CONNECTING THE DEAD AND THE LIVING: PALEOETHNOBOTANICAL EVIDENCE OF MORTUARY PRACTICES AND PUBLIC CEREMONIES AT MONTE ALBÁN

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Dissertation Draft

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Abstract

The ancient Zapotec city of Monte Albán, in Oaxaca, Mexico, has been a focal point of numerous archaeological studies. It has long been presumed that grave offerings included a number of botanical elements such as maize. Nonetheless, studies of mortuary offerings and public activities have focused on architecture, ceramic assemblages, and human remains—not botanical residues. In this study, I examine botanical remains from vessels and sediment samples collected from mortuary contexts and sites of public rituals to provide novel information on those meaningful rites from three different angles.

First, I examine the connections between the use of plants in temporally limited events (rituals) with medium-term phenomena (economic, political, social, etc.) taking place at Monte Albán. This study demonstrates the potential for