 corresponds to structure #152, a rectangular-shaped structure with two rooms. This structure appears elevated from the patio over a platform that extends from structure #153, separating these two structures by a corridor with steps attached to the platform that gives access to the patio (Figure 91). We explored this structure only to the floor level due to the lack of time and the complexity of the floor itself. The floor in the east room consists of stone slabs arranged on their edges (EU#4). The west room has a rammed floor (EU#3) and a square element attached to the wall that separates both rooms (EU#2), consisting of small rocks that could be a hearth. Over the floors of both rooms, a humus layer (EU#1) was found (Figure 92).

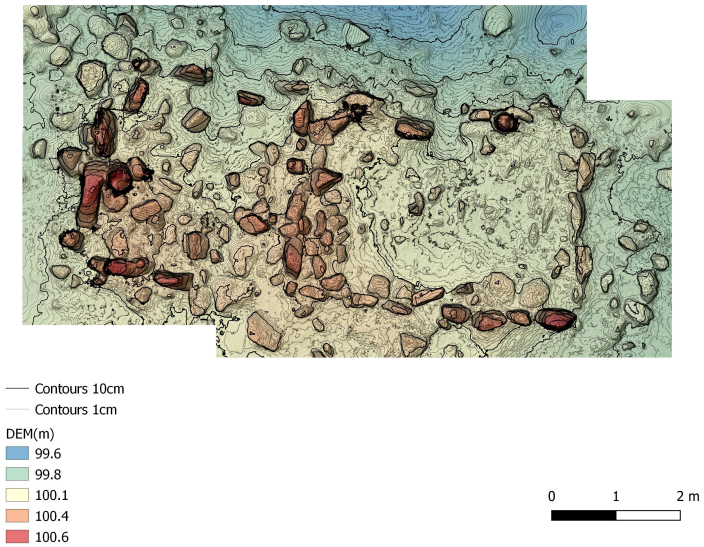


Figure 91. Surface Structure #152 (M. Dueñas).

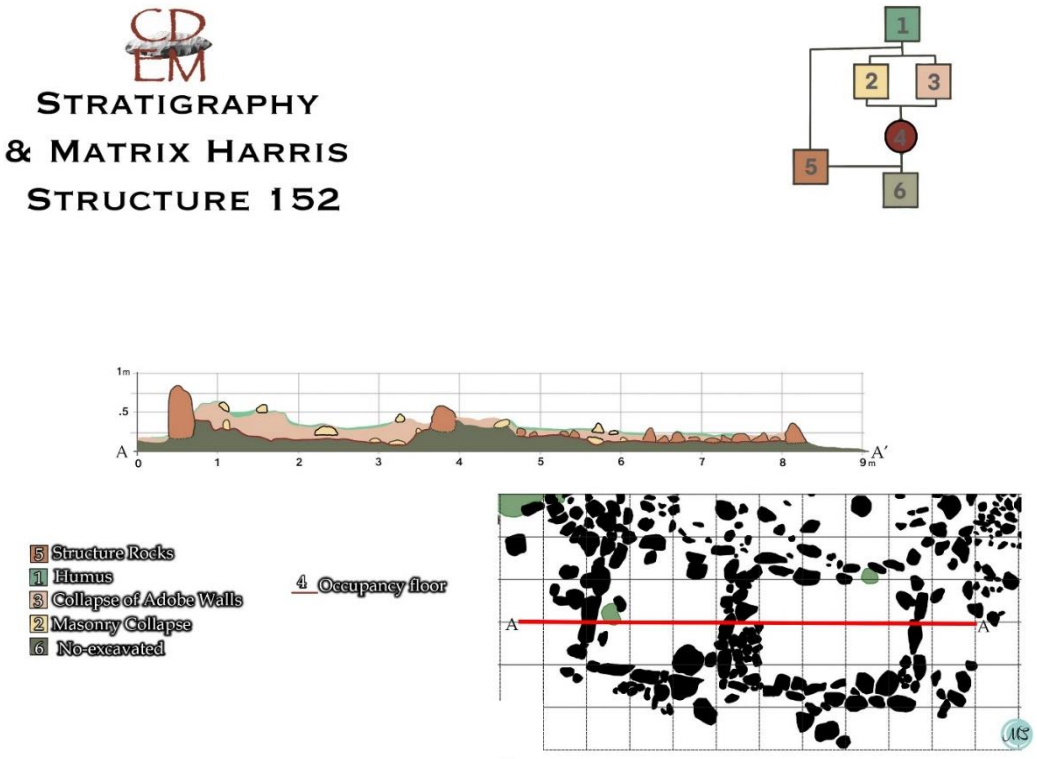


Figure 92. Operation #8 Harris Matrix. (M. Campos and M. Dueñas).

4.4.6.3 Excavations on Patio #12

Located in quadrant C3, Patio #12 is at the south-central part of the site (Figure 93). It is composed of structure #175, closing the patio from the north, and is one of the most prominent structures of the site (8.3x7.7 m) but is disturbed by a colossal yuca; this structure connects patio #12 with patio #11 since it is closing its open space by the south; Structure #176 is a squared structure west of patio #12. Structure #177 is a rectangular construction with two-room south of the patio, the only one that we could explore through excavations. Finally, and through the closer exploration of structure #177, structure #213 was detected, which is also a square construction (Figure 94). Ceramic materials were recovered associated with structure #175. Of particular importance among these was a fragmented tablet, whose importance was stated in the previous chapter.

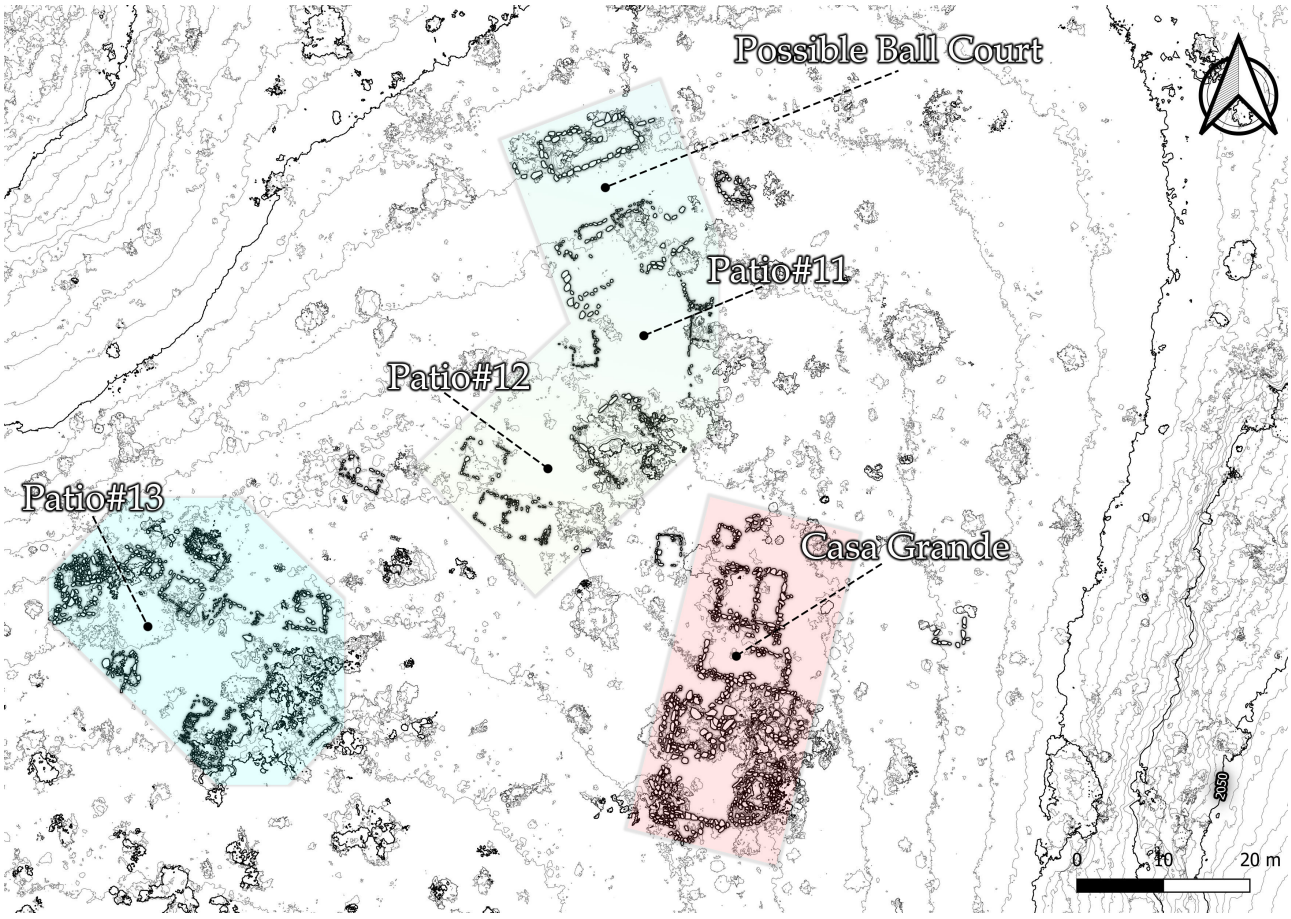


Figure 93. Location of patio #12. (M. Dueñas).

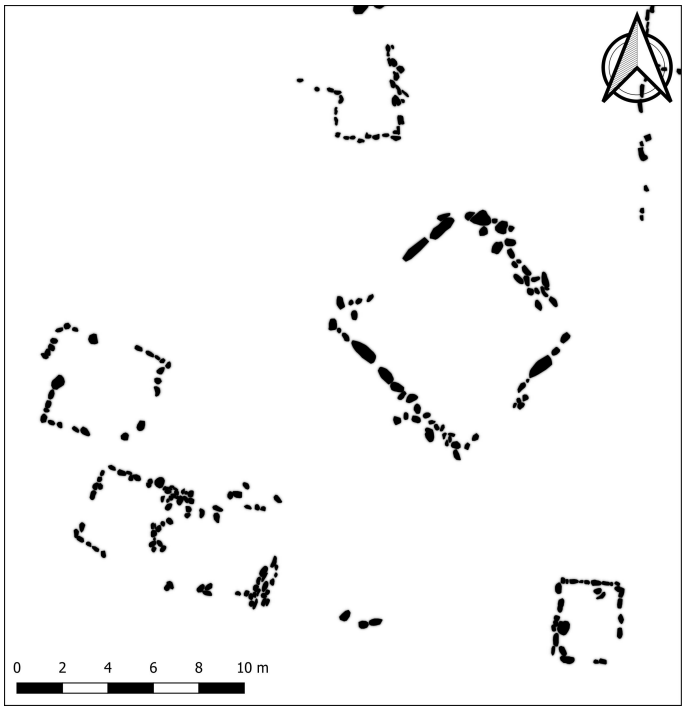


Figure 94. General map of Patio#12 (M. Dueñas).

4.4.6.3.1 Operation #9

Structure #177 is a rectangular structure that measures 8.5x3.5 m. It contains two rooms with entrances facing the open space of the patio (figure 95). EU #6 is similarly a rockfill in the east room that becomes a cobblestone pavement (EU#5) for a floor. Aligned with the entrance of the east room, a cist was found (EU#4), filled with brownish clay material, the same material found in the rest of the room (EU#3). At this level, the foundation rocks were collocated (EU#2), and over EU#3, a layer of humus was formed (EU#1) (Figure 96).

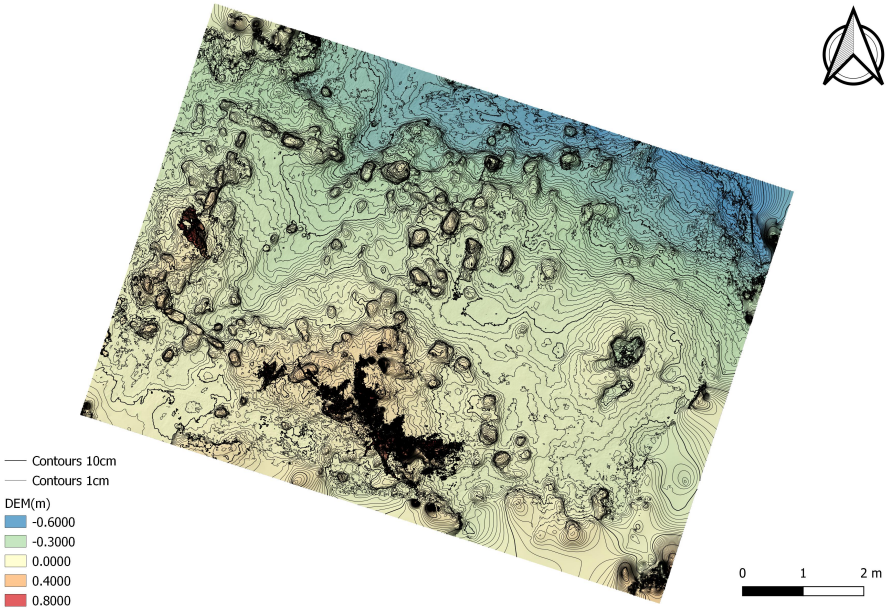


Figure 95. Surface Structure #177 (M. Dueñas).

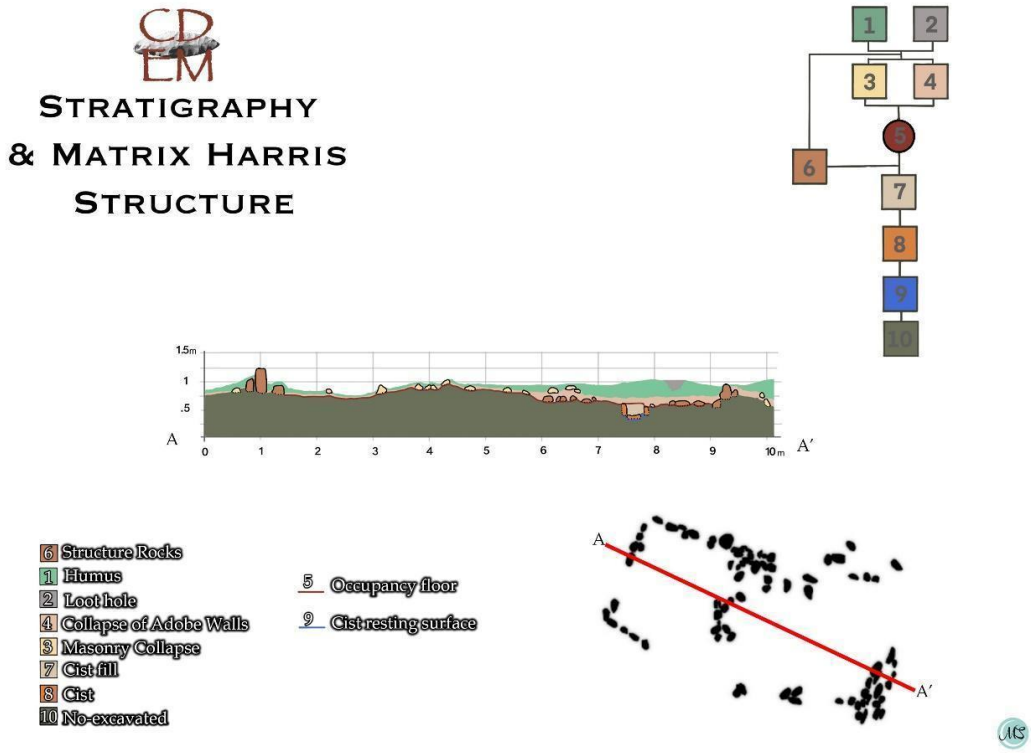


Figure 96. Operation #9 Harris Matrix (M. Campos and M. Dueñas).

4.4.7 Analysis of Archaeological Artifacts

Throughout the explorations carried out on CDEM, 3368 archaeological materials were recovered, including 2373 ceramic sherds and 995 lithic pieces. So far, only one human tooth has been found, and no animal bones have been found in the excavation. We think this is mainly because of contexts. Since we have been concentrated on the interior of constructions, architectonical fills, and platforms, we think they could be found if we dig a garbage concentration or a context of ritual significance. Some cow bones have been found on the surface, still to this day. The land is currently used for bovine pastoralism, which leaves cattle scattered in the wild where they can feed and water themselves, and owners only pay weekly or even monthly visits to see how they are doing.

Due to this pastoral activity, locals constantly visit the site, rendering unfruitful any systematic samplings. Nevertheless, we recovered 226 materials during the surface surveys, mostly small lithic tools. The association level for most materials goes per structure, although some materials were recovered in the lower parts of the mesa (Figure 97).

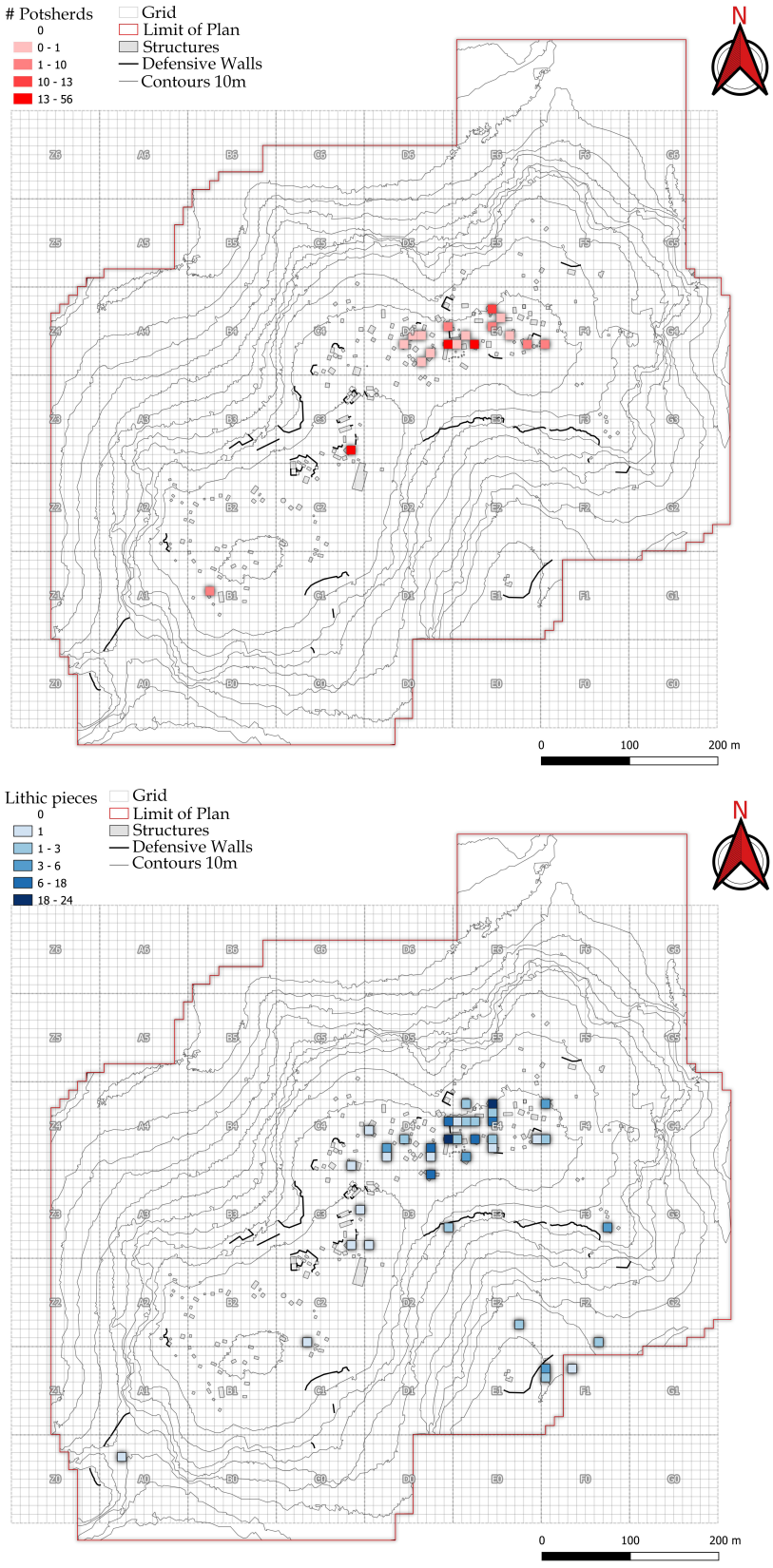


Figure 97. Surface Material distribution Maps (M. Dueñas).

4.4.7.1 Comments on Excavation Material Distribution

We recorded every single position of the material recovered using a total station throughout, excavations had led us to some interesting findings of the construction systems found in CDEM, stratigraphic identification, and ceremonial deposits.

We suspect that part of the walls, either adobes or wattle and daub, contained thrashed ceramic and lithic materials to temper the clay. Nowadays, people of the current San Jose de Gracia still temper the clay for adobes. Even the mortar contains crushed ceramic chips (Figure 98). This was the case in all the structures in Patio #2, Patio #9, and structure #177 of patio #12. The foundation of these materials signals us where the walls collapsed over the floor.

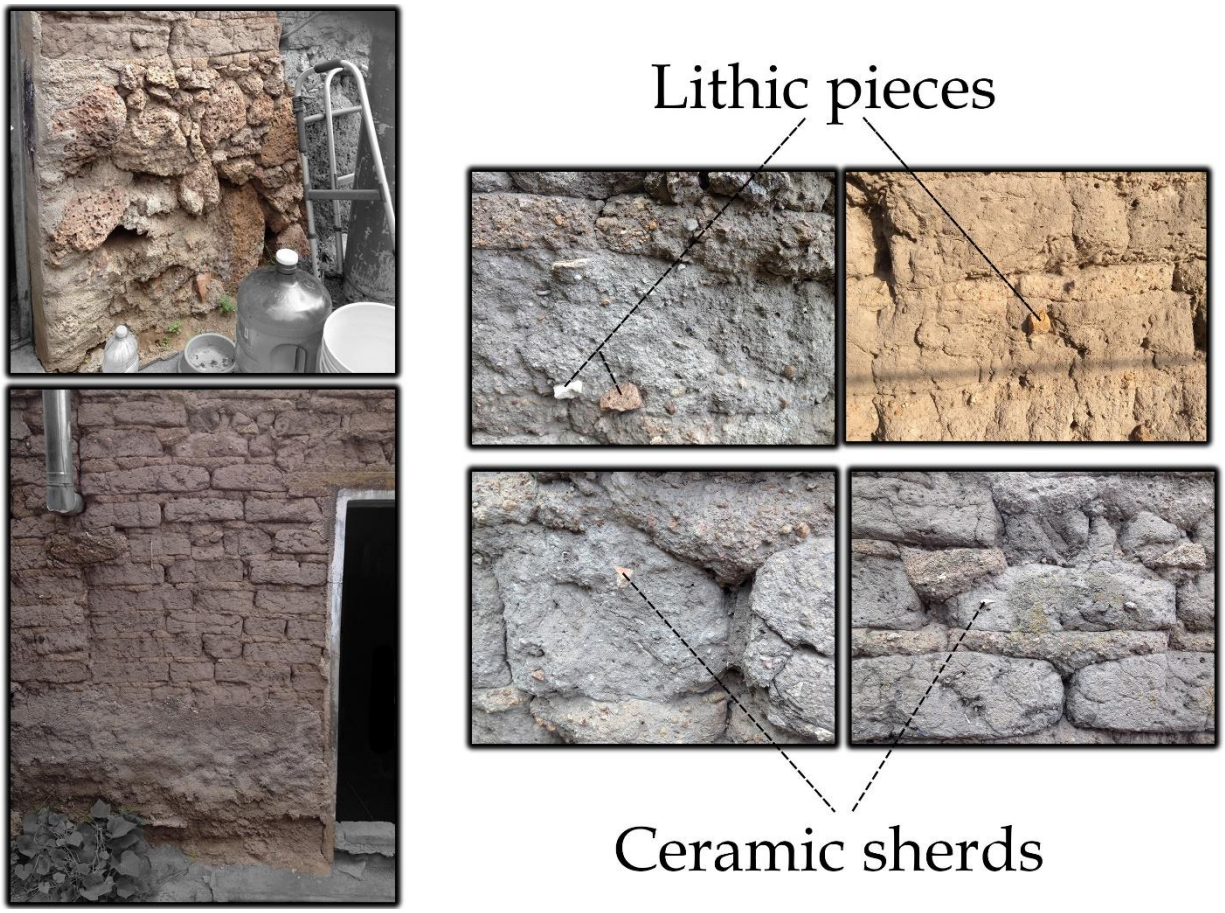


Figure 98. Photos of current adobes at San Jose de Gracia. (M. Dueñas).

Since both the construction raw materials, the floor, and the surrounding spaces contain similar compositions, it is not easy to distinguish their contacts in a stratigraphic column, but finding these materials, in conjunction with the rocks that formed the upper parts of the foundations, marked where the occupation floors were laid.

Where more significant, more complete forms were found, we assumed the floor was reached. In some cases, we found concentrations of ceramic material, particularly in the corners or in the center of spaces that could be part of abandonment rituals, since we did not ever find

100% percent of a vessel, but roughly half of them. Lithics are different since complete instruments were recovered, suggesting different symbolic treatments (Figure 99, 100, 101).

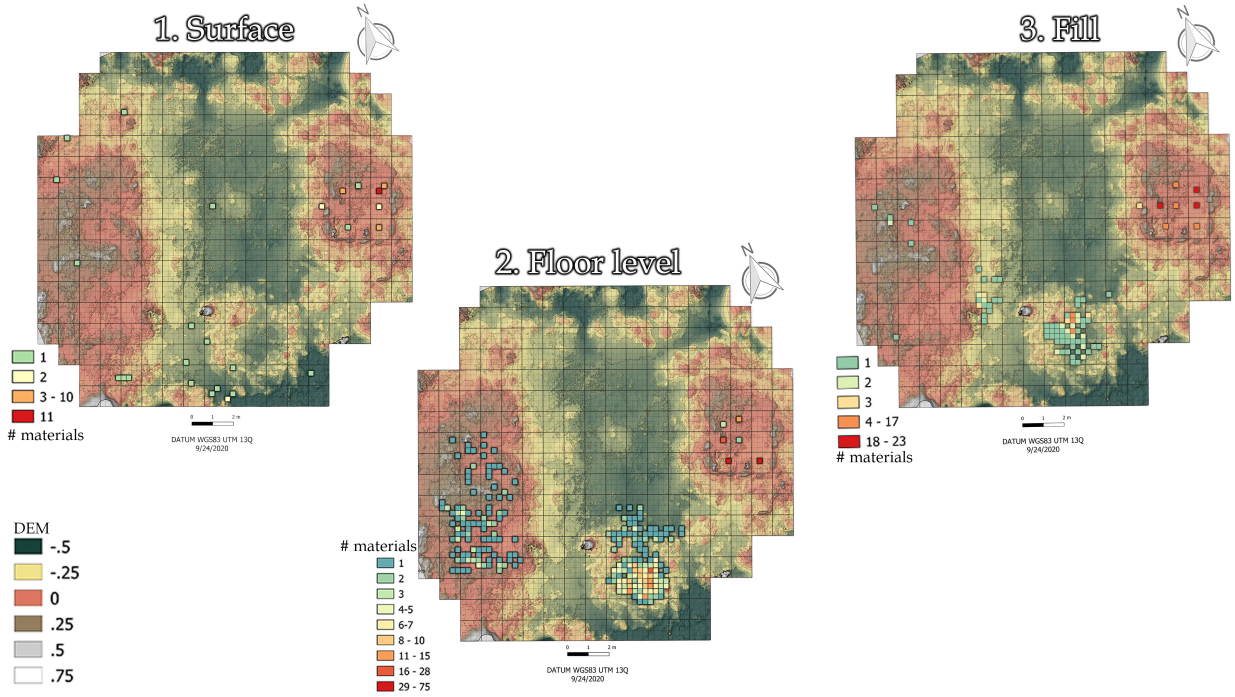


Figure 99. Distribution of patio #2 Materials map by Layer. (M. Dueñas).

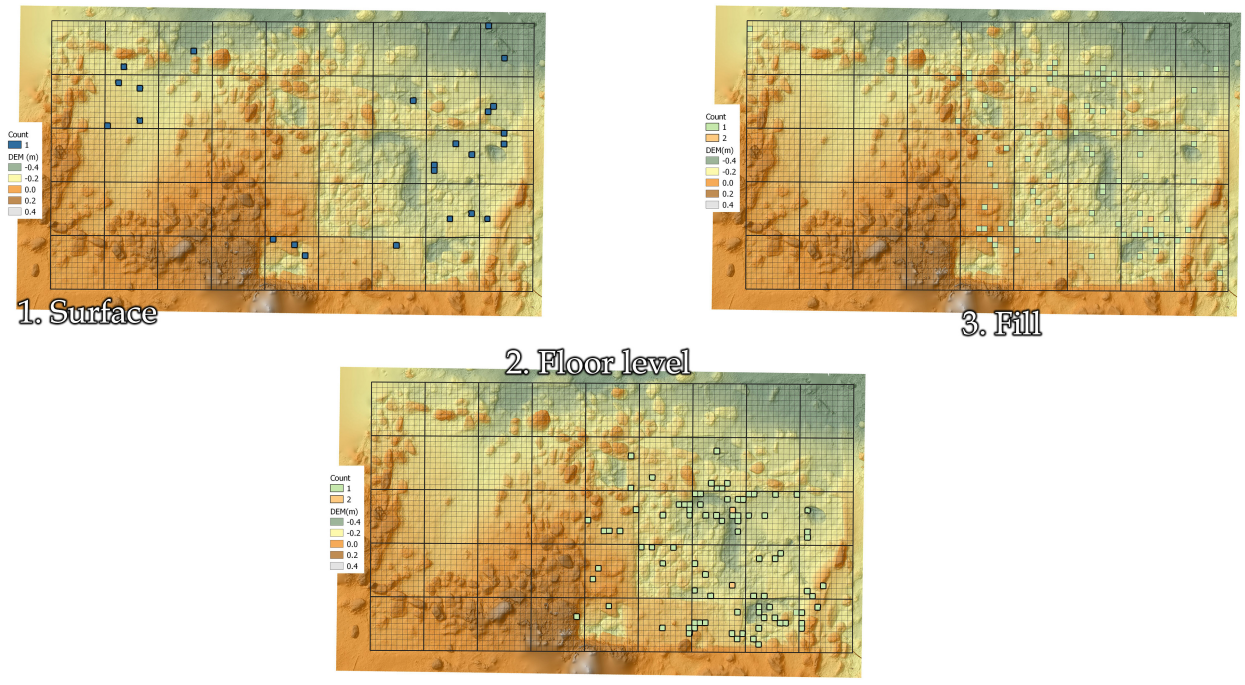


Figure 100. Distribution of Patio #12 materials map by Layer. (M. Dueñas).

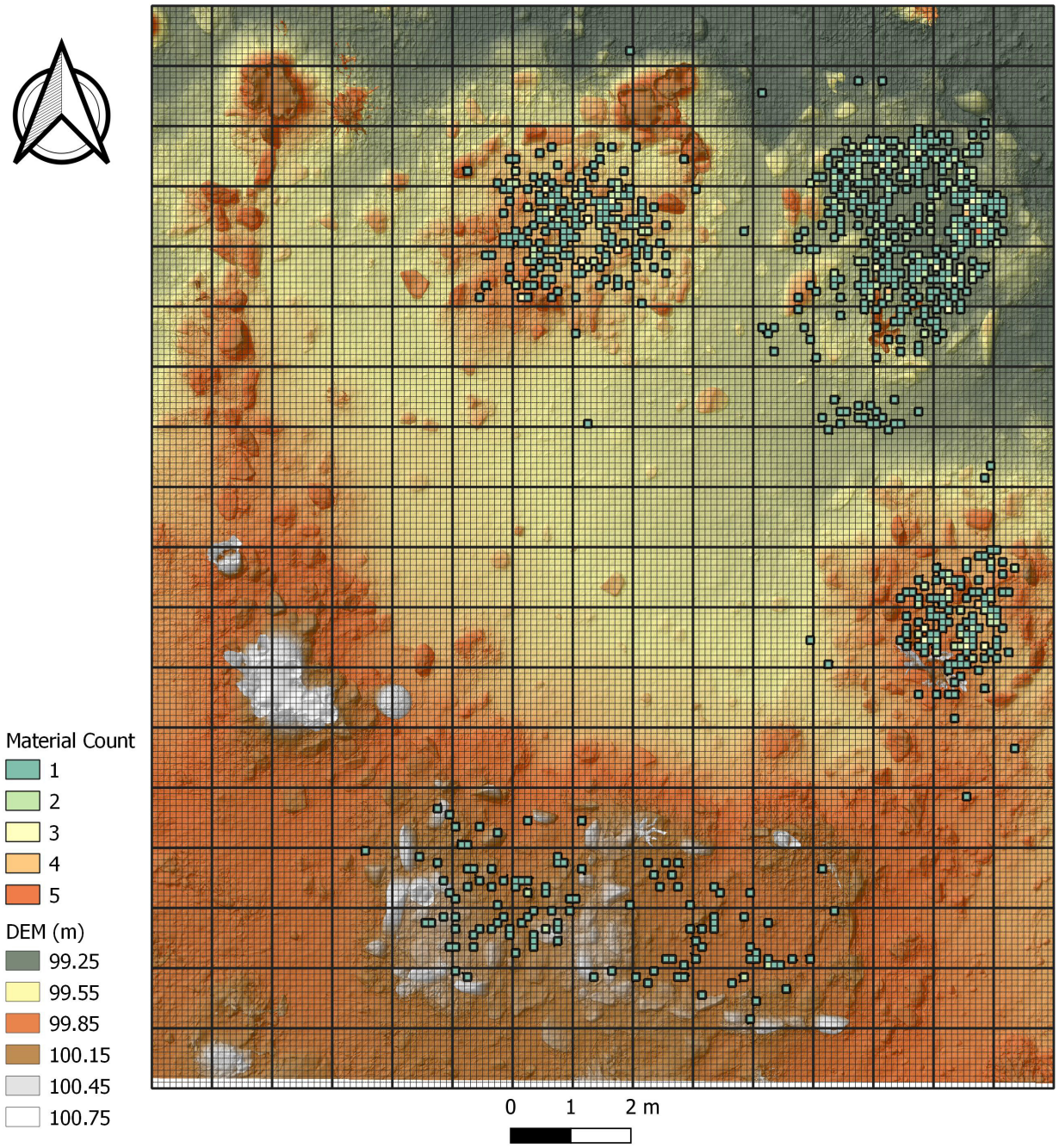


Figure 101. Distribution of Patio #9 materials map. (M. Dueñas)

4.4.7.2 Ceramic Analysis Methodology

The analysis of the ceramics focuses on the features identified in the sherds. The identification of the traits was made based on the primary literature on the subject (Merino and García Cook 2005; Mirambell 2005; Orton and Hughes 2003) that formed the basis for the development of the database. The Munsell color chart was used to determine colors by comparative macroscopy (Chavarria 2009). However, when carrying out the analysis, we had many sherds with a high degree of deterioration (eroded), which were assigned the "natural" color, which refers to the

color of the paste. The Type of Vessel was divided according to the form and decorative finishes made by Annick Daneels (2006).

4.4.7.2.1 Vessel Type

One important characteristic often used to determine the quality and use is its thickness. Vessel walls thickness functions as follows: thinner than 4 mm could be a luxury item. Thickness between 4 to 6 mm, could be a serving vessel. Thickness bigger than 6 mm could be a kitchen or storage vessel (Daneels 2006:399). Of course, this is a starting model. We will see in the results if these brackets and interpretations make sense.

Similarly, one can infer the shape of a vessel by identifying where the decoration is located. While the open shape of bowls, vases, jugs, or some pots will have interior decoration, a closed shape like pots or *tecomates* will be roughly smoothed on the interior. Dimensions were measured and length, width, and thickness were recorded for every sherd using calipers.

4.4.7.2.2 Manufacturing Technique and Firing

The following attributes were considered: modeling, molding, or lathe (only present in colonial materials). Firing conditions can be observed in sherds, as the firing diagram of Orton and Hughes (2003) shows.

4.4.7.2.3 Anatomical Part

The anatomical part analysis attempts to recognize the silhouette of a vessel while simultaneously defining which part of the vessel it corresponds to, whether the handle, edge, lip, neck, body, base, support, etc. (Bagot 2003).

4.4.7.2.4 Surface Finishing and Decoration

Analyses distinguished between exterior and interior, differentiating manufacturing techniques such as smooth, polished, burnished, varnish, or natural finish. Additionally, the motifs were recorded, with categories such as resist-painted, engraved, perforations, incisions, and applications.

4.4.7.3 Ceramic Analysis Results

A total of 2098 ceramic materials were analyzed over the course of three years, with research locations alternating between the Autonomous University of San Luis Potosi and the INAH Aguascalientes Center. Considering the total of 2098 sherds, 2058 came from vessels, six were beads, three were figurines, and one was a ceramic button (Figure 102).

Regarding the color applied, 28% of the collection could not be identified by color or has not been analyzed. Of the remaining majority, 26% is brown, 24% is red, 6% is color buff, 3% is red on buff, 2% is orange, and less than 1% are black or white decorated materials (Figure 103).

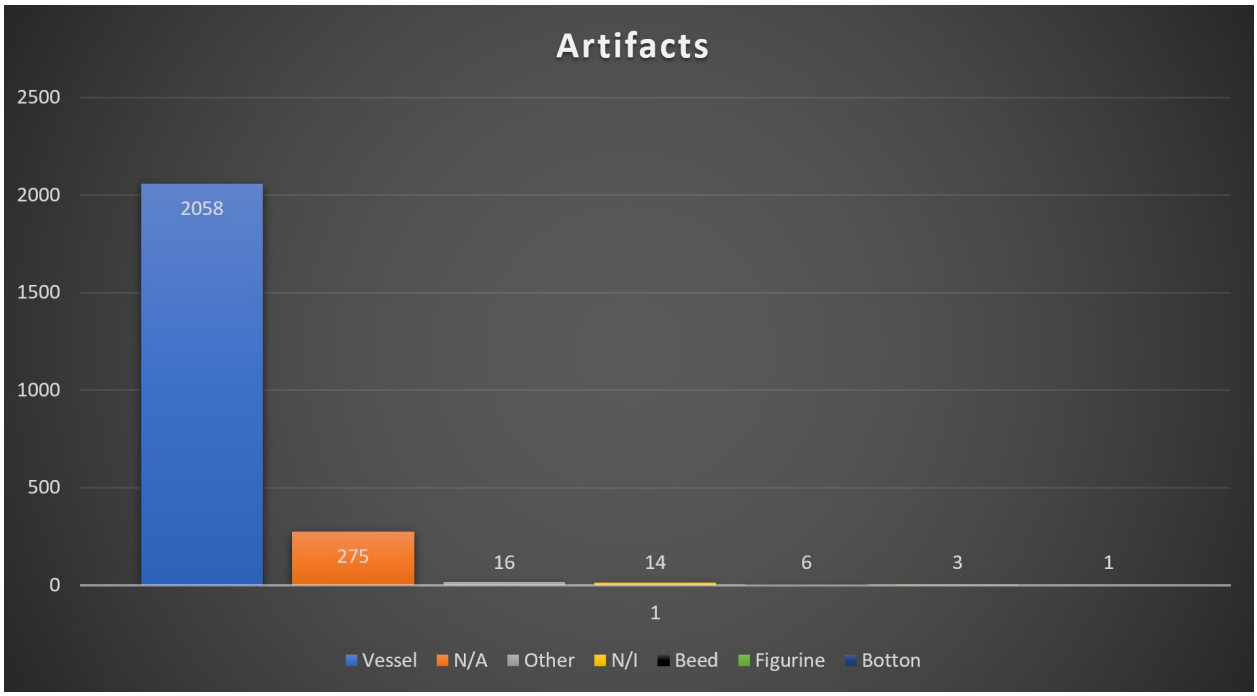


Figure 102. Graphic of ceramic artifacts.

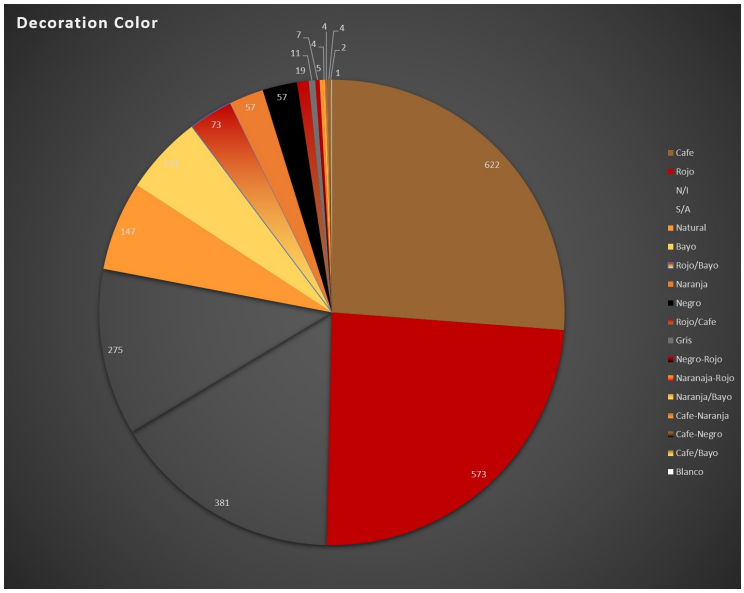


Figure 103. Graph of exterior color.

To identify the form of a vessel, analyses considered the shape of the sherd, the type of paste, and its thickness, since a bowl is usually made with a thin paste, while a pot is usually made with a thick paste. Considering the above, 83% of the collection are pot fragments, 15% are bowls, cups, or an open form, and 2% could not be identified (Figure 104).

89% of pottery sherds are body fragments, 4% are rim fragments, 3% are neck fragments, and 1% are support fragments. To interpret the size of the vessels, the diameter of the mouth was considered; 34% could not be determined due to conservation issues, but 31% have a size between 3-15 cm, 24% have a size between 16-28 cm, 9% have a size between 29-40 cm, and 2% have a size bigger than 41 cm (Figure 105, 106).

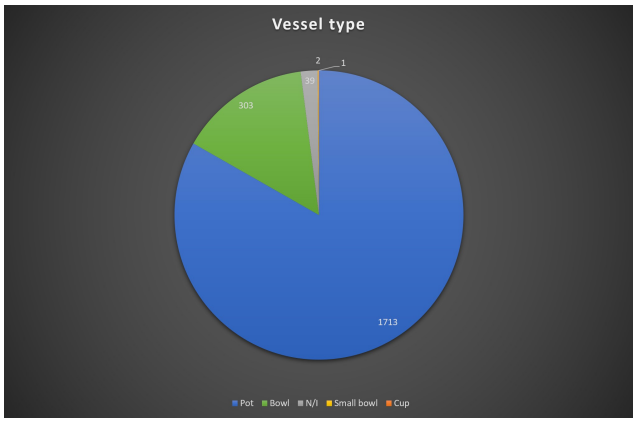


Figure 104. Graphic of vessel forms.

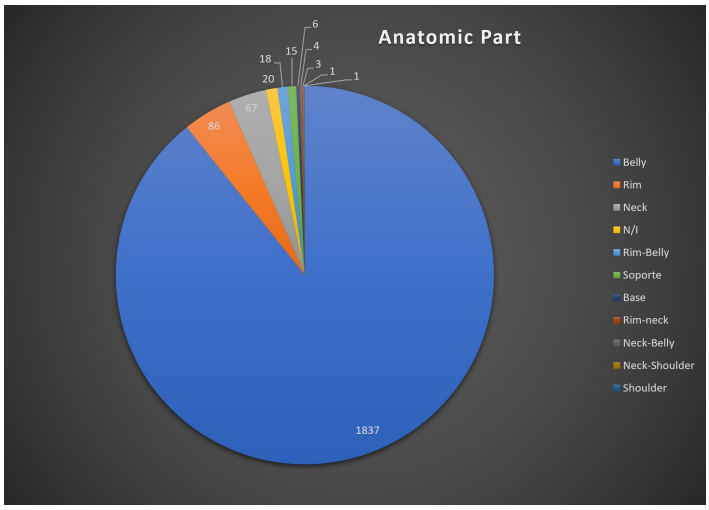


Figure 105. Graphic of anatomical parts.

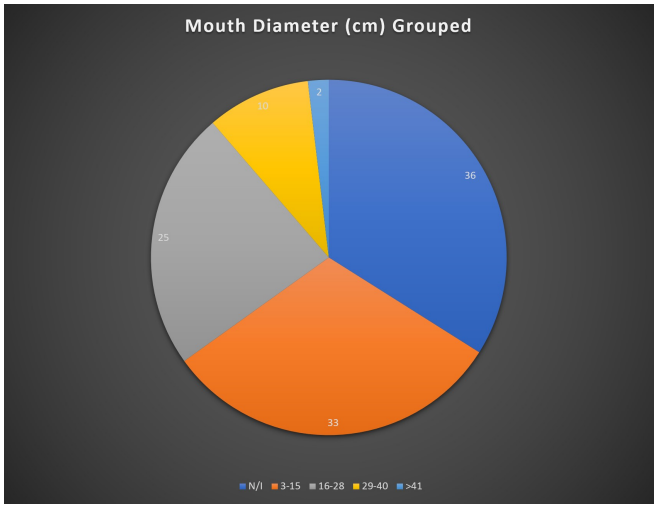


Figure 106. Graphic of vessel size.

4.4.7.4 Diagnostic Ceramic Materials

Diagnostic material is an umbrella term since different materials can be diagnostic of different socio-cultural phenomena. In this regard, we have materials with diagnostic decorations of a time and place. Additionally, we include storage items that could be found at any given time or place but that reflect the permanence of the population at CDEM.

Ceramic typologies of the materials analyzed so far show us a clear association with the contemporary settlements of Highland Jalisco and southern Zacatecas, making this border condition clear in which we can observe the confluence of various cultures.

4.4.7.4.1 Pseudo-cloisonné (North Mesoamerica Sphere)

This decorative technique was distributed throughout the northwestern region from the beginning of the Classic period (200-400 CE) and is considered a distinctive feature of the northern Mesoamerica region (Jimenez B. 2020; Jimenez B. and Darling 2000; Kelley 1974).

The technique entails a high degree of specialization and handling of pottery. Thomas Holien 1977 suggested that this technique was related to the consumption of *pulque* as part of the cult of the god *Tezcatlipoca* (Holien 1977; Perez C. 2007). Vessels with pseudo-cloisonné decoration are associated with other materials like the ring-based *opposing* bowls and Type I figurines (Jimenez B. 2010, 2020; Solar V. and Padilla 2013; Williams 1974).

In the Chalchihuites region, pseudo-cloisonné presence has been reported as far back as the Early Classic period (Kelley and Abbott K. 1971; Perez C. 2007). Likewise, in the Malpaso Valley, pseudo-cloisonné ceramics were found abundantly at the La Quemada and the neighboring sites, as well as in Juchipila Canyon, during the second phase of occupation (550-900 CE), which is when sites like Las Ventanas had their peak. This period is related to the culture of Ixtépete-El Grillo to the south and the Bolaños Canyon to the west. During this period, vessels with black sgraffito filled with red pigment are also associated with pseudo-cloisonné pottery (Jimenez B. and Darling 2000; Nelson and Wells 2001; Perez C. 2007).

In the Atemajac Valley, nowadays Guadalajara, we observed this type of pottery in the El Grillo complex, which is associated with ring-based bowls, hollow tripod supports bowls and ring-based bowls with reversed rims (Beekman 1996). In Jalisco's Highlands region, the presence of ceramics of this type was reported during the Classic period (400-900 CE), where the technique on pedestal-based cups and later on ring-based bowls and pots (700-900 CE) (Lopez M. et al. 1994; Perez C. 2007). Towards the Guanajuato region, pseudo-cloisonné decoration has been reported at El Cóporo site (Torreblanca et al. 2007).

In Aguascalientes, the presence of vessel fragments with pseudo-cloisonné decoration has been reported in Cerro de Santiago, El Ocote, Cerro de En medio and La Montesita (Dueñas G. 2017; Jimenez B. and Darling 2000; Jimenez B. 2020; Puch Ku 2014; Schulze and Perez R. 2015). This ceramic type is characterized by fragments of pots and bowls on which a grayish paste was applied that marks the outline of the figures and was later scraped to be filled with a colored paste: white, reddish, salmon, blue and green. The motifs consist of geometric figures such as circles, rectangles, frets, lines, and sometimes a series of more elaborate figures (Lopez N. 2019; Puch Ku 2014).

At the Cerro de Santiago site, samples have been recovered from surface surveys in sector A and during the excavations of Structure 53 (Puch Ku 2014). Similarly, pseudo-cloisonné pottery has been reported at the El Ocote site, where the variety of objects recovered is more

comprehensive. For example, this type of decoration has been reported on fragments of bowls and miniature pots, pots, bowls with annular bases, and earmuffs (Pelz M. and Jimenez M. 2006).

At the La Montesita site, pseudo-cloisonné ceramic fragments have been recorded from the survey and excavation, from the filling of the walls of structure 76, located in sector C of the site (Lopez N. 2019; Schulze and Perez R. 2015; 2016). At Cerro de En Medio, a rim fragment was recovered in the excavations of Structure 27 within Patio #2 (Aguilar and Diaz de Leon 2018; Dueñas G. 2017) (Figure 107).

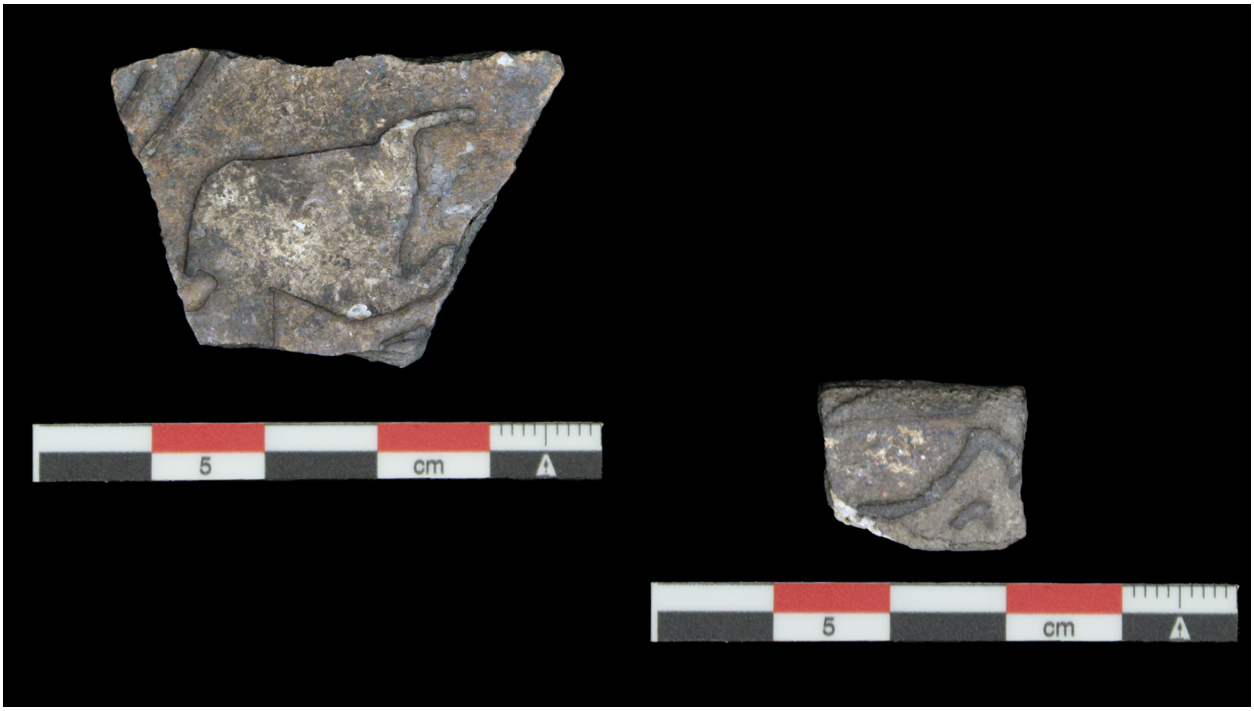


Figure 107. CDEM Pseudo-cloisonné (M. Dueñas)

4.4.7.4.2 Reverted lip/annular base/Resist-painted (North Jalisco Materials Sub-sphere)

The materials distributed in the Atemajac Valley, the Juchipila Canyon, the Jalisco Highlands, and the rest of the Río Verde Grande basin are critical to understanding the communication channels established during the Epiclassic in the north Mesoamerican.

Among the most emblematic materials in this area are the annular-based resist-painted bowls. According to the definition of Eduardo Noguera (1965), the decorative technique of the resist-painted wares consists mainly of covering the parts of a vessel with some pasty material (perhaps some type of natural wax or resin), forming the decorative motifs. The rest of the piece is painted in another color, so when the piece is put in the oven, the pasty material melts during the firing process, provoking the natural color of the vessel to ultimately form the decorative designs, which are framed by a darker surface (Noguera 1965). This type of decoration was widely used among the pre-Hispanic cultures of the South American continent. The materials recovered in archaeological contexts in Colombia, Venezuela, Ecuador, Peru, and Panama show the above (Cabrero G. 2014).

In Mesoamerica, there is evidence of its use from the Formative found at the site of Tlapacoya (Piña Chan 1967), in some parts of the gulf (Padilla 1993), and during the San Miguel phase of the Chupícuaro culture in the Bajío (Braniff 1972; Saint-Charles et al. 2005). During the classic, it is reported in the Maya area (Coe 1960; Lowe and Navarrete 1959; Muñoz 2001) and Teotihuacán (Crider et al. 2007; Rattray 2001). This technique is recognized throughout the region in all periods of the chronology sequence up to the Postclassic (Noguera 1965).

In Western Mexico, it is common to find these materials also from early dates as a characteristic cultural feature (Barrera R. 2007; Bell 1971; Cabrero G. 1989, 1992, 1994, 1995; Cabrero G. and Lopez C. 1993, 1997, 1998, 2002; Furst 1976; Galvan V. 1976; Grosscup 1964; Jimenez B. and Darling 2000; Kelley 1971; Oliveros 1974, 1989; Schöndube 1980; 1990; Schöndube and Galvan V. 1978; Townsend 1999; Valdez 1994; Weigand 1974, 1993; Williams 1994). It is common to find this decoration complementing other techniques in the same piece, such as incised-engraved or simple painting (Grosscup 1964). Resist-painted ceramics can be grouped into different complexes chronologically. The Late Formative and Early Classic periods correspond to the shaft tomb tradition, where buried individuals have been found accompanied by resist-painted ceramics (Barrera R. 2007; Bell 1971; Cabrero G. 1989, 1992, 1994, 1995; Cabrero G. and Lopez C. 1993, 1997, 1998, 2002; Furst 1967; Galvan V. 1976; Oliveros 1974, 1989; Schöndube 1980, 1990; Schöndube and Galvan V. 1978; Valdez 1994; Williams 1994). This was mainly during the time of the first sedentary villages in West Mesoamerica.

In regions such as the Bolaños Canyon, this ceramic type has been identified in association with pseudo-cloisonné decorated ceramics, along with the first ceramics recovered at the site of Totuate, Jalisco (Hrdlicka 1903; Kelley 1971), within the shaft tombs discovered in the sites of Chimaltitán and San Martín de Bolaños, in association with the buildings of the earliest ceremonial centers in the region (Cabrero G. 1994), in ceramic forms such as tripod bowls with spherical supports (Cabrero G. 1989, 1994; Cabrero G. and Lopez C. 1997; Jamarillo L. 1984).

Cabrero G. (1994) proposes that the pseudo-cloisonné and the resist-painted wares are contemporary in the first period of occupation of Bolaños, with a date of 100-250 CE in correspondence with similar contexts in the Jalisco's Highlands (Bell 1974). Given the similarities between shaft tombs, some figurines, and negative decoration on the Mexican and South American Pacific coast (mainly Panama, Colombia, Ecuador, and Peru), a possible maritime influence from south to north has been proposed (Barrera R. 2007; Cabrero G. 1994; Noguera 1965).

The presence in Northwest Mesoamerica of these materials since the Late Formative/Early Classic (100-200 CE) has made it possible to define a sphere of interaction that articulates the sites defined under the Chalchihuites culture with the rest of the Lerma-Santiago axis (Jimenez B. 1989). In this way, the resist-painted decorative technique is diagnostic of the communication channels established between southeast Zacatecas, northwest Jalisco (the canyons), and Jalisco's Highlands during the Epiclassic (Jimenez B. 1989, 1992; 1995; Jimenez B. and Darling 2000; Ramos and Lopez M. 1996).

Articulating the interaction networks from east to west, ring-based bowls with negative polychrome decoration are distributed from the Tlaltenango Valley and Juchipila Canyon, crossing the region from the lakes to the northeast Guanajuato (Jimenez B. 1989, 1992, 1995; Jimenez B. and Darling 2000). To the south, in the Sayula basin (Jimenez B. and Darling 2000; Lopez et al. 1994; Schöndube and Galvan V. 1978), these pieces are considered diagnostic of the Epiclassic, and they are very similar, if not identical, to pieces found in the Atemajac Valley

(Jimenez B. 1989), giving us indications of the scope of certain pottery traditions, which in themselves represent the extension of the Northern Mesoamerican border (Jimenez B. 1989).

In the Bajío, annular bases have been identified within a type called "Late Resist-painting," which was used from 300 to 900 CE (Ramos and Lopez 1996). In the Juchipila Canyon, ceramics decorated with this technique have been located mainly for the second phase of occupation that goes from 300/350 to 850/900 CE. (Jimenez B. 1995). In the Malpaso Valley (La Quemada), annular base polychrome bowls are imported from the Atemajac Valley region through the Juchipila Canyon (Jimenez B. 1995). However, a resist-painted type of manufacturing has also been recognized, locally defined as the Tepozán type (Jimenez B. and Darling 2000).

Resist-painted pottery has been reported in the Chalchihuites area since the Canutillo phase (Kelley and Abbott K. 1971) in the Formative. However, it is recognized that it acquires relevance in the Epiclassic (600-900) when diagnostic types of interaction with its southern neighbors also appear (Jimenez B. and Darling 2000). Annular-based bowls are usually resist-decorated on a polished red slip; however, resist-painted motifs sometimes appear on vessels decorated with red-on-bay polychrome. Baus de Czitrom and Sanchez C. (1986), allude to the fact that this modality is found in the Iztepete-El Grillo site, in the Atemajac valley (Schöndube and Galvan V. 1978), which date between the years 600-900 CE (Baus de Czitrom and Sanchez C. 1986) Braniff also reports the presence of this annular base in the ceramic materials of the Villa de Reyes site (Braniff 1992), stratigraphically associated with the Electra Polychrome type, and which is still present with less importance in the Epiclassic (Braniff 1992), as well as in the San Luis Resist-painted type of the San Luis phase (Braniff 1992), of local manufacture.

Alongside the resist-painted annular-based bowls, a typical rim form is also diagnostic of the Northern Epiclassic: the reversed rim. In our area of interest, the reversed rim is also known as the "step" or "bracket" rim and is a characteristic feature of the orange-cherry red ceramics of Jalisco's Highlands, and there are reports of its presence eastward in San Luis Potosí, both in the valley and in the Río Verde region, as well as far as Colima to the west (Ramos and Lopez 1996).Three sites in Jalisco's Highlands, Baus de Czitrom and Sanchez C. (1986) describe ceramic materials with this type of rim and mention that the most common shape among the objects they recovered with reversed rims is a pot (although it is also present in a lesser extent in bowls), decorated with a polished red slip on the outside, and an unpolished cream slip on the inside (Baus de Czitrom and Sanchez C. 1986).

This same type of edge is mentioned by Isabel Kelly when she reports the materials from the site of Tuxcacuexco, in the south of the state of Jalisco (1949 in Baus Czitrom and Sanchez C. 1986). In the eastern part of the state of Jalisco, it is also reported by Otto Schöndube (1973-1974 in Baus Czitrom and Sanchez C. 1986) in three complexes in the area Tamazula-Tuxpan-Zapotlán with a chronology that goes from 600 to 1523 CE, (Baus de Czitrom and Sanchez C. 1986).Jimenez B. reports these rims in the Juchipila Canyon, and the Tlaltenango Valley, with a temporality of between 300/400-900 CE. There are also reports of this type of rim in the northern region of Michoacán, near the Río Lerma during the Epiclassic (Michelet 1984); the same for Guanajuato (Brown in Baus de Czitrom and Sanchez C. 1986).

No negatives have been found in the CDEM archaeological site, but an essential presence of reversed rim is found as an offering under the floor of structure 27 of Patio #2. An annular-base bowl fragment was found in the same structure but in layer II. In the site Casa de Indios/Cerro del Meco, located to the nearby north of CDEM, inverted edges, an annular-based vessel with pseudo-cloisonné decoration, and resist-decorated materials were found in surface

surveys (Dueñas G. 2013), allowing us to conclude that the site was also inhabited during the Epiclassic and participated in the northern Mesoamerican spheres of interaction (Figure 108).

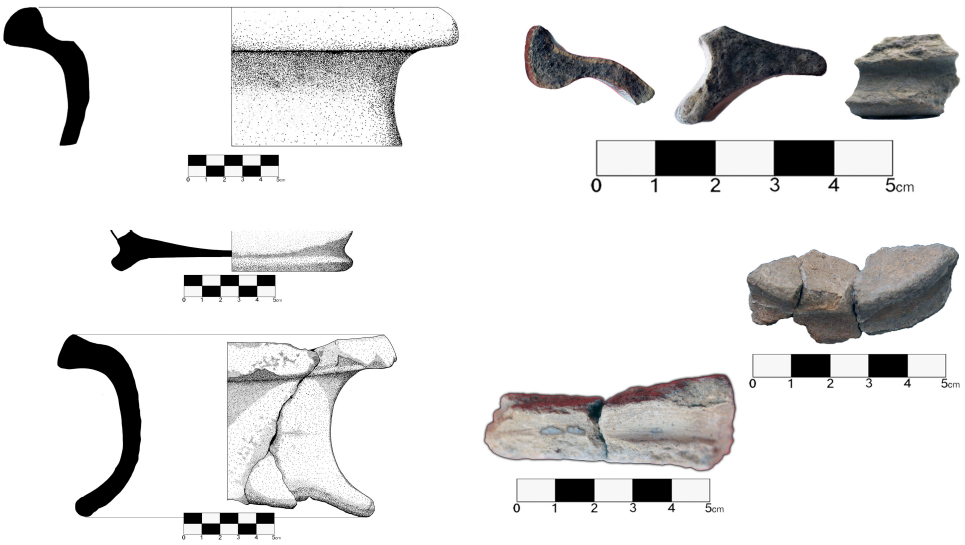


Figure 108. CDEM Reverted lip/annular base (G. Aguilar and M. Dueñas).

4.4.7.4.3 Incised/engraved and Nail impressions Decoration

This decorative technique is one of the oldest used in pottery in the Americas. Piña Chan (1967) mentions it as part of the decoration used in the Olmec culture of the Early Preclassic (1500-800 BCE). It appears in the Basin of Mexico during the Middle Preclassic (1300-800 BCE) at Tlatilco and Tlapacoya (Piña Chan 1967).

Ceramics with imprinted decoration or nail impressions are described as early in association with shaft tombs at the site of La Florida, north of the Bolaños Canyon, and in the Chalchihuites region, western Zacatecas (Cabrero G. 2005; 2014; Kelley and Abbott K. 1971). In the Bolaños canyon, it is considered part of the region's oldest materials, associated with the phase of shaft tombs.here is a record of ceramic fragments with *nail impressions* decoration in the fill of structures 153 and 154 of patio #9 in CDEM, being the only site with this type of ceramics

Just as with nail impressions, the incise/engraved technique was widespread throughout Mesoamerica (Noguera 1965). In the Chalchihuites region, two types appear: Canutillo Red-Filled Engraved, which is part of the Canutillo phase (200-650 CE), and Michilia Red-filled Engraved, which is part of the Alta Vista phase (750-900 CE) through the Calichal phase (900-950 CE) (Kelley 1971), and through the Calichal phase (900-950 CE) (Kelly 1971) (Figure 109).

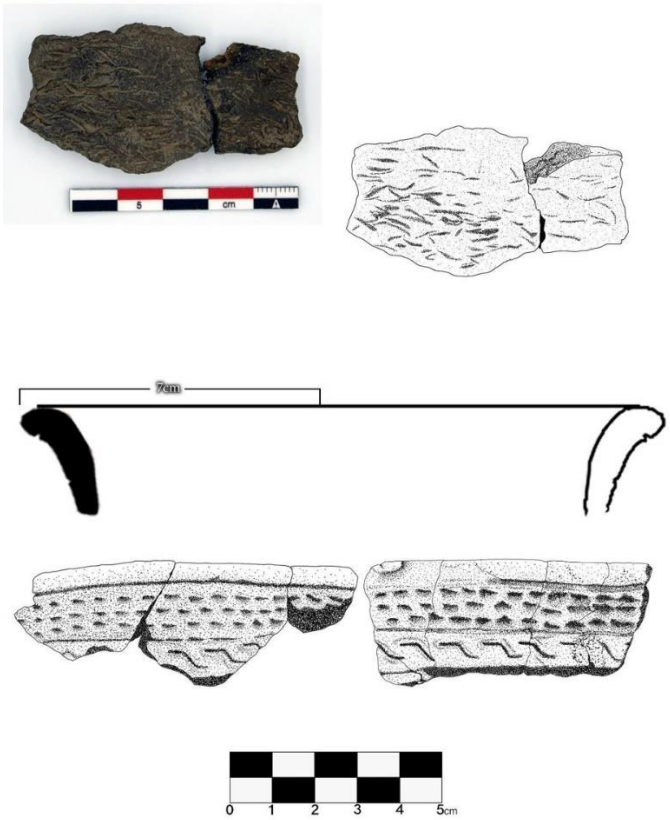


Figure 109. CDEM Nail impression and Incises/Engraved ceramic types (G. Aguilar and M. Dueñas).

4.4.7.4.4 Plaques

Objects known as ceramic plaques, tablets, plates, or trays have been classified as having high cultural value because of the archaeological context in which they were located and the temporal or chronological dimension to which they belong. These objects' function is unknown; In the Bolaños area, they have been found flat or with a slight curvature and have very varied designs: there are panels in which double undulating lines are combined, forming triangles, rectangles, all of them engraved; wide painted bands, stepped frets, geometric motifs painted in red and black, and incised geometric or zoomorphic motifs.

These have been found in the Bolaños region (Cabrero G. 2005), in the archaeological site of La Quemada (Nelson 1997; Trombold 1990), in El Teúl (Jimenez B. 2020) and in the Tlaltenango valley (Jimenez B. and Darling 2000). In the center of Jalisco, they were found without decorative motifs and of great size. Javier Galvan V., a researcher at the INAH-Jalisco Center, associated them with the Grillo period of Atemajac, Jalisco.

Their use is not yet defined, although they have been identified as head pads for burials and as pallets for painting. However, their temporality places them during the Epiclassic (600-900 CE) (Cabrero G. 2005), and until now, their presence has been reported in the archaeological site of El Ocote associated with burials dated between 600 and 900 CE, thus belonging to the Mesoamerican Epiclassic; In CDEM, a fragment was recovered during surveys, associated with patio #12 (Figure 110).

Figure 110. CDEM pallet (G. Aguilar and M. Dueñas).

4.4.7.4.5 Bowl Supports

Tripod-supported vessels have been widely used in Mesoamerica from very early dates. In Western Mexico, Schöndube (1980) points out that tripod bowls appear in the shaft tomb tradition and the Chupícuaro tradition, which overlap in Jalisco's Highlands and Juchipila, where evidence of shaft tombs has been detected. This confluence of Late Preclassical and Early Classic could be manifested at CDEM. Although no shaft tomb has been detected there, the materials could give us some *clues*.

Apozol tripod bowls occur in the Juchipila region, a neighboring region, analogous to those found at Cerro Encantado in Jalisco's Highlands (Bell 1974). These are directly related to the types identified as components of the Morales complex of northwestern Guanajuato (Braniff

1972, Jimenez B. 1998), these being the early ceramics that Kelley defined as “Chupícuaro affiliation” types for the northern border. At Cerro Encantado, these diagnostic ceramics were associated with hollow figurines known as “Cornudos” (horned). The existing links with Colorines-Tabachines/Morales (Beekman 2004) have been defined in Jalisco’s Highlands as phase I (ca. 200 BCE-300 CE) and seem to indicate the integration of the Juchipila valley with the Jalisco’s Highlands region from very early dates (Jimenez B. and Darling, 2000). Nevertheless, above all, this convergence is shown by the presence of shell trumpets, pyrite mirrors, Cornudos figurines, and polychrome geometric designs on resist-decorated wares, something that can be associated as part of the Morales de Guanajuato complex.

Resist-painted tripod bowls (claws or hollow bulbs) from the Juchipila Valley have direct analogies with items explored in a sealed shaft tomb in the Bolaños Valley, which gave radiocarbon dates between 200-400 CE (Cabrero G. and Lopez C. 1998). These Bolaños’ cultural elements suggest a confluence within the Juchipila Valley of three of the largest regional systems in western Mexico (Bolaños, Jalisco’s Highlands-Sayula, and Chupícuaro-Morales), all the way south to the coast of Colima, in what Ramírez (2005) has proposed as the ceramic marker of a larger sphere of interaction that occurred from 500 to 750 CE.

During the apogee of the Epiclassic (600 – 900 CE) in the Malpaso Valley, La Quemada rose as a regional system (Jimenez B. 1989; 1998; Jimenez B. and Darling 2000; Lelgeman 2000; Nelson et al. 1993; 1997; Trombold 1990), in the so-called La Quemada complex dated approximately between 600/650 and 850 CE, in which new ceramic types come into use. This period's diagnostic types for La Quemada are Incised-Sgraffito decorated tripod bowls (Jimenez B. and Darling 2000) (Figure 111).

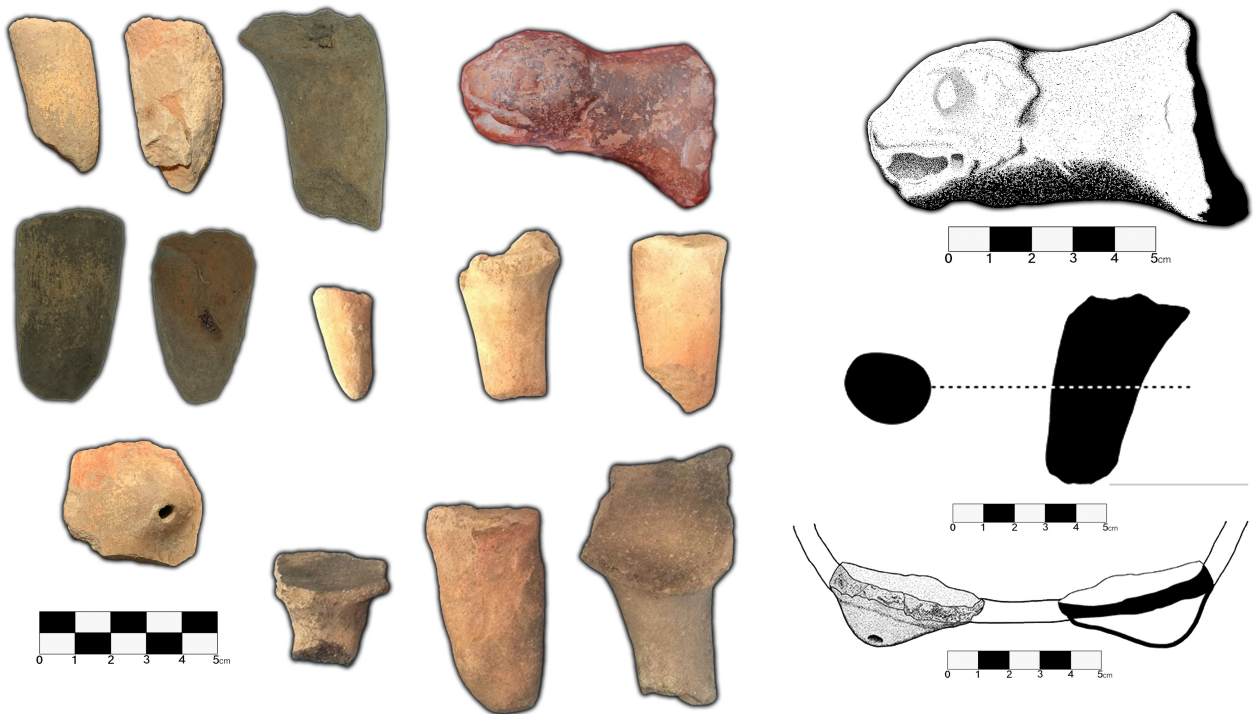


Figure 111. CDEM supports (G. Aguilar and M. Dueñas).

4.4.7.4.6 Shapes and General Forms

No complete ceramic wares were recovered during the project. This is probably due to the intense erosion agents of a semidesert environment that make preservation on the surface almost impossible; regarding excavated materials, this could be primarily due to the context explored, which was primarily Architectonic fillers.

Nevertheless, incomplete materials can help identify what kind of ceramics were used on the site regarding cultural affiliations. Further, this will come in handy in the next chapter when recreating CDEM for the purpose of divulgation virtually (Figure 112).

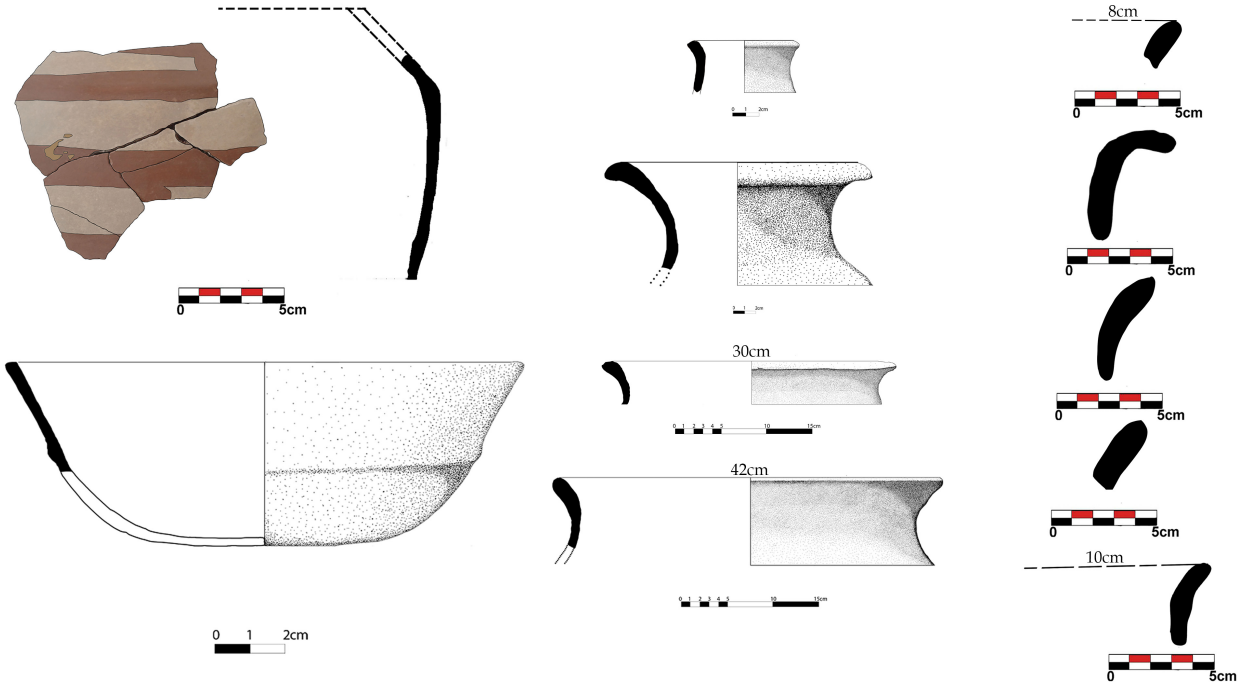


Figure 112. Shapes and forms (G. Aguilar and M. Dueñas).

4.4.7.4.7 Figurines

Ceramic figurines are artifacts of rare interest in identifying cultural, social, and economic interactions at different scales. Widely studied in Mesoamerica, these objects support various anthropological interpretations of the archaeological record. These interpretations include the question of human and animal representation, the composition of ritual paraphernalia; the gestures and actors of rituals; technological knowledge, and production processes. Although not on site, but in a local collection in San Jose de Gracia, where materials recovered from CDEM are exhibited, many figurines are diagnostic of the Epiclassic interaction in the northern frontier.

On one side, are fragments of figurines Type I, defined initially by Williams (1974) for the Jalisco's Highlands, considered by Jimenez B. and Darling (2000) as a horizon marker for the Inland Northern Mesoamerican Network (Solar V. 2021) (Figure 113).

Figure 113. Figurines (photos by M. Dueñas)

4.4.7.4.8 Miscellaneous

Tejos or Malacates (spindle whorls) were the tools used to elaborate textiles (Figure 114) and a possible bow drill fire kit; although more research is needed, this is one possible use for this artifact found on patio #2 (Figure 115).

Figure 114. Tejos (photos by M. Dueñas).

Figure 115. CDEM Fire Kit (G. Aguilar and M. Dueñas).

4.4.7.5 Lithic Analysis

Of the 995 worked stone fragments, 865 were analyzed, consisting of 7 pieces of polished stone and the rest of knapping techniques. Debitage (224 pieces), flakes (423 pieces), scrapers (35 pieces), cores (26 pieces), projectile points (20 pieces), a knife, and some lapidary ornaments (4 pieces) were identified (Figure 116).

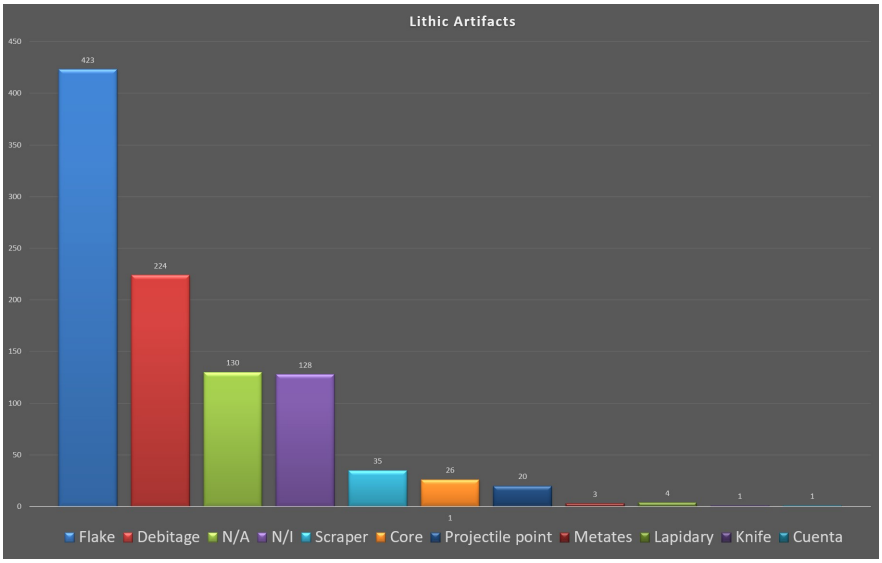


Figure 116. Graphic 6 Lithic tools.

The most common raw material was flint with 34%, followed by rhyolite with 31%. Other materials identified were chalcedony (5%), ignimbrite (2%), quartzite (1%), and single pieces of andesite, jasper, and pumice. Obsidian stands out with 4%, and its importance as a prestige material not found in the area speaks of the trade networks within which the site was embedded (Figure 117).

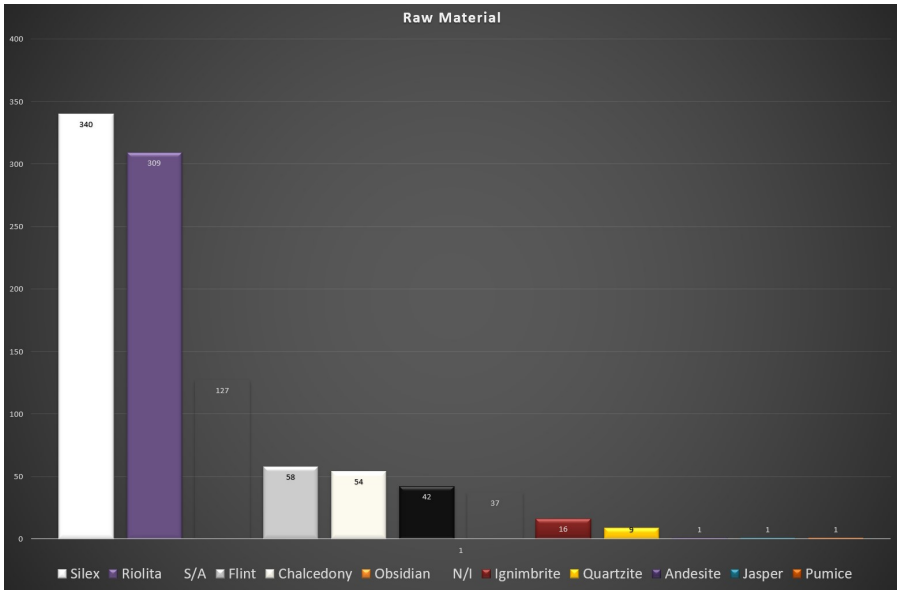


Figure 117. Graphic 7 Raw lithic material.

4.4.7.6 Lithic Analysis Methodology

Using as a basis Santamaria and Garcia-Barcena (1984), Garcia Cook (1967), Torreblanca (1999), and Mirambell (2005), the following artifacts have been identified:

4.4.7.6.1 Scrapers

Made on flakes, they present a thinning edge; the touch-ups are marginal and can be semi-covering or covering, the extension can occur on only one of the edges or extend to the lateral edges. The touch-up is continuous, not abrupt. It is never bi-marginal or bifacial. The side edges are parallel or slightly converging. Those scrapers that present touch-ups on the side edges are presented as a function of the material (probable sleeve). They have a very reduced heel (Garcia C. 1967; Santamaria and Garcia-Barcena 1984) (Figure 118).

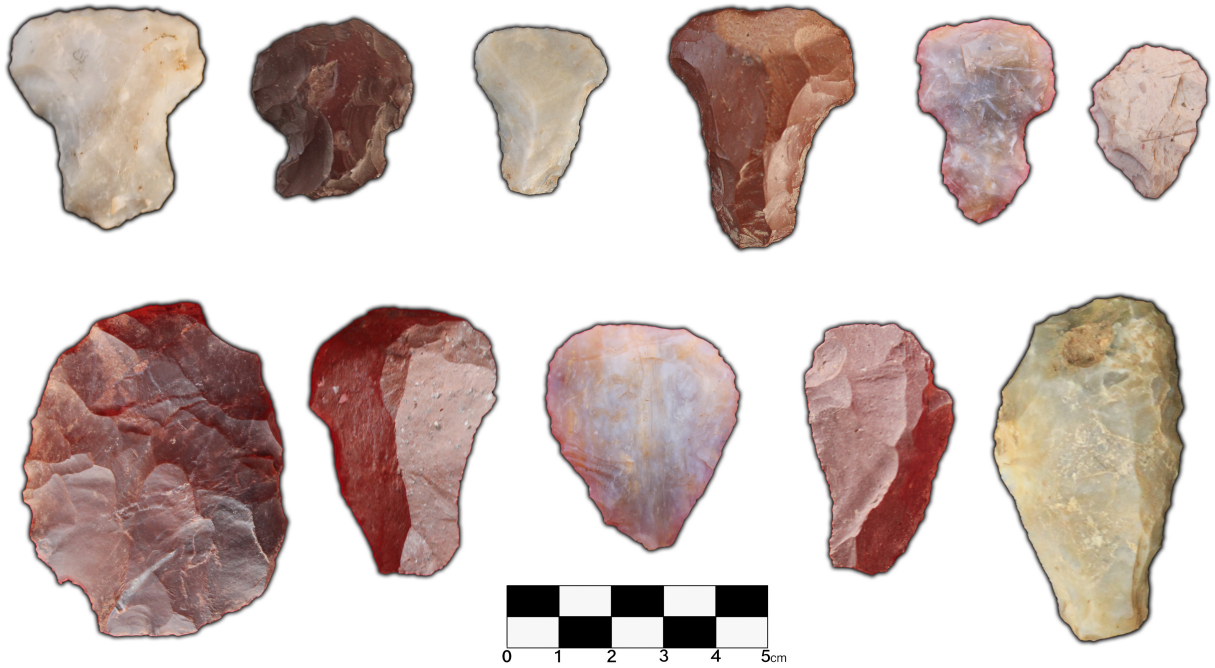


Figure 118. CDEM Scrappers (M. Dueñas).

4.4.7.6.2 Projectile Points

They can be manufactured as flakes or razors, although these are difficult to distinguish. Their Most remarkable attribute is that they consist of two cutting edges that come together to form a point capable of drilling because it is sharpened. In addition, sometimes they have a peduncle of different shapes and notches to hold them. (Torreblanca 1999) (Figure 119).

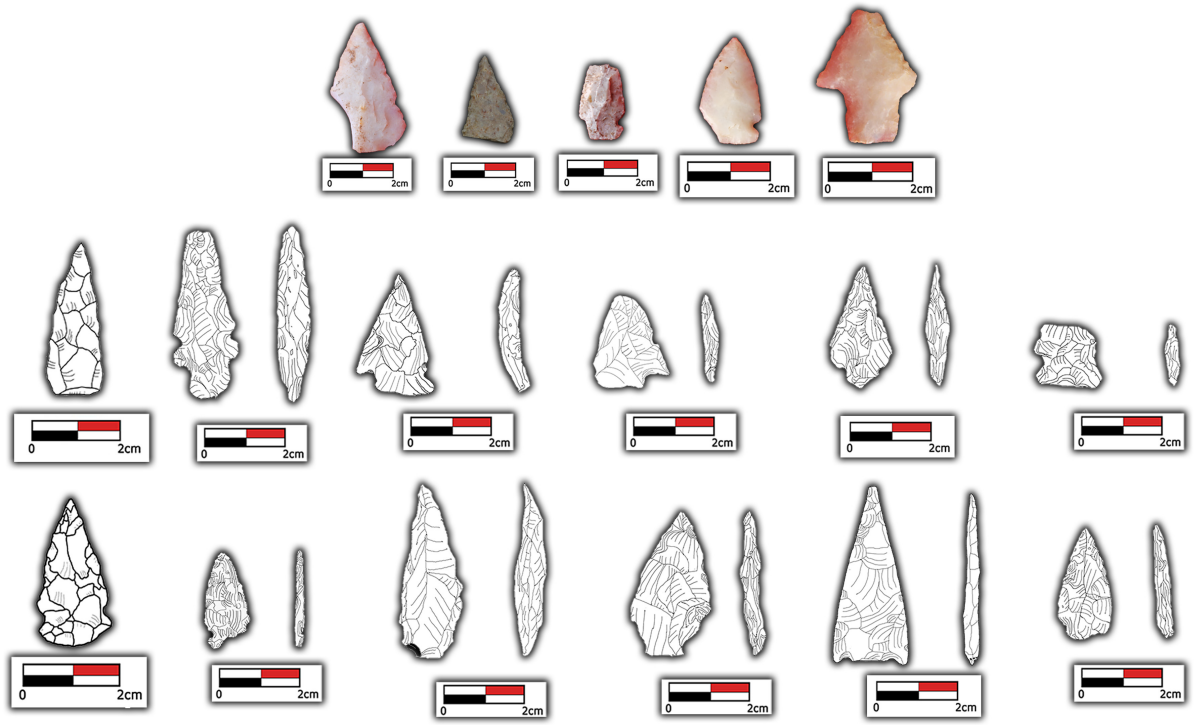


Figure 119. CDEM projectile points (G. Aguilar and M. Dueñas).

4.4.7.6.3 Flakes and Knapping Waste

Flakes are pieces extracted from a core of raw material by percussion or pressure and whose length tends to be less than twice the width (Alcaraz 2009). Sometimes they are fragments of raw material detached during the knapping process. Dimensions were only taken on objects such as projectile points, scrapers, and bifacial, not in the case of knapping debris. To identify the parts of the pieces, the diagrams of Torreblanca (1999) and Silva (2015) were used.

Finally, the degree of conservation was determined by observing the piece, searching for bumps that would indicate if it was fragmented, and identifying the artifact type to determine which part of the piece was still preserved. Depending on the type of artifact in question, some other data were obtained, such as the presence of a peduncle, type of peduncle, location of notches, and type of sleeve, as indicated by Silva's scheme for projectile points.

4.4.7.6.4 Percussion Tools

Percussion tools, like axes or hammers, are used to flake or impact cutting instruments, reducing the volume of raw material until the size and shape desired by the craftsman is achieved (Adams 2002; Garcia C. 1967). An ax is a stone artifact cut by direct percussion, attached from its proximal part to a handle. The tie begins in the medial or distal portion of the blade and covers the entire throat, or the area intended for the tie. The ends of the piece define its shape and are made up of a cutting edge at its distal end, the sides or flanks, and a heel or counter-edge at its proximal end (Adams 2002; Garcia C. 1967; Gutierrez 2016) (Figure 120).

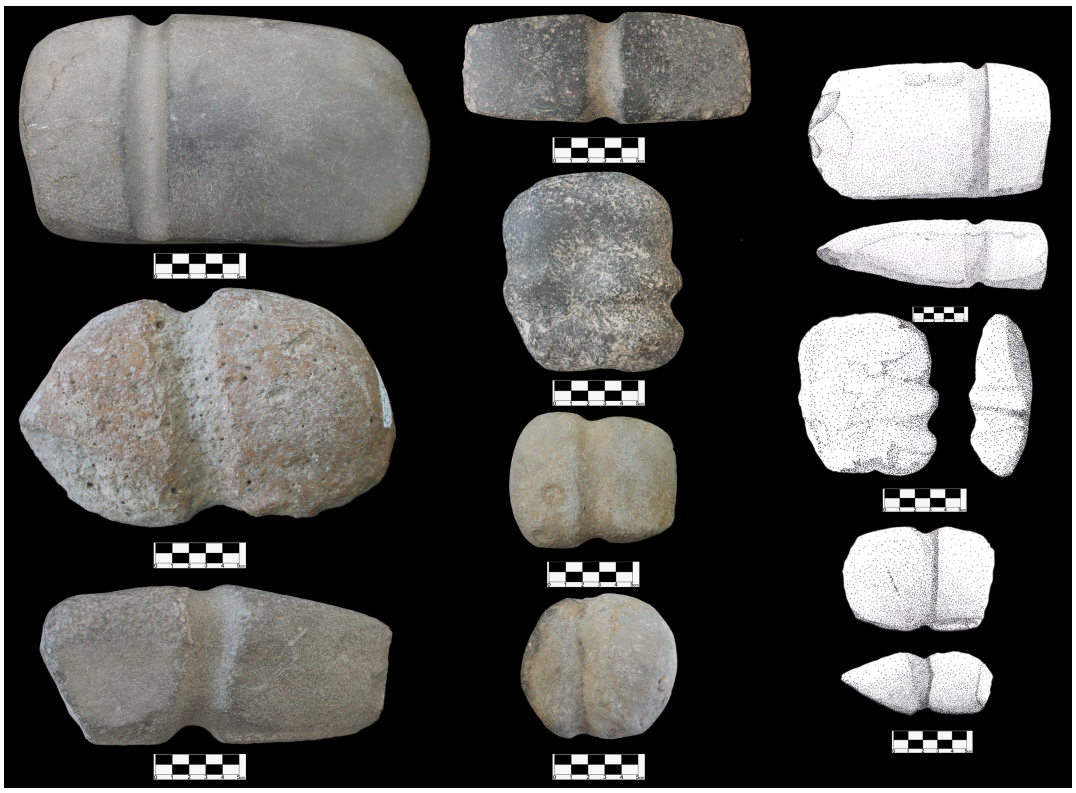


Figure 120. CDEM Axes (G. Aguilar and M. Dueñas).

4.4.7.6.5 Metates

Grinding tools are designed to reduce the particle size of food, clay, mineral, or vegetable pigments to a more delicate texture. This classification integrates manos and metates (Figure 121).

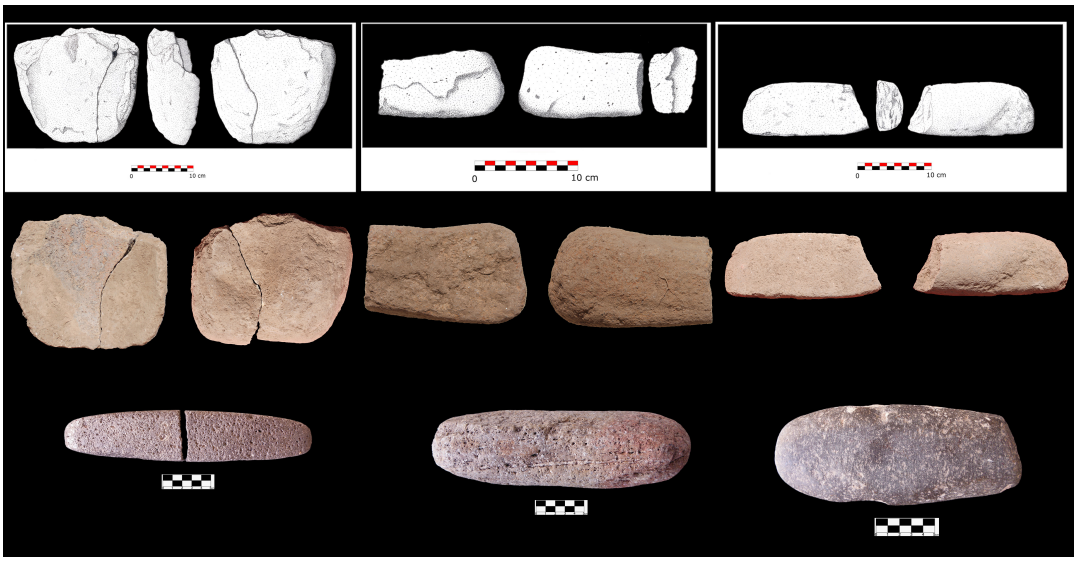


Figure 121. CDEM Metates (G. Aguilar and M. Dueñas).

4.4.7.6.6 Other Instruments

During the analysis, other manufactured pieces were encountered, but their function was not clear. We present various hypotheses, but further research will show their most probable function (Figure 122).

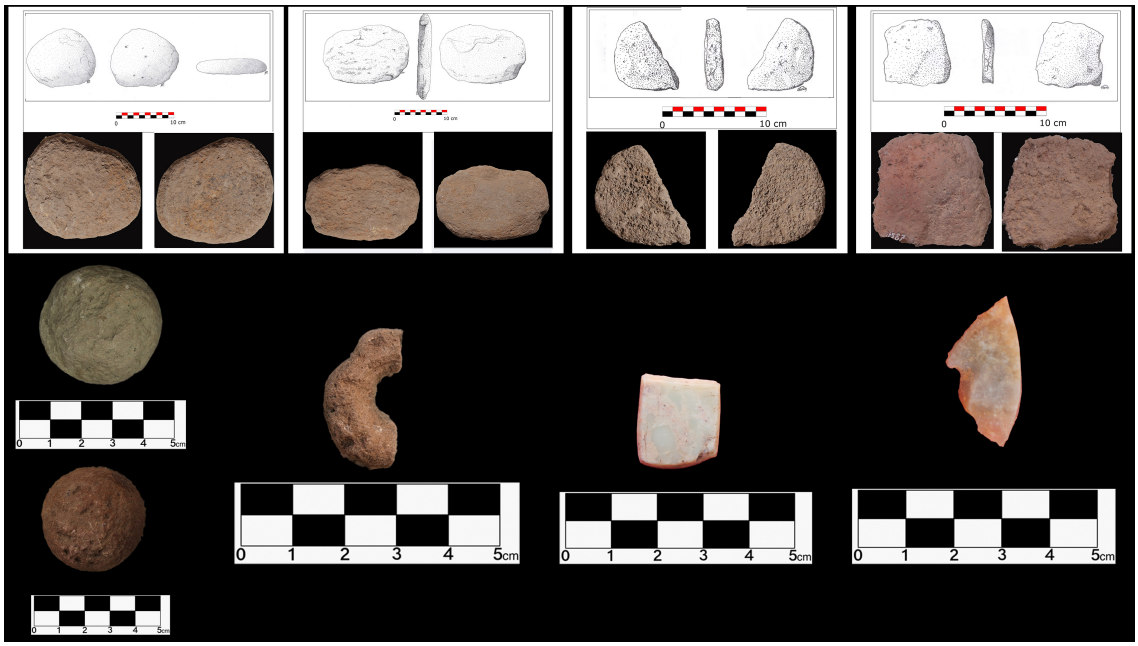


Figure 122. Other instruments (G. Aguilar and M. Dueñas).

Like ceramic diagnostics identified, we can see that different lithic artifacts are simultaneously diagnostic of different things: some types are diagnostic of regional manufacturing techniques, some raw materials are diagnostic of long-distance trade and, at the very least, all of them are diagnostic of activities beyond toolmaking carried out by the people living in CDEM.

Among the recovered artifacts, identifiable materials include polished lithic artifacts such as axes, metates, and polishers; carved lithic materials such as projectile points, blades, and scrapers made generally with local materials such as rhyolite or flint, and allochthonous materials such as obsidian, since no volcanic glass deposit has been found in the vicinity to date. It is important to mention that some forms of arrowheads and scrapers seem to represent typologies from regions of northern Mexico.

4.5 Conclusions

There are several areas where the project has advanced the understanding of the site's internal function and its place in the regional system. The architecture among the patios were analyzed based on three factors: contemporaneity, social class, and function. Concerning the structure’s contemporaneity, the regional setting helps us shed some light on this issue because both the circular patios and square patios with central altars appear in the Northern Border of Mesoamerica at specific temporal periods, as noted in Chapter 3. The circular patios remind us of the Teuchitlán tradition located in the areas of the Tequila volcano in the center of Jalisco

during the early Classic period (Beekman 2005; Beekman and Weigand 2008; Galvan V. 1991; Ramos and Lopez M. 1996). The central altars are an architectural addition that appears in conjunction with sunken patios and pyramids at the beginning of the Epiclassic in the Bajío area (Cardenas G. 1999) and from a little earlier in the Malpaso Valley within the Zacatecas region (Lelgeman 1997; 2000), where La Quemada is an excellent example of the patio architectural canon of the sunken-altar-pyramid. These data help us to position CDEM both in terms of cultural influences and chronology, CDEM falling squarely into the Epiclassic period (600-900CE). Additionally, structures located within the CDEM site are single phase and likely to be contemporaneous. The ceramic and lithic materials are similar between both patios studied, and ceramic analyses supports the Epiclassic dates, allowing us to assert that the ceremonial structures and the peripheral housing units were also likely occupied in the same overall temporal period.

One of the fundamental questions that this project seeks to answer is whether CDEM sustained a permanent population and a sedentary lifestyle. Our surveys and excavations reveal that it is indeed sedentary, though chronologies cannot determine whether there are intermittent or continuous occupations. What can be said is that the site sustained an agricultural economy and was part of regional trade network. This is reflected in an artifact assemblage that includes grinding stones and some trade goods such as obsidian. The site also contains storage areas and constructed permanent residential spaces. The technology and construction materials directly reflect a sedentary lifestyle because, the type of adobe used in construction is well-known ethnographically to be superior to other types typically chosen for its effectiveness in extreme climates and variable yearly weather conditions. This suggests that the site may have been used in any season.

Two construction systems were found at CDEM, one based on wattle and daub and another one based on adobe walls (Figure 123). In the wall construction, stone foundations and masonry walls had a maximum height of 50 cm. These collapsed over the occupation floor in patio #2.,. No post footprints were found in the scans, making it is difficult to know with certainty how the roofs on these structures were supported. Similarities with other nearby sites such as El Cóporo and La Quemada, suggest that roofs could have been flat or one-sided *terrados* or mud roofs (Torreblanca and Dueñas G. 2019).

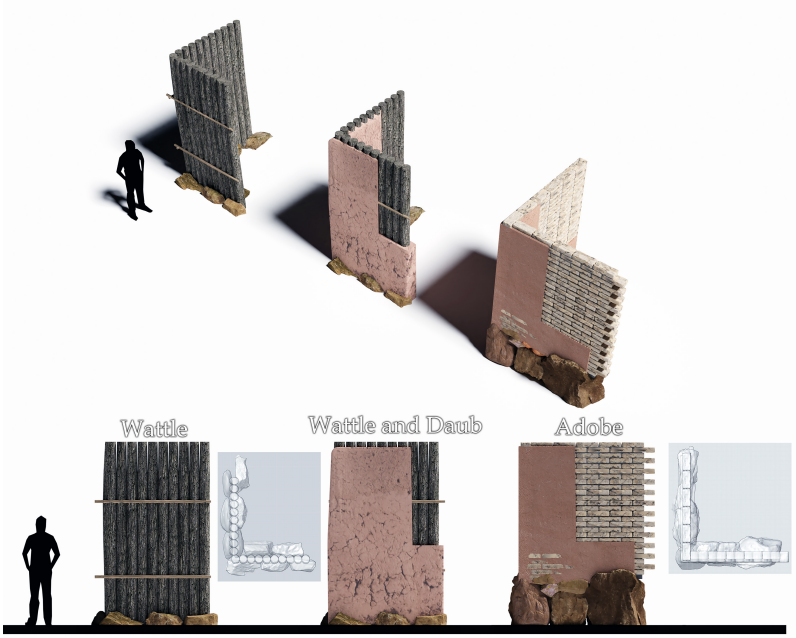


Figure 123. CDEM construction systems. (M. Dueñas)

In Figure 124 there is a hypothetical reconstruction that illustrates the way the granaries structures were built by building up clay walls. Currently, analyses are being carried out to determine what type of materials were stored there, but examples from other areas in Mesoamerica indicate that these were likely used for the storage of corn.

Further the presence of a corn-based diet is evidenced through chemical analysis that demonstrates the use of nixtamal (the corn and lime preparation for transforming corn grain into flour) (Aguilar and Jasso 2017). This is a fundamental component in the sedentary lifestyle.

It is possible to observe differences in the living spaces on the site that allow us to achieve an understanding of the social organization. For instance, the storage structures present at the patios suggest differential accumulation of foodstuffs in various households. Most patios have 1 to 3 storage silos, but Patio #3 has 9 of these units (see Figure 66 and 67). This patio, which seems to be disproportionately storing agricultural products, is the biggest one, also having the most extensive rectangular structure and the most extensive circular structure.

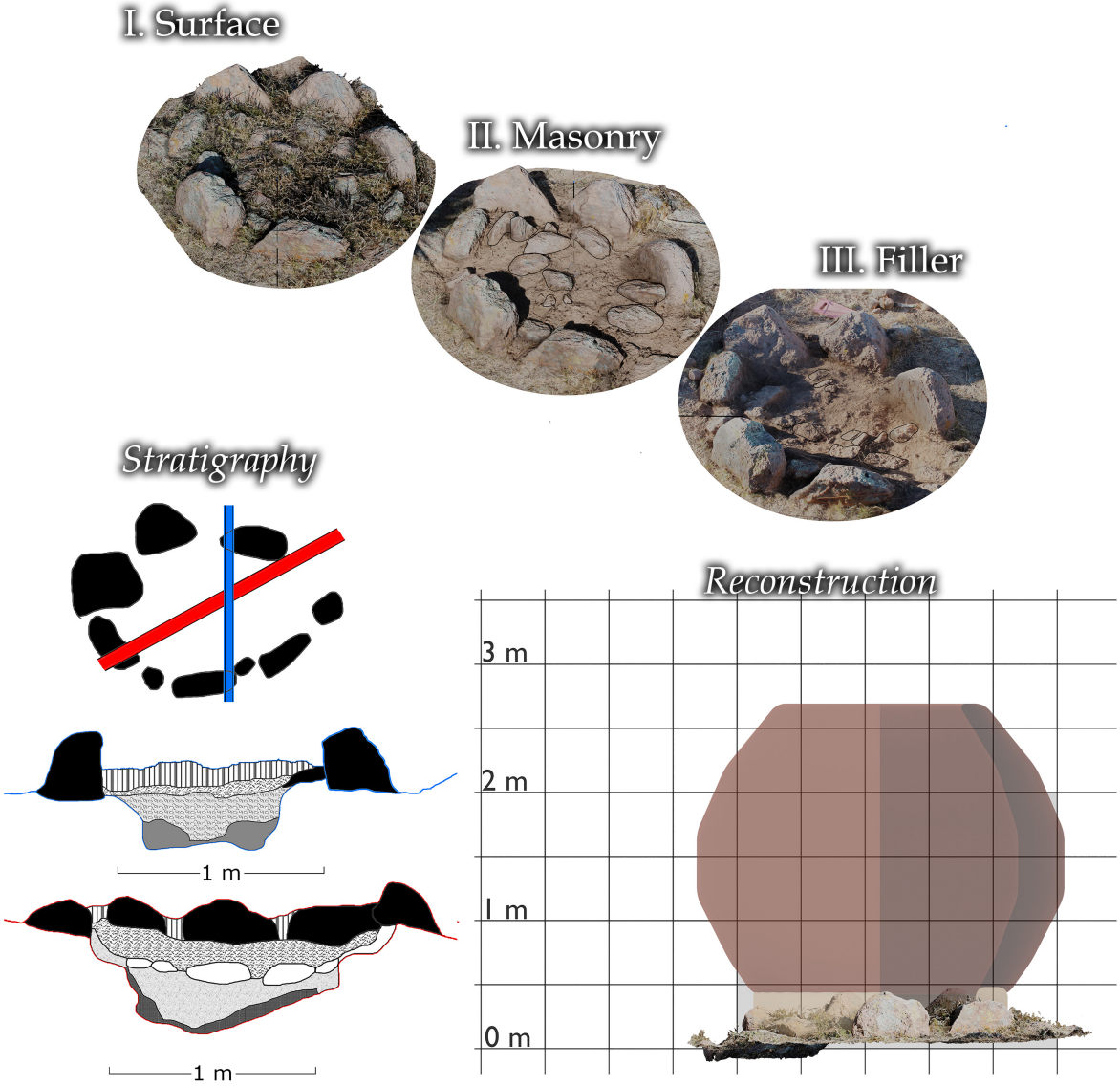


Figure 124. Silo's construction system. (M. Dueñas)

In addition, spatial organization is a consideration. The structural difference of forms can be explained through the functions and transformations that use and reuse can demand. In this sense, the spaces from which we can infer a specific function in the settlement are the residential patios and ceremonial architecture. The central ceremonial structures, consist of a small platform a pair of circular patios reminiscent of the Teuchitlán tradition of Jalisco (Figure 125), and a small ball court. the presence of ceremonial structures and ballcourts are typical of sites in the region to fulfill the religious needs of the community.

The data suggests that social inequalities existed at the site. The buildings in the center of the settlement seem to have a higher labor investment, with quarried rocks in the facade and walls made almost entirely of stone due to the abundant amount of rock found during excavation of patio #9. The amount of effort to level spaces is also impressive, using the natural topography and investing in leveling and raising patios and house units. This suggests that there is a level of management or at least community engagement organized by elites.

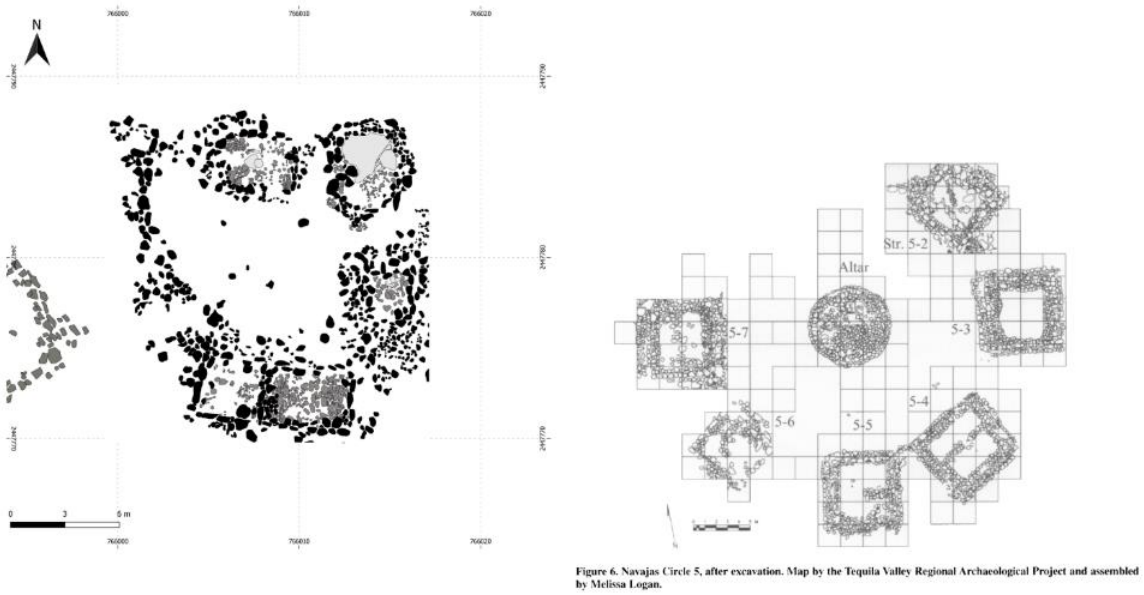


Figure 125. Circular patio comparison between CDEM and Las Navajas. (M. Dueñas)

Finally, one of the most critical aspects is understanding why the ancient inhabitants of CDEM placed their village on the mesa is understanding CDEM's place in a regional system. During the Epiclassic, settlement patterns in the Northern Frontier of Mesoamerica have been attributed to a defensive position due to their locations on top of hills or mesas. Most of the sites previously described as defensive in the Rio Verde Grande Basin region were only partially surveyed. With the demographic information as it is and due to scarce excavation data, it is difficult to infer a regional system, although we can point to some lines of inquiry.

First, we must ask if any of the sites discussed, dominated a regional system? In the Northern Frontier of Mesoamerica during the Epiclassic, it has already been established, based mainly on the presence of regional ceramic styles adorned with symbolic iconography, that interaction among elite members occurred. This evidence a long-distance trade of rare materials and prestige goods as well as widespread information networks materialized by the specialized ritual architecture like mounds or ball courts. The sites in Aguascalientes were clearly part of this trade system. Therefore, the presence of elite groups in the sites procuring these prestige materials could be inferred. But none of this shared material culture indicates any political

dominion of one site over the others. Rather they are symptomatic of intense interaction, trading, and communication among each other to the point that they share a similar cultural affiliation (Jimenez B. 2020).

Not all sites have the same prestige materials. Santiago, for example, has not reported salt commerce or seashells, but it has the biggest ceremonial center at the top of a hill, and contained several of the regional ceramic elite markers of the Epiclassic. In contrast, El Ocote has the smallest ceremonial site, but prestige goods were excavated from each of the households. So, prestige and power had different ways of manifesting materially. In this climate of intense interaction, CDEM has some of the Epiclassic elite ceramic markers and a small ceremonial core. We have not yet identified other prestige goods at the site that could allow us to establish its regional political role. But, together with its unusual setting -having both the ceremonial and habitational structures located on the hilltop, it is likely that CDEM has a special relationship with the other the sites in the region.

Although research is in its preliminary phases the evidence points to the site as having specialized use. If one accepts that the area is plagued by chronic warfare as many researchers have proposed (Baus de Czitrom and Sanchez C. 1986; Lopez M. et al. 1994), it is possible that the site functioned as a place of refuge, ostensibly for the nearby site of Santiago, who supported a similar population size. Santiago is more exposed to the east and down the valley, therefore it is not in a good defensive position.

The refugee population would have conducted everyday tasks to sustain themselves while protected, so they would have required all the raw materials needed for survival without leaving the village for too long. In theory, this should leave evidence of the procurement and storage, and it has been demonstrated that CDEM is the only site in the region that contains storage units necessary for a refuge. The rest of the year, the site could have served other purposes, possibly maintaining a smaller population consisting of an elite group occupying Patio #3, or perhaps Patio #9 that housed multiple storage units.

Additionally, although CDEM may have a small ballcourt (See Figure 93) and a small religious shrine, these do not feature prominently as those at Santiago. Therefore, it appears that CDEM is secondary to the larger site. This too supports a refuge model. Finally, another factor is that when one considers the settlement pattern, CDEM is the only site in the region in which all the residential structures are located atop the mesa, further supporting a defensive stance.

Many questions remain unanswered, but up to this point, we have presented all the archaeological information that the project has generated so far. The main goal of this thesis is to transmit the relevance of the settlement to the public in a palatable way. This raises the critical question: what is appropriate to present to the public effectively? What are their interests and concerns? The next chapter defines a communication strategy using Meaningful Divulgation.

Chapter 5
Meaningful Divulgation and Serious Games: CDEM Virtual Visit

5.1 Introduction

This chapter constitutes the synthesis of a thematic interpretative proposal of an archaeological site for its virtual visit. Here, the project will define *why* it is important in archaeology to "divulge" and *what* is important to divulge to the public. Addressing these topics supports the design of a script for guided tours of this type, which aims to involve visitors in the site through the necessary translations of the specialized language (which constitutes the archaeological information that exists about the site) to the general public. Finally, the technology that allows us to create this virtual tour is discussed.

In order to communicate the heritage value that archaeological research produces effectively, the information generated is not enough, but. requires a communication strategy. The effective communication of historical/archaeological heritage is inexorably linked to conservation, and although institutions are crucial for the protection of heritage, it is more effective for heritage to be protected by citizens--. that is, a public heritage defended by civil society (Gandara V. 2019). To achieve this, however, archaeologists need to present their work in a manner in which the public is the target audience and the central focus of the presentation.

As proposed in Chapter 1, the challenges related to knowledge dissemination in the social sciences are different from those in the natural sciences. Science museums worldwide use general theories produced by the natural sciences, leveraging experiments and equipment to represent and make accessible the scientific discovery they aim to convey. In social or history museums, the research process itself is sometimes not considered worth mentioning and is often not included in exhibitions. Consequently, museums presenting knowledge from the social sciences often communicate only empirical results, i.e., the so-called "hard data" and technical descriptions, and few people want to visit them. What this translates to is that the public is less likely to become an ally in conserving archaeological heritage. Only archaeologists, historians, or specialists may find the raw data fascinating.

The apparent apathy of the public is, in part, the result of the apathy of museum curators or archaeological site staff themselves, because sometimes they are only interested in looking good to other curators, historians, museographers or specialists; these specialists are little concerned that heritage reaches the public in a pleasant, entertaining way. Therefore, the purpose of this chapter is to consider how to communicate what archaeologists, anthropologists and historians do, in an effective way.

5.2 Meaningful Divulgation in Action

Interpretation requires a clear organization, a structure that the public can follow, and a finite number of ideas that people can retain and remember. That is why it should revolve around a single theme, and if one manages to get the public to reflect on this theme, then the interpretation will have fulfilled part of its mission. However, the goal is not simply for the public to retain the message, but also for them to act in favor of heritage conservation, and this will depend a lot on whether that message is relevant to them, whether it touches them, and whether it resonates with

them. That is why thematic interpretation refers to universal concepts with which the public can identify (Ham 1992).

At a minimum, Meaningful Divulgation presents descriptive data but to divulge effectively, it is necessary to go beyond the description, especially technical descriptions that normally turn audiences off. Most importantly, its goal is to preserve heritage by disclosing its heritage value by taking a narrative approach. In this sense, a well-posed conjecture (openly recognized as such, maybe even with contending points of view), is preferable to a long, boring, and spineless description, even if that description is fully supported by empirical data. Therefore, audience engagement is of the utmost importance.

5.3 The Script for Virtual Visit to CDEM

The goal of this script is to translate household archaeology through a social archaeology perspective using the data recovered during the past 10 years of research to create a virtual tour of CDEM. The translations are presented in the main thesis and sub-thesis. Later, the specific proposal for a virtually guided tour in CDEM is presented including each of the proposed stops. At the stops the user will view the characteristics for why that station was chosen as well as other types of specifications such as the estimated time and the narratives that will be discussed.

5.3.1 Conceptual Design

The present conceptual design for Meaningful Divulgation seeks to be the instrument to create a work plan that communicates the heritage values of the CDEM archaeological site to the community of San José de Gracia, and in general to the population interested in the pre-Hispanic heritage of Aguascalientes.

5.3.2 Background Information

CDEM is a pre-Hispanic settlement (600-900 CE) in Aguascalientes. It is located on the northern border of Mesoamerica. Its privileged location along a plateau hidden between canyons and difficult to access allows us to take a look at the complicated sociopolitical conditions during the Epiclassic, as well as providing an excellent example of the adaptability of the Indigenous cultures of the country. Since 2012, it has been the object of study of an archaeological project that, together with the community, has established the basis for a digital exhibition that significantly disseminates the relevance of the archaeological heritage.

5.3.3 Justification

The historical socio-cultural conditions of the north of central Mexico as is information about the pre-Hispanic past of Aguascalientes are little-known. Colonial stereotypes of the Indigenous populations in the north of Mexico are a systematic problem in which the educational authorities, researchers, and academics take part. The characterization of this region as by fortified settlements and laden with unstable social organization, a belief most likely promoted by the Spaniards' 16th-century accounts. Recognizing this problem, from an archaeological perspective, we propose that the communication, not only of the results of archaeological investigations, but also of the motivations, interests, and questions, require interpretation to be meaningful. In

addition to this, since 2015 there have been efforts from the San Jose de Gracia municipal government, along with the state government, to diversify the cultural tourism offer of San Jose de Gracia by making it a *Pueblo Magico*[2], which gives an extra boost to the tasks of divulgation.

5.3.4 "Endgame"

Endgame is Ham's term for the overall purpose of an interpretive program (Ham 2013:53). This meaningful divulgation endgame is to entertain the young public of Aguascalientes while reflecting on the continuity of Indigenous knowledge found in the CDEM; that is, to entertain and to provoke.

5.3.5 General Objective

The objective of the project is to promote appreciation, enjoyment and understanding of heritage values, and to promote a culture of conservation of the archaeological site. The aim is to integrate the Indigenous culture and past into the identity of the Aguascalientes population and of San Jose de Gracia in particular. To achieve this second objective, we will create a virtual tour of the archaeological site of CDEM that exposes what daily life was like on the site during its occupation between the VI and IX centuries of our era, thus achieving a more inclusive society by being more aware of the permanence not only of Indigenous communities, but also of their culture, lifeways, and technology today.

5.3.6 Target Audience

The target audience for this project is a national young public with basic and intermediate level studies (according to the primary and secondary official curricula on History), especially those in the San José de Gracia vicinity, and Aguascalientes at large. Of course, the general public is included as well.

5.3.7 Characterization of the Heritage to be Interpreted

The archaeological site is a 7ha mesa located on a plateau 12 kilometers from the municipal seat of San José de Gracia. It is a site made up of 213 architectural structures of which only their foundations remain. Archaeological excavations have found in context ceramic materials of regional typologies located during the Epiclassic (600- 900 CE) on the Northern Border of Mesoamerica.

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[2] The *Pueblos Magicos* (Magical Towns) program is a comprehensive federal tourism development program for localities that organizes various actions of an economic, social, and environmental nature with the purpose of improving the living conditions of a tourist locality. It allocated federal money to build touristic infrastructure like paved roads, access to touristic spaces, cleaning services, advertisements, etc. Currently, there are 132 Magical Towns in Mexico. Source: *https://www.gob.mx/sectur/acciones-y-programas/pueblos-magicos-267851*

5.3.8 Information Available

The archaeological site is mentioned for the first time by the archaeologist Eloy Castellanos in his project "Identification and cataloging of archaeological sites in the state of Aguascalientes" (see Table 1, below), in whose 1991 technical report he reports having visited the Cerro de en Medio and reported that the site shows stone alignments on the surface; he registered 17 structures and also reports recent looting. Regarding the structures, he explains that it is rudimentary architecture consisting of walls of carved stone embedded in the earth, without the use of cement; the stones are set in rectangles or semicircles, possibly rooms with ceilings and walls made of perishable materials. Later he carried out excavations with disappointing results. According to the same report, he did not find cultural materials that would help to understand neither the site's chronology nor cultural affiliation.

Table 1. Diagnosis of the socially available information.

Publication type	Title	Author	Publication date
Report	Identification and cataloging of archaeological sites in the state of Aguascalientes	Castellanos C.	1991
Report	Identification and cataloging of archaeological sites in the state of Aguascalientes 3rd Stage	Castellanos C.	1993
Report	identification and cataloging of archaeological sites in the state of Aguascalientes Final Report	Castellanos C.	1994
Report	Archaeological Atlas Project. Prospecting at Cerro de en medio and Cerro del Meco	Dueñas G.	2013
Report	PACE Partial Report 2014-2015	Dueñas G.	2015
Report	PACE Research Report 2018	Dueñas G.	2018
Thesis	Northern border of Mesoamerica	Dueñas G.	2017
Scientific article	Evaluating settlement defensibility during the late classic in northern frontier of Mesoamerica: a geospatial approach to the study of conflict	Dueñas G., Campos M. and Lercari	in press
Magazine Article	El Cerro de en medio, a pre-Hispanic settlement hidden among canyons	Dueñas G. and Campos M.	2021
San Jose de Gracia municipality Coat of Arms		*anonymous*	1953

Since 2012, researchers from the Autonomous University of San Luis Potosí, in collaboration with staff from INAH Aguascalientes, began the Cerro de en Medio Archaeological Project (PACE) investigated the site with the goals of updating previous records, updating the cartography available up until that time, and characterizing the archaeological site accurately. After the first field season, the project broadened its objectives, now also seeking to delimit and characterize the archaeological settlement via 1) the mapping of its structures identified on the surface and 2) analyzing the housing structures to learn about the way of life and the social hierarchy of the site, 3)analyzing the archaeological materials in order to inquire about the way of life, subsistence and exchange economy and the cultural interaction with the neighboring regions and sites, 4) establishing a preliminary chronology of the site through typological comparisons of ceramics and lithics, as well as typified architectural spaces.

5.3.9 Assessment of the Heritage Site in Terms of the "Dimensions of Heritage Value Star"

This "Star of Value" is a quick assessment tool developed by Gandara V. (2018a) as a complement and even an alternative to the concept of "genius loci[3]," which is normally used by heritage interpreters. By examining five "dimensions of value" Gandara V. (2018a), we can gain a deeper understanding of the heritage site (or element), which makes it easier to construct the main "theme" or "thesis." The goal is to determine which of the five dimensions are salient at the site, and that helps to focus the creation of the thesis (Figure 126).

5.3.9.1 Historic Value

CDEM has historical value to the San Jose de Gracia community expressed in the inclusion of its Indigenous past to the municipal coat of arms in which a bow and stone axe and arrow are portrayed. This mainly due to the historical accounts of the Chichimeca, because the founding of the town of San Jose de Gracia began when in the 18th century a group of evangelized Indigenous people from the Jalisco's Highlands bought a large cattle site called "de Marta." These first records mention that various families were using CDEM as their habitation, and from there they would in the early 19th century, found the town of San Jose de Gracia, as a "*Pueblo de Indios*", which would already appear with this name on various colonial maps and documents.

It is thus that the archaeological site Cerro de en Medio was mentioned as part of the founding process of San Jose de Gracia, although there is no material evidence of the early colonial use of the site. But, it is possible there has been an interrupted occupation. Witness to this are the construction systems that have been identified in archaeological investigations, which connect the populations of the Epiclassic with Colonial and modern San Jose, as they continued to be used in the construction at the *Pueblos de Indios*, and even in the current Town.

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[3] The term derives from the Roman religion, according to which it represented the protective spirit of a place (Kepczynska-Walczak and Walczak 2013). The genius loci, or special meaning, is considered the starting point for Heritage Interpretation (Beck and Cable 2002).

5.3.9.2 Scientific Value

The archaeological site has a very high scientific value because it has not been looted and therefore one of the few well-preserved sites in the state of Aguascalientes. In addition to this, the site presents circular architecture, typical of the Teuchitlán tradition, making it probably the oldest sedentary site so far registered in the state of Aguascalientes.

5.3.9.3 Aesthetic Value

The site's aesthetic value is perhaps not its strongest component because it pales in comparison with the larger monumental archaeological Mexican sites. However, the semi-desert landscape is not without charm as it can be contrasted with the pine-oak forest of the Sierra Fría (connecting cultural heritage with natural heritage). During the rainy seasons the site is surrounded by the rising streams that flow into the Calles Dam basin, with which waterfalls and springs appear around the site, allowing one to hear the running of the water from the plateau. The dam also allows the arrival of migratory birds, which make the site a privileged place to bird watch. To date, it is within a protected natural area as it is one of the few places in Mexico where the golden eagle nests. In short, its aesthetic value could be developed from natural heritage perspective.

5.3.9.4 Symbolic Value

Finally, although at present the symbolic connection between the population of San Jose de Gracia is not entirely clear, the site is included in its Coat of Arms. Therefore, this project seeks to make the population reflect on the permanence and millennial cultural continuity with the site. The site is not a place of legends or myths and although the local population knows of its existence, it is still not clear who lived on the site and why, questions that the archaeological project seeks to solve. Therefore, the symbolic value is not developed among the modern San Jose de Gracia population but can be a potential source of pride.

5.3.9.5 Economic Value

The economic value of the site can be evaluated from the touristic potential of San Jose de Gracia because the main economic activity of the municipality is already religious and adventure tourism. Taking advantage of the canyons and the landscape of the Sierra Fria, part of the Sierra Madre Occidental, is the main source of economic benefit for the entire municipality. Additionally, the archaeological site has the potential to take advantage of its proximity to the city of Aguascalientes, the tourist infrastructure of the municipality and the promotion that the place already has as a *Pueblo Magico* coupled with the fact that there are no archaeological sites open to the public in the State.

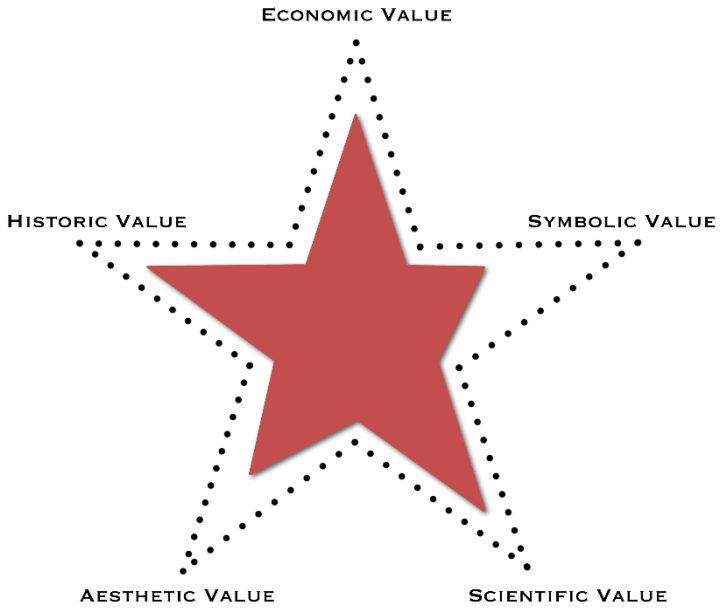

Figure 126. Value star. The red star symbolizes the current values, and the pointed outer star symbolizes the potential value, achievable through an effective communication technique (Based on Gándara's (2018a) model of dimensions of heritage value) (M. Dueñas).

5.3.10 Guiding Questions

The guiding questions make the backbone of our Meaningful Divulgation of CDEM approach.

- Who lived at Cerro de en Medio?
- Since when?
- Were they a warrior society? /is their site a fortress?
- How did they build their houses?
- What foods did they eat?
- What things done in the Epiclassic are still done in the community of San José de Gracia today?
- What do we have in common with them?

5.3.11 Specific Objectives

This refers to the kind of information that would facilitate understanding the main thesis and sub-thesis. It will include background and context information, as well as clarification of technical terms that could not be eliminated.

Knowledge Objectives

1. That the public will culturally contextualize CDEM in the northern border of Mesoamerica, understood as a zone of cultural confluences, mixtures, and reinventions, outside the dichotomy of civilization-barbarism and prejudgments about violence in the past.

2. That the public will recognize the advantages of the construction systems found in CDEM, and their relationship with the environment, not as evolutionary stages, but as practical solutions to common problems.
3. To show the public the diversity of food resources of the semi-desert cuisine found at CDEM, and Indigenous deep knowledge of natural rhythms by pre-Hispanic populations.

Emotional Objectives

1. That the public from Aguascalientes will feel pride not only in the pre-Hispanic past of the site, but in the regional pre-Hispanic past of the Mesoamerican north, which, together with the south of Zacatecas, north of Jalisco and the Potosino Altiplano were part of the same cultural dynamics.
2. “If it isn’t broke, don't fix it.” That the public will reflect on the continuity of Indigenous knowledge as part of our current culture (Anthropological approach).
3. That the public will take pride in knowing that their ancestors were not “Chichimeca savage warriors” that barely could survive, which is a common perspective on hunters and gatherers in the northern states, and even in the Bajío region.

Action Objectives

1. Call to reflection on local identity, as a mixture where Indigenous knowledge is present today, is part of our daily life and a source of pride. That is why CDEM is a material witness of this knowledge, of its closeness to us and that is why it is worth preserving it.
2. Invitation to use the digital visit (once it is finished).

5.3.12 The main Theme - Thesis

CDEM tells a story over 1,000 years old, a testament to the ingenuity of Indigenous populations to adapt to the Aguascalientes environment, with ingenuity that persists to this day.

Subordinate Messages (sub-themes).

Sub-thesis 1. Who lived at Cerro de en Medio and since when have they lived there?
CDEM is a sedentary settlement of agrarian Indigenous population culturally related to the populations of "The Northern Border of Mesoamerica", which flourished between the 600 – 900 d.C.

Sub-thesis 2. Were they a warrior society?
Although the project found indications that the difficulty of accessing the site provided defensive advantages if the population of CDEM were attacked by its neighbors, it is the only site in the entire region with these characteristics. Could it be that this village functioned as a temporary refuge?

Sub-thesis 3. **A comfortable home for a particular climate**
To adapt to climate changes not only in the year, but also to the difference in temperature between day and night, the residents ingeniously used stone foundations that prevented the deterioration of the adobe walls, which function as thermal insulators.

Sub-thesis 4. **Eating in the semi-desert requires ingenuity.**
Providing food and water in this area requires being clever. The environment provides edible plants such as the mesquite pod or the cactus fruits, but it also allows the hunting of wild animals such as deer, rabbit, or even frogs, although in a sedentary population agriculture consumes most of the time. At the site we have detected the use of nixtamal, an ancient technology for preparing corn flour, which can potentially be eaten in the form of *tortillas*, *tamales* or even drunk as *atole*.

Sub-thesis 5. Changes and continuities.
We really are not that different today. In San Jose de Gracia people still build in the same way and eat in the same way.

Sub-thesis 6. Together, we can preserve this heritage.
It is important to preserve this heritage as a testament to the ingenuity of the native peoples, their resilience and continuity to this day.

5.4 Media

The media will be a multimedia application accessible from the web. Due to the delivery mechanism, a multimedia medium is a non-personalized, low-cost sequential medium: it is software, which does not require personnel training nor maintenance costs; and it will be accessible through the web all year long. It would be a series of interactive Serious Games.

The general objective of the Serious Game is to experience a virtual visit to the CDEM archaeological site via a “walking simulator” that, when explored, tells the narrative according to our meaningful divulgation strategy.

The particular objectives are:

- The production of a three-dimensional environment, with 3D models both modeled and extracted from reality using photogrammetry and laser scanning.
- The programming is oriented to the production of a first-person perspective simulator, with an interface operated via the peripherals of a personal computer, such as a keyboard and mouse.

Walking simulators are narrative games that generally avoid any type of user input outside of movement and environmental interaction, allowing players to experience their narrative through exploration and discovery. Walking simulators feature few or no puzzles, and there may be no winning or losing conditions. These simulations allow players to roam the environment and discover objects such as books, audio logs, or other clues that flesh out the story, and can be augmented with character dialogue and non-playable “cutscenes, i.e. short videos that illustrate the story. These games allow exploration of the game world without any time limits or other enforced restrictions, an option not usually offered in more action-oriented games.

These types of games are also called "environmental narrative games" or "interactive narratives," emphasizing the importance of narration and the fact that the plot is told through interaction with environmental elements. Notable examples of walking simulators include *Gone Home* (The Fullbright Company), *Dear Esther* (The Chinese Room), *Firewatch (*Campo Santo*), The Vanishing of Ethan Carter (*The Astronauts*), Proteus (*Ed Key and David Kanaga*), Jazzpunk (*Necrophone Games*), The Stanley Parable (*Galactic Cafe*), Thirty Flights of Loving (*Blendo Games*), and What Remains of Edith Finch (*Giant Sparrow*).*

The walking simulator genre is the one favored by independent video game developers. However, some triple-A, high grade commercial examples have begun to show features of walking simulators. *Assassin's Creed: Origins and Assassin's Creed: Odyssey* (Ubisoft) features a "Discovery Mode" that removes combat from the game and allows players to explore recreations of Ancient Egypt and Ancient Greece, respectively.

The proposal then is based on a walking simulator to carry out the visit, although there will be three stops with particular scenes and mechanics. At the end of the Conceptual Design, it is necessary to create a “congruence table,” to check if all the design correctly transmits the messages. Our table of congruence can be found in Appendix 1.

5.5 Synthesis of the Guided Tour.
Interpretive Script for a Virtual Guided Tour in CDEM

STOP 1. INTRODUCTION TO THE SITE

Specs:

Location: Starting position at the eastern entrance.

Estimated time: 2 min.

Points to discuss:

- Introduction to the walking simulator application
- Introduction to controls
- Introduction to the Theme

Development

The past comes to meet us in different ways. Sometimes we come across places that we have no written mention of and all that is left of what people did. This is the case of CDEM, which tells us a story of more than 1,000 years, a testament to the ingenuity of the Indigenous populations to adapt to the environment of Aguascalientes, an ingenuity that persists to this day. Join us to discover our heritage.

CONTINUING STOPS (8 DURING THE TOURS). SPACE-TIME CONTEXT

Specs:

Location: Throughout the tour

Estimated time: 20 min.

Points to discuss:

- Interaction spheres of the Mesoamerican Northern Frontier during the Epiclassic

Development

Throughout the tour, the user will find objects recovered throughout the CDEM investigations. Upon inspection, geographical and cultural information will be displayed in the form of a 15-second video showing a map and naming the most important sites where similar artifacts have been found. The 8 objects are: (from Chapter 5): pseudo-cloisonné, annular

bases/reversed edges/negative decoration, incised/sgraffito, tablets, tripod bowls, Type I Figurine with coffee bean eyes, and obsidian points

Example of info: Pseudo-cloisonné Northern Sphere
Map
Text: This type of vessel stands out for its fine decoration and its association with religious rituals dedicated to the Aztec God Tezcatlipoca, that include the consumption of pulque. They have been found in archaeological sites of this region, shown in the map.

STOP 2. THE WALL AND THE VIOLENCE IN THE PAST.
Specs:
Location: Eastern Wall
Estimated time: 3 min.
Points to cover:

- The concern for security on the site.
- How far can you see from the site?
- What does controlled access to the site tell us?

Development
Video: presentation upon arrival at the wall, showing that visual control was not an essential factor that influenced the decision to settle in this place, but also based on the hiddenness of the site and its ability to withstand small-scale conflicts. We argue that CDEM was a refuge and not a fortress, and thus evidence of sporadic or seasonal conflict in the region challenges previous interpretations of the Northern Border as a land of perpetual violence and calls for renewed investigation.

STOP 3. HOW WE FIND THE EVIDENCE OF THE PAST
Specs:
Location: Yard #1
Estimated time: 2 min.
Points to discuss:

- Evidence on the surface of the site: alignments and open spaces.

Development
Video: presentation upon arrival at patio #1. Evidence of the past can take different forms. Identifying them is the work of archaeologists, and at CDEM we have found evidence of 215 buildings. Some of them are arranged around open spaces that we call “Patios.” Although these patios share similarities with each other, such as having multiroom structures and storage units, the differences between them are substantial. Some patios are circular, some have central altars, and others have perimeter walls. These differences could be explained by factors such as contemporaneity (same forms correspond to the same time), social class (the more elaborate, the higher the rank of its inhabitants) or function (same form, same function).

STOP 4. HOW THE ANCIENT INHABITANTS OF CDEM BUILT
Specs:
Location: Yard #3
Estimated time: 5 min.
Points to discuss:

- Construction systems

Development

Two construction systems were detected at the site: *bajareque* walls and adobe walls. So that the visitor understands how the buildings were built, we will use an interactive application in which different materials have to be selected to build, illustrating step by step which materials and techniques could have been used and the different results. As the user experiments with different materials and techniques, the walking simulator will now have the reconstructed structures of the entire site enabled, showing how it could be seen when it was inhabited. Symbolically, the user's action brought the site back to life.

STOP 5. KITCHEN AND FOOD

Specs:
Location: Yard #2
Estimated time: 5 min.
Points to discuss:

- Recipes

Development

Upon reaching patio #2, the user will enter another scene, restricted to a pre-Hispanic kitchen corresponding to the one found in this space after the explorations. He/she will have all the clothing material, and the ingredients to make recipes that will be requested. The user will have five minutes to complete them; the more recipes completed, the more points accumulated. At the end, the user will return to the walking simulator.

STOP 6. CHANGES AND CONTINUITIES

Specs:
Location: Yard #9
Estimated time: 5 min.
Points to cover:

- Continuity in constructions
- Continuity in food
- Continuity and changes in economic activities such as

0. Agriculture
1. Hunting
2. Pottery
3. Clothes

Developing

Upon reaching patio #9, the user will enter a restricted space with a reconstruction of a daily scene in patio #9. The user will be able to interact with highlighted objects and spaces that, when selected, will show a certificate with photographs, videos and interviews and oral history about the continuity and changes in these aspects.

STOP 7. HELP US PRESERVE THE SITE

Specs:
Place: Big House
Estimated time: 2 min.
Points to cover:

- Call to action

Development

“There are still many questions to be answered, and with your help we will be able to preserve this enigmatic place, continue studying and one day resolve its mysteries”.

5.6 Game Development

The next phase in the process is the “game development” proper. Our game design includes all the functionalities, the player character, the non-player characters, game assets, and animations. To document this properly, we will use screen mock-ups and other pieces of documentation discussed in Borromeo (2021). The game design is like the blueprint. It is the foundation for the look of the game, what the players objectives are, the gameplay, supporting user actions, animations, audio, Artificial Intelligence, and victory conditions.

The first component is the game idea. Our basic concept is a third-person view walking simulator where the player can follow a track, triggering information hubs and minigames that will convey the heritage value of the site. The game ends when it reaches a certain point, at the end of the virtual visit. One minigame is about building a house, and the other minigame is about cooking ancient recipes. All design decisions and mock-ups can be found in Appendix 2.

5.7 Recapitulating

Throughout this chapter we discussed not only why it is important to divulge heritage meaningfully for conservation purposes, but also that the research delineates the knowledge being created in CDEM’s archaeological project, which includes explanation and understanding as to how we can translate it using thematic interpretation into a divulgation program. Finally, we presented the virtual tour design as well as the decision making regarding the messages that convey valuable information to the public.

Chapter 6
Conclusions

This doctoral dissertation has engaged with the production of archaeological, anthropological, and museographic knowledge, both theoretically and methodologically, through the creation of a Meaningful Divulgation strategy for the Cerro de En Medio archaeological heritage. Until today, the pre-Hispanic past of the state of Aguascalientes has remained largely unknown. Its history beginning in most texts with the presence of nomadic Chichimeca hunter-gatherers who were the object of abundant prejudice and stereotyped as “savage.” To correct this characterization, my research and dissertation have demonstrated a more complex panorama populated by sedentary agrarian societies during the Epiclassic. By conducting a systematic archaeological study, my work updated and reviewed the data on the existing archaeological information associated with the CDEM archaeological site and others framing archaeological data from Aguascalientes within a regional context as part of the Northern Mesoamerican Frontier.

In addition to expanding the chronology of occupation, the archaeological materials recovered and analyzed during the explorations of CDEM revealed cultural ties with other sites of the northern part of the Río Verde Grande, the Northern Border of Mesoamerica and West Mexico through like related ceramic types, architectural patterns, and lifeways. This shared horizon belongs to an apogee period detected by other researchers in areas like Chalchihuites, the Gran Tunal, the southeast of Zacatecas and Los Altos de Jalisco. It points out that the Río Verde Grande region was an important artery of communication that during the Epiclassic. Moreover, the interaction was not limited to this region. The artifact record from archaeological sites gives us a much more complex picture. Earrings and necklaces made from seashells from both oceans (Pacific and Atlantic), ballcourts, mounds oriented towards sunrise and sunset, sunken patios, and figurines related to the salt trade are evidence of the extensive and complex pre-Hispanic cultural connections and trading system of the Río Verde Grande.

These regions have been considered by both scholars and the general public to be populated by the misnamed and under-studied "Chichimeca hunter and gatherers," mainly due to the limited extent of the geographical, temporal scale of the studies, and the lack of detail in the analysis of the archaeological evidence. In the framework of the North Mesoamerican Epiclassic border, the region of the Rio Verde Grande was populated by sedentary societies that in a macro-regional perspective seemed to be part of different trade routes connecting the coasts of two oceans with an inland semi-desert route. Understanding these conditions will help us dispel derogatory conceptions of the populations north of the Lerma River in pre-Hispanic times. Instead, this project proposes an interface zone between the groups of the "Nuclear Mesoamerica," "Greater Mesoamerica," and "The Gran Chichimeca." The Epiclassic, far from being a period of fragmentation, instability, and constant conflict on the border, can be better characterized as a period of intense regional interaction.

At some point during the Epiclassic, conflict might have increased to the extent of creating a settlement like CDEM as a place of refuge. There are several lines of data that point to the specialized use of CDEM as a refuge, like inaccessibility, elevation advantage, and having all residential structures up to the mesa, characteristics that are unique not only in the Rio Verde Grande basin, but in general through the Northern Mesoamerican frontier.

Particularly, the CDEM archaeological project successfully delimited the archaeological settlement and initiated investigations of the ancient population’s lifeways and social hierarchy

by deploying and advancing digital methodologies for surveys and excavation records using a 3D photogrammetric methodology to record both the stratigraphy and the location of artifacts. This allowed for the timely completion of fieldwork, in the difficult conditions of the COVID pandemic, while maintaining a high level of data quality by using a 3D photogrammetry record of Matrix Harris units and GIS data management. Archaeologists and other stakeholders are increasingly turning to digital methods to mitigate some of the threats to at-risk heritage, and to enhance the scale and reach of capturing, analyzing, managing, curating, and disseminating archaeological knowledge.

To accomplish the latter, the Meaningful Divulgation for CDEM developed with project information focused on depicting daily household life through the lens of Marxism. Perhaps the most important consequence of this position with a strong dialectical heritage, is the idea that everything in society is historical. That is to say, it had an origin, it has been transformed continuously, and can even disappear.

But to adopt historical materialism generates consequences, even at a level of generality as broad as that employed in this project. One of these is that our central obligation is towards the subaltern classes. This contradicts approaches that see the "educated public" as the ideal audience for museums and coincides with a principle derived from visitor-centric approaches--designing museums for more general audiences. This kind of public is numerically much larger than the elite audiences that some museums prefer to serve.

In the twentieth century, it became clear that the museum, as an institution, had great power to legitimize and empower its collections and exhibitions. Thus, creating and presenting a digital exhibition to the local audience in Aguascalientes on topics such as traditional cuisine or building techniques along with exhibits on the archaeology of the Northern border of Mesoamerica, can potentially legitimize the region's cultural heritage and increase a sense of pride and identity in the local population. These are among the main objectives of the CDEM's Meaningful Divulgation produced in this dissertation. Additionally, the produced digital exhibition can be used to instruct the sizeable migrant population of the nearby town of San José de Gracia, who may have lived for many years in the United States and return every year to the area for the Dia de San Juan, the saint patron's festival in their home village. During the festival, families take those who may have been away to renew their sense of their culture. In addition, even people who may not have left the community can also learn about their own culture.

Another ethical and political consequence of this project's position is that divulgation must combat prejudice and discrimination. Visiting an archaeological site is an opportunity to reflect on ideas, which in many cases are inaccurate or unfair when they refer to past cultures. These ideas almost always bear the imprint of the visitor's own culture, which is why they are, in many cases, mere stereotypes. But drawing attention to them can lead to fairer ideas. Presenting archaeological theories to the public may be risky because they are bound to change with future research, but it is also an opportunity to comment on the controversial and changing nature of scientific knowledge as well. This project proposes that cultural diversity in the Northern Border of Mesoamerica is explainable and that several diverse lifeways coexisted. Proposing a Meaningful Divulgation for CDEM in such a peripheral region is crucial because the cultural diversity can be studied and exemplified clearly so long as its materiality is preserved for future study.

The preservation of cultural heritage requires integrating activities of research, restoration, legal protection, management strategies, and overall, the socialization of the heritage value. If the communication of CDEM relevance is effective, the site will have won allies in its

preservation, aware of the importance not only of the site, but of the relevance, longevity, and ingeniousness of Indigenous cultures. This project proposes that enhancing the pride of the contemporary Aguascalientes population in their Indigenous heritage as identity is a better strategy for preserving its archaeological heritage than elevating cultural heritage to erudite knowledge disconnected from the current social environment. In that sense, people will pay attention to the remains of that past as part of their present, and in doing so, activities such as looting and selling artifacts on the black market can be discouraged. The "endgame" of CDEM virtual visit is to entertain the young public of Aguascalientes while reflecting on the continuity of indigenous knowledge, conveying the information that we produced. By promoting an appreciation, enjoyment, and understanding of heritage values, the projects help to generate a culture of conservation for the site.

The most promising feature proposed by this research is to provide a theoretical foundation for Serious Game development, one that combines archaeological theory (social archaeology of households) with a theory of heritage interpretation (Meaningful Divulgation). The capabilities of games to foster and facilitate learning, awareness, and behavioral change have encouraged more games of this nature to be deployed in real-life settings, which we recreate in our game. Its Conceptual Design reflects this theoretical foundation, although we also incorporate cultural history information, to create a line of cross-cultural analysis (between ancient society and San Jose de Gracia current cultural practices). Video games have the potential to impact both the player's perceptions of the past, as well as his or her identities in the present, possibly to a much greater extent than through other less interactive encounters with the archaeological heritage.

The project is now at a stage in which the next step will be to develop the game following the script I presented in this dissertation, which will illustrate what daily life was like at CDEM during its occupation between the 6th and 9th centuries. I hope the game will contribute to achieving a more inclusive society by being more aware of the creativity not only of indigenous local communities in the past, but also of their culture, their way of life, and their technology in the present.

Alongside the creation of the videogame will be the design of the tools to evaluate its impact in the local population. I propose to achieve that goal by creating and studying visitors' profiles, examining satisfaction and opinions about the site, quantifying the duration of the experience, as well as the total time spent reading during the proposed stops. Most of that data can be collected automatically by the analytic tools of the game engine. In addition, the project can use several strategies that can help us gain a deeper insight, such as wayfinding analysis, personal significance mapping, and start and exit surveys (Gandara 2015).

In particular, the personal significance maps will let us to compare the conceptual repertoire of the players before and after the game, in terms of breadth and scope (Falk 2003 in Gándara 2015). This is done by comparing the "maps" the visitors write or draw when presented with a non-directive prompt like "The inhabitants of CDEM" before playing. They are asked to write o draw whatever comes to their mind when they think about the prompt; later, after they have played, they are asked to add to, or to delete parts of, the original map. The observed differences can be attributed to the game`s impact. The technique does not attempt to measure retention in memory of facts, but the creation of personal significance, as a result of the playing experience. The degree to which their conceptual repertoire increases and/or deepens is a measure of the impact of the game. When combined with the other assessment tools, we can gain a greater understanding of the game's impact.

In the near future, this project seeks to continue the archaeological research at CDEM and continue collaborations with the local community, the local authorities, and the federal Mexican government to open the site to the public. The methodologies presented in this dissertation create a roadmap that can be applied not only to other archaeological sites, but to historical and intangible heritage as well. Therefore, I conclude that the research presented in this manuscript paves the way for future public engagement and creates a model for a more robust understanding of the past.

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Appendix 1 Congruence Table

CDEM Meaningful Divulgation (Living in Borderlands)

Manuel Dueñas 2/26/2021

Purpose: Entertain the young public of Aguascalientes while reflecting on the continuity of indigenous knowledge found in the CDEM (Entertain and provoke)

Thesis: CDEM tells a story of more than 1000 years, a testament to the ingenuity of the indigenous populations to adapt to the environment of Aguascalientes, ingenuity that persists to this day.

National young public with basic and intermediate level studies

- Who lived in the Middle Hill?
- Since when?
- How did they build their houses?
- What did they subsist on?
- What of everything that was done in the Epiclassic is still being done in the community of San Jose de Gracia today?
- We're they warrying "chichimeca savages? Was CDEM a fortress?

Specific objectives of the entire plan: cognitive, emotional and action (Bloom table)

	Title	Thesis	Knowledge Obj.	Emotional Obj.	Action Obj.	Minimal content	Illustrative material
Sub-thesis 1	Who lived here?	CDEM is a sedentary settlement of indigenous population culturally related to the populations of "The Northern Border of Mesoamerica", which flourished during the Epiclassic.	That the public culturally contextualize CDEM in the northern border of Mesoamerica.	That the public feels regional pride of the Mesoamerican north with the south of Zacatecas, north of Jalisco and the Altiplano of Potosí.	Discover the sites contemporary to CDEM on an interactive map	CDEM is a sedentary settlement of indigenous population culturally related to the populations of "The Northern Border of Mesoamerica", which flourished during the Epiclassic.	3D models, maps and Cutscene video - infographics.
Sub-thesis 2	The House in the semi-desert	A comfortable home for a (particular) climate (this is the also a sub-thesis for this topic) To adapt to climate changes not only in the year, but also to the difference in temperature between day and night, the residents ingeniously used stone foundations that prevent the deterioration of the adobe walls, which function as thermal insulators.	That the public know the advantages of the construction system given the climatic conditions.	Let the public be amazed that CDEM's construction system is incredibly effective in controlling temperature changes.	Mini game: Build your own house by selecting the right materials according to different climates	Build your house To adapt to climate changes not only throughout the year, but also to the difference in temperature between day and night, the residents of the CDEM ingeniously used stone foundations that prevent the deterioration of the adobe walls, which function as insulators. thermal.	Minigame

Sub-thesis 3	Eating in the semi-desert requires ingenuity.	Providing water and food requires being alive. The environment provides edible plants such as the mesquite pod; it also allows the hunting of wild animals such as deer, although in sedentary populations agriculture consumes most of the time. At the site we have detected the use of nixtamal, an ancient technology to prepare corn flour, which can potentially be eaten in the form of tortillas, tamales or atole. It is important to save the grain for the winter, and at the CDEM we can see how important it was to do so.	That the public identify the diversity of foods that were used in pre-Hispanic times in the CDEM.	That the public feel food security in the semi-desert. Plenty to eat if you know how to look.	Mini game: preparing food.	Prepare your food Providing water and food requires being alive. The environment provides edible plants such as the mesquite pod; it also allows the hunting of wild animals such as deer, although in sedentary populations agriculture consumes most of the time. At the site we have detected the use of nixtamal, an ancient technology to prepare corn flour, which can potentially be eaten in the form of tortillas, tamales or atole. It is important to save the grain for the winter, and at the CDEM we can see how important it was to do so.	Minigame
Sub-thesis 4	The legacy of CDEM	San Jose de Gracia current habitants still build and eat in the same way, That is why it is important to preserve the site, as a testament to the ingenuity of the original peoples, their resilience and continuity to the present day.	That the public (compare) recognize that indigenous knowledge is still being used in their daily lives. That the public reflect on indigenous knowledge as part of our current culture.	If it's not broken, don't fix it Empathize with indigenous communities while appreciating that your identity has a strong indigenous component.	That the public is committed to the conservation of the archaeological site	Video with a sequence of historical and current images of San José de Gracia.	Cutccene Videos
Sub-thesis 5	Together, we can preserve this heritage	It is important to preserve this heritage as a testament to the ingenuity of the native peoples, their resilience and continuity to this day.	Preservation is a co-responsibility between government and population.	The public plays an important role in preserving, because this heritage is their heritage.	People actions goes a long way in preserving the site, Not only keeping it clean and safe, but in promoting its heritage values beyond the visit.	A final message in the game over screen	infography

Appendix 2
Game Development Documentation

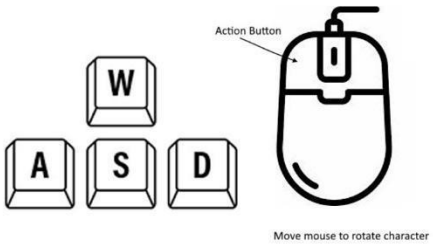
The game design includes all the functionalities, the player characters, the non-player characters, game assets, and animations. To document this properly, we will use screen mock-ups and other pieces of documentation discussed in Borromeo (2021).

Game Concept

The game design is like a blueprint. It is the foundation for the look of the game, the players objectives, the nature of gameplay, supporting user actions, animations, audio, Artificial Intelligence, and victory conditions.

The first component is the **game idea**. The basic concept is a third-person view walking simulator where the player can follow a track, triggering information hubs and a couple of minigames that will convey the heritage value of the site. The game ends when it reaches a certain point, at the end of the track. One minigame is about building a house, and the other minigame is about cooking ancient recipes.

The next element of the design is the **input controls**. It is important to consider how the players will interact with the game. There are a variety of options, from console joysticks to VR or AR gestures. In this case, the inputs consist of the keyboard and mouse.



Mouse input	Action
Mouse movement	Rotate character
Left mouse button	Action Button

Mouse mapping

Keyboard input	Action
W	Move forward
S	Move back
A	Move left
D	Move right

Key mapping

Input controls

The left mouse button will be the action button, while the horizontal and vertical motion of the mouse will aim the camera.

Winning or Losing Conditions

Our winning conditions will be if the player reaches the final point. Additionally, the building app will finish when a set of parameters are selected, triggering an event that will spawn the rest of buildings in the site to appear. For the cooking minigame, there will be points per recipe finished, and these will be displayed in a higher score chart.

As it is a serious game, there are no losing conditions, but the user can quit at any point in the virtual visit.

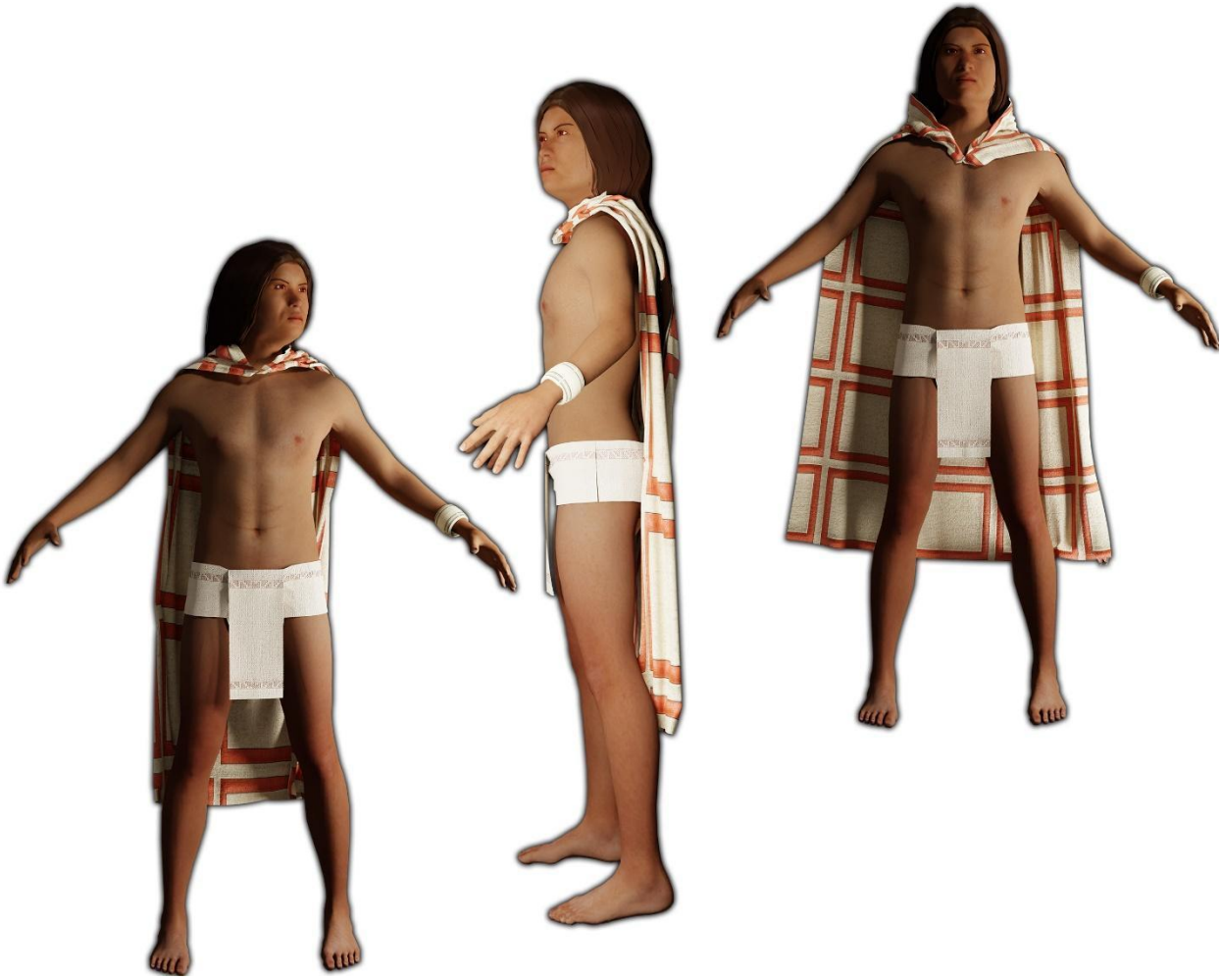
Game characters

The game features several objects and two types of characters. This first type of character is the avatar and will be controlled by the player. The second type will be the Non-Player Controlled characters (NPC). The NPC population will become apparent once the building minigame is completed.

The Avatar

The player will become the protagonist, so what can their avatar do? We have already established that the avatar will be able to move throughout the game environment, using a combination of keyboard and mouse inputs. We also defined that with the left mouse button the avatar will interact with the environment.

Figurines; La Quemada Figurines (Forest et.al. 2021); Figurines type I (Solar V. 2021); Xolotl, Mexica leader from their hunters and gatherer period. Codex Xolotl, leaf X.020; Chichimeca family, Florentine Codex, Book 10.



Avatar Concept Art. Created using figurines from archaeological sites in the northern frontier, and historical depictions as reference (M. Dueñas).

Because the avatar is controlled by a human player, it is referred to as the player character. We will implement the following animations for the player character.

Idle: This animation will play when the character is not being moved by the player.

Walk/**Run**: this animation will play when the character is being moved by the player, and the player holds down SHIFT the key.

Reach: this animation will cause the player to reach for something any time it interacts with an object.

NPCs

Our game is going to be populated by friendly villagers. We will control how many of them we want in our game, and where they are placed. We will also control their behavior through AI. The villagers will go come from houses to plazas, will interact with each other.

They will share the following animations:

Idle: When the NPC is not moving.

Walk: When the NPC is moving.

Careful planning and scripting will be required to create the desired behaviors. This will include decisions regarding the number and placement of the villagers. This will be discussed during the design phase and during development.

NPC Concept Art (M. Dueñas.).

NPCs Concept Art (M. Dueñas).

Gameplay

The game will start with the player downhill, in the east access. The Avatar, controlled by the player, will need to move first uphill, and then throughout the mesa interacting with different stations. After station 4, the buildings and NPC will appear, and the Avatar will stay in the site for the remainder of the visit.

Starting point (down the mesa) (M. Dueñas).

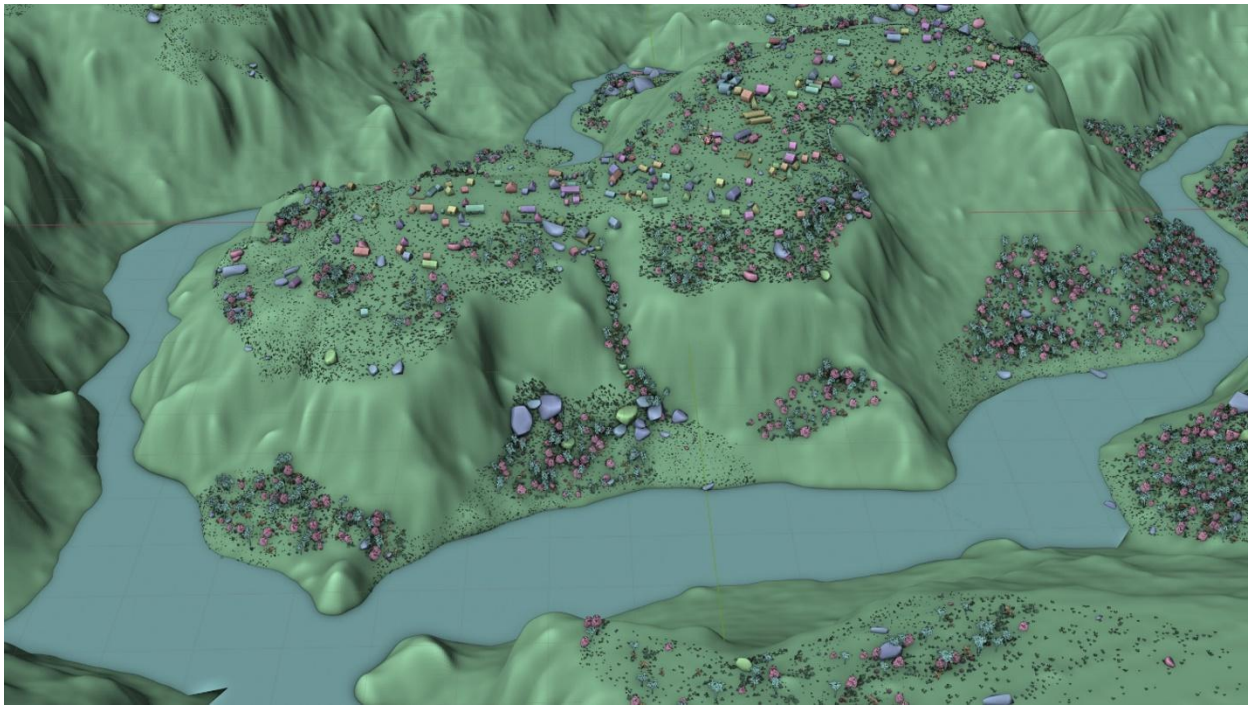
The goal is to reach the end, at Casa Grande, the southernmost point of the visit. We will require the follow components:

- Game-world layout
- Starting condition
- Ending condition
- Point System
- Heads-up Display (HUD)

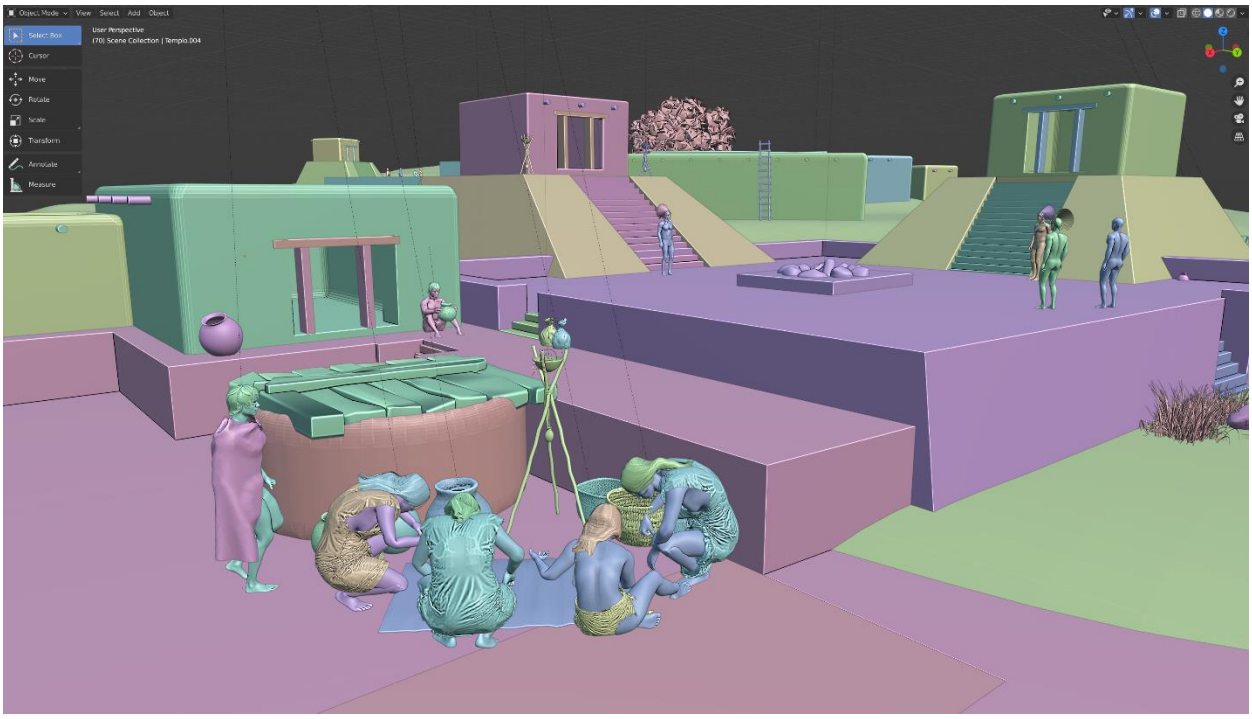
Game-world layout

We will create an environment that consists of an Epiclassic (600-900 CE) northern Mesoamerican Village, following the layout of our mapping. The topography will be implemented from a digital elevation model product of our drone remote sense survey. Flora and Fauna will populate the environment, product of the archaeological findings not only in the site, but in all archaeological sites that have been researched (chapter IV). For the building minigame, the scene will consist of a blank space where the player can select the materials to build the houses. They will be accompanied

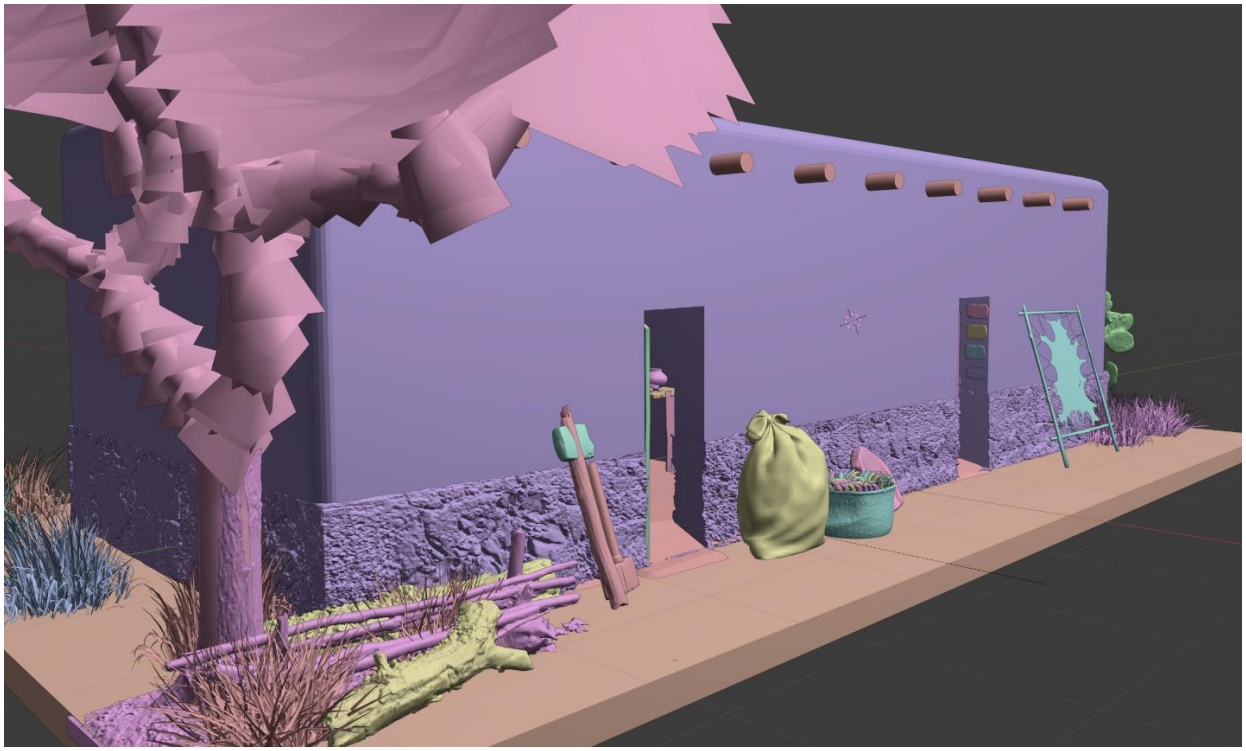
by an explanation of the benefits or problems inherent in choosing such materials. The cooking scene will be inside a house, in the kitchen. The player will have to select ingredients located around the house to prepare food and serve it at the door.



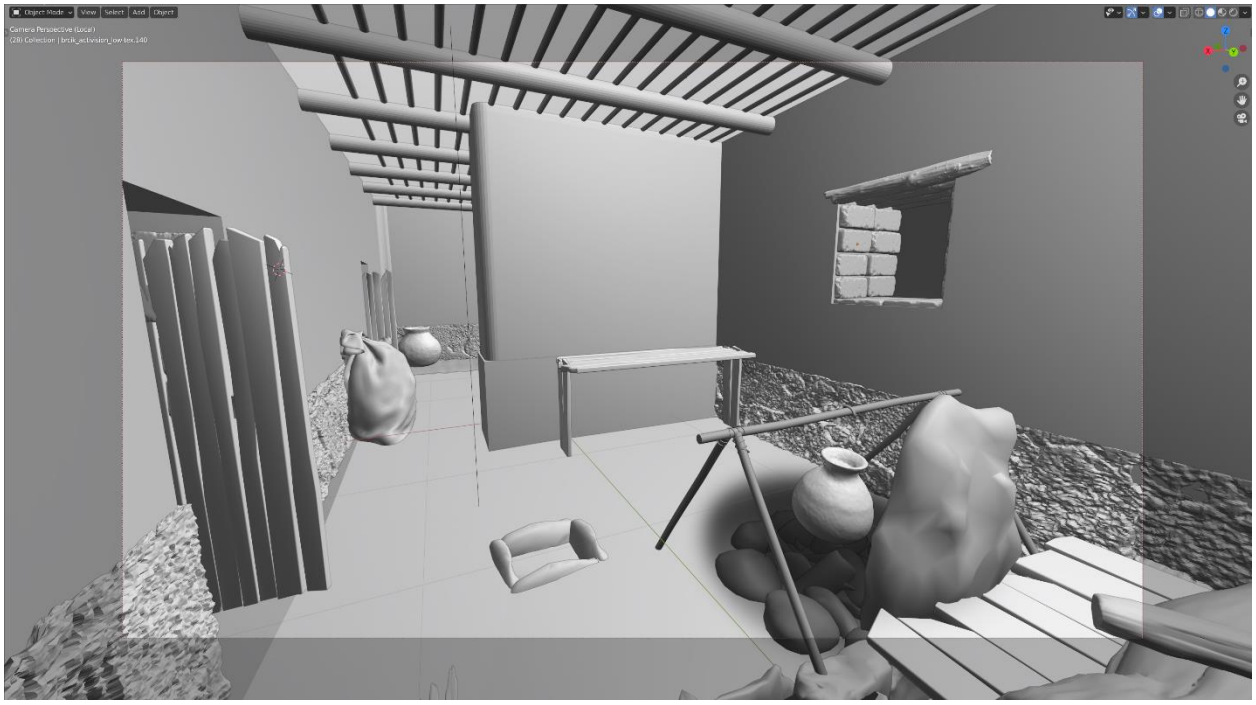
Mock-up 1, the entire settlement setting (M. Dueñas).



Mock-up 2, the building settings (M. Dueñas).

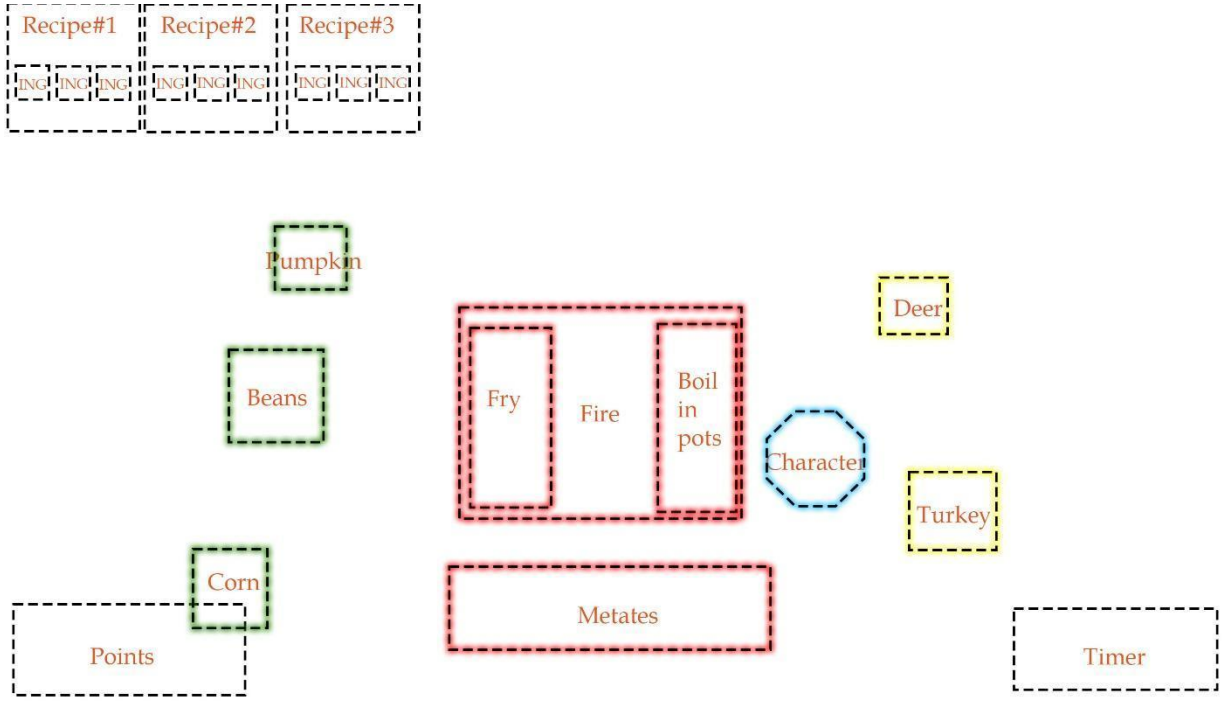


Mock-up 3a, the kitchen setting (M. Dueñas).



Mock-up 3b, the kitchen setting (M. Dueñas).

Mock-up 3c. the kitchen setting (M. Dueñas).



Mock-up 3d, UI the kitchen setting (M. Dueñas).

Working in Unity®

There are several ways to create a game. So, why Unity? At the beginning of the gaming industry, developers struggled with devices with limited resources and created simple designs. The industry has evolved, the hardware has become more powerful, and the games have become more complex. A big AAA game title requires almost 200 developers working on different areas of the game. Each role that is undertaken requires years of experience, making game creation an expensive and risky task. Creators never know if a game is going to be a success or a big waste of money. For these reasons, it was very difficult for a single person to make an entire game.

In the past, a programmer needed to learn how to use lots of tools to solve different game development problems. Some tools stopped receiving support from their creators, leaving them with unresolved bugs and features. Because of that, big companies started to hire highly skilled developers to create all those tools, resulting in what is called a game engine.

A game engine is a set of different pieces of software that solve game development problems such as audio, graphics, and physics. But they are designed to work together, all operating in the same programming environment. Creating a game engine from scratch is a great task, and only a few big companies can do this. The game engines that companies create are usually private, so only the company is allowed to use them. Some companies sell their engines, but the cost is very high.

However, another way to aquire game engines became available a couple of decades ago. Indie games started to appear, developed by teams of 1 to 10 individuals using a **general-purpose game engine**. This type of engine created a whole generation of enthusiast developers who are now able to create their own games easier than before. There were lots of game engines of this kind in the past, but few have survived. Unity is one of the most influential ones.

The general characteristics of Unity are as follows: its programming language is C#, which is very well-known to both beginner and advanced programmers, it has mobile gaming design capabilities incorporated, it has incorporated Augmented Reality and Virtual Reality, and it has a big community of developers that created bibliographies and tutorials but also a market of “pre-fabs” (prefabricated elements) that saves development time.

Scenes and Game Objects in Unity

Unity works in “scene,” the idea being that separating a game in scenes allows designers to process and load the data needed for a specific scene only. For example, usually one will start with a main menu which has only textures, music and some objects that the main menu needs loaded in Random-Access Memory (RAM). Upon Pressing the play button, the user is taken to another scene where the game actually happens, and through loading screens the user can change scenes as required.

The main space of work in Unity is the Scene View, a place where one can place Game Objects, implementing what the documentation of Unity states: the “WYSIWYG” (What You See Is What You Get) concept.

When creating a scene, the developer can choose between two different types of cameras: 3D or 2D. The camera is basically the eyes of the player, but it is also the eyes of the developer. Usually for menus a 2D camera is well suited, whereas a 3D camera is how 3D video games get to render the experience.

A Game Object is any 3D primitive (cube, sphere, cylinder, etc.) or 3D mesh that can be placed in the scene. Game objects can be manipulated through the Transform tool, or the graphic

solution of a Transform Gizmo, which basically allow the developer to change the position, rotation, and scale of the object.

Computer graphics use the classic 3D Cartesian coordinate system to represent object location. Unity can show this coordinate in a Global Coordinate System, where 0,0,0 is the origin. This can potentially represent a problem when importing georeferenced objects. They will require a reset in their transformations to be seen in the scene.

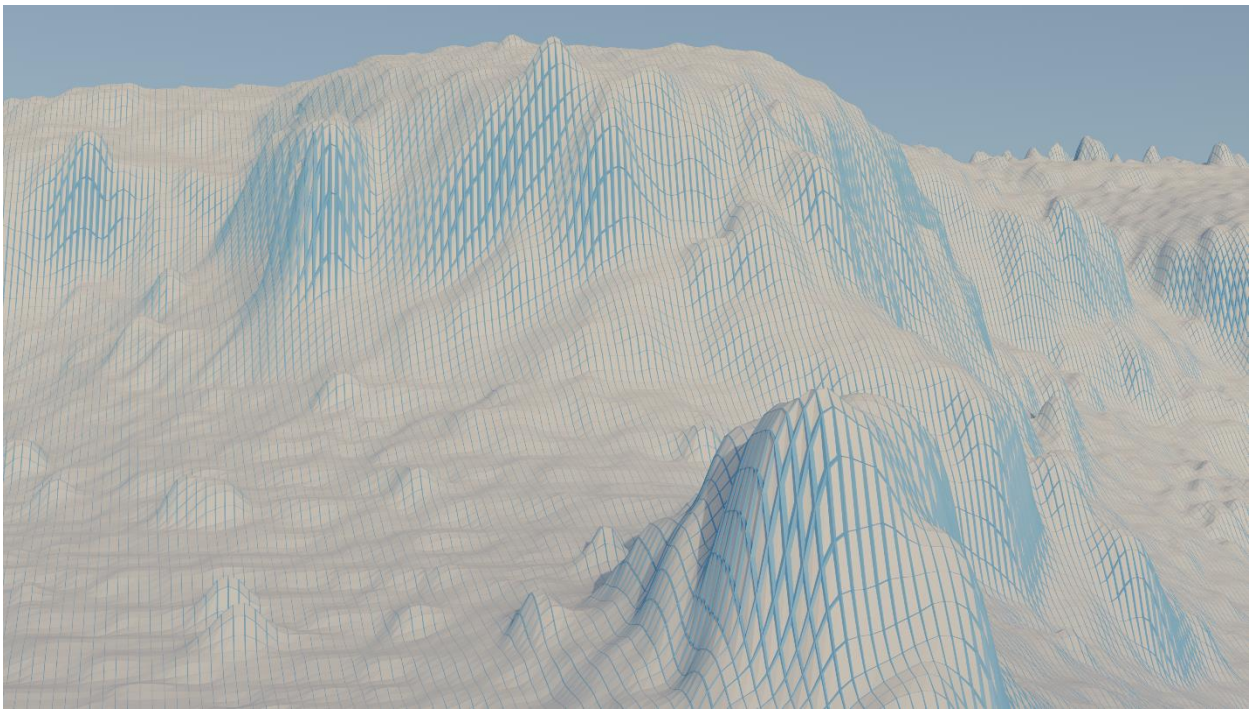
Each Game object has a series of components by default, such as playing sounds, rendering meshes, applying physics and so on, but the most powerful characteristic is that developers can create their own components.

Landscapes in Unity

Creating a complex terrain with hills, canyons and rivers using only cubes or spheres would be annoying. For that, Unity has a couple of tools that can help generate 3D terrain. One tool that can be used for this purpose is applying height maps. Height maps are textures that help define height in a terrain. Instead of generating a large 3D model for the whole terrain, Terrain tools use an image called a height map, like what one would use in a GIS, which looks like a top-down black and white photo of the terrain. Each pixel of the image determines the height of that specific area of the terrain.

CDEM Height map (M. Dueñas).

Unity Terrain Tools can automatically generate a Terrain 3D mesh from that image, saving the hard drive space from having full 3D models of that terrain. Also, Unity will create the terrain as one moves along, generating high detail models for nearby areas and lower-detail models for faraway areas, making it a performant solution. It has its limitations, and currently one cannot add terrain with caves or cavities, but for those environments we have other solutions.



CDEM Terrain mesh (M. Dueñas).

A second tool that one can use to create terrains is creating a Game Object type named terrain, and editing it with tools that allow the developer to sculpt the terrain manually, using brushes that increase the height or sharpen the edges, etc.

Importing and Integrating Meshes

Unity has a tool to model 3D objects (named ProBuilder) but, because I happened to have more experience with Blender, a similar tool, all modeling was conducted there, to be imported later into Unity. There are different sources of assets that one can use for projects. One can simply get a file from a modeler, download it from a different free or paid assets site, or use the Asset Store or Unity's official virtual asset store.

A 3D mesh is the structural build consisting of polygons. 3D meshes use reference points in X, Y and Z axes to define shapes with height, width and depth. While it can take large numbers of polygons to make a 3D mesh approach photorealism, these relatively simple shapes allow for faster processing than other techniques that produce smooth curves. The polygons used are typically quadrangles or triangles.

3D modeling can sometimes be a smooth process like working with clay. However, the necessity for edge loops often involves methodical and laborious placement of polygons. Some modeling software includes a process for defining the polygon layout separately from making the general shape.

3D Photogrammetry, a newer process, creates accurate 3D models from photos, creating point clouds to later convert into meshes. Nowadays this process is more effectively conducted using the depth maps that created the point clouds, rather than triangulating point clouds into meshes.

To add color to the geometrical surface of a model one uses Materials, which are files that contain the information about the texture (the colors or patterns) and the UV map. A UV map is the flat representation of the surface of a 3D model used to wrap textures easily. The process of creating a UV map is called UV unwrapping. The U and V refer to the horizontal and vertical axes of the 2D space, as X, Y and Z are already being used in the 3D space.

To increase photorealism, there is a more complex type of material, a PBR material. PBR stands for Physically Based Rendering and means that the material describes the visual properties of a surface in a physically plausible way, such that realistic results are possible under all lighting conditions.

The core idea of PBR is to use BaseColor, *Metalness*, and *Roughness* properties to emulate a wide range of real-world materials. A detailed description of PBR is beyond the scope of this dissertation. The following properties are specific to PBR materials:

- Base Color: In PBR materials, the albedo color is referred to as the base color. In Azure Remote Rendering the albedo color property is already present through the common material properties, so there is no additional base color property.
- Roughness: Roughness defines how rough or smooth the surface is. Rough surfaces scatter the light in more directions than smooth surfaces, which makes reflections blurry rather than sharp.
- Metalness: In physics, this property corresponds to whether a surface is conductive or dielectric. Conductive materials have different reflective properties, and they tend to be reflective with no albedo color. In PBR materials, this property affects how much a surface reflects the surrounding environment.
- **Normal Map:** To simulate fine grained detail, a normal map can be provided.
- **Occlusion Map:** Ambient occlusion makes objects with crevices look more realistic by adding shadows to occluded areas.

These properties come in handy during the optimization phase of the modeling process: suffice it to say that all 3D photogrammetric models created using AgiSoft Metashape can be accompanied by Normal and Occlusion maps.

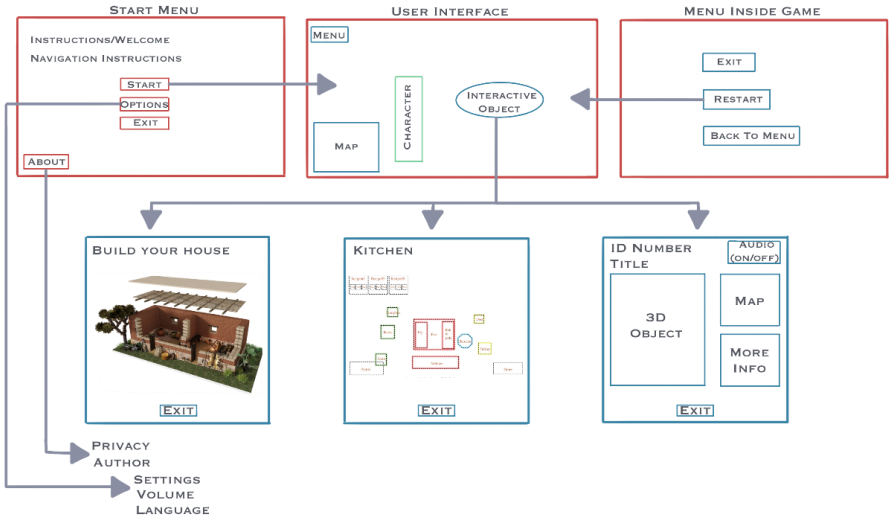
Once that terrain and a set of game objects are available, a scene may be considered complete.

Objects Concept Art. 3D models (M. Dueñas).

User Interface Design

Everything that is shown on the screen and transmitted through the speakers of a computer is a form of communication. A game like this one will need to communicate other information such as where in the site the player is located, where they should go next, and all the information about the stations. To transmit this information, another layer of graphics is needed on top of the scene. usually called a User Interface (UI) or Heads-Up Display (HUD). This will contain different elements, such as text fields, bars, and buttons, to prepare the user to make informed decisions.

Unity has a UI system creator integrated, usually known for its two main concepts: Canvas and RectTransform. Canvas is a master object that will contain and render our UI, and RectTransform is the feature in charge of positioning and adapting each UI element on our screen.

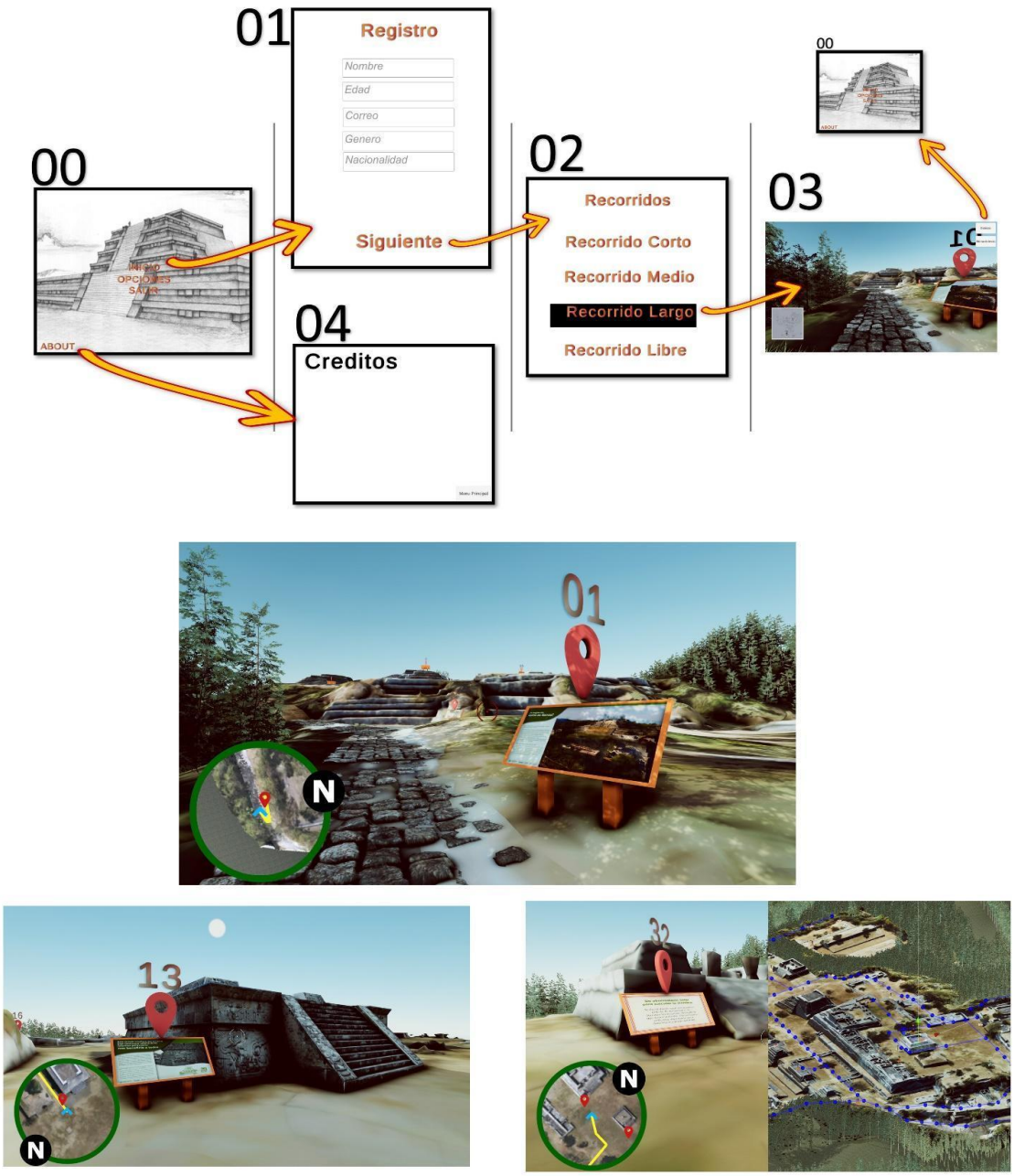


User interface mock-up (M. Dueñas).

User Experience Design

An important mention must be made about interface design, since in the last decades it has become imperative to design user experiences at the same time that user interfaces are created.

Also known as UXD or UED, user experience design is a process whose sole objective is to design a system that offers a great experience to its users. Thus, UXD embraces the theories of several disciplines such as user interface design, usability, accessibility, information architecture, and Human Computer Interaction.



User interface mock-up 2 (M. Dueñas).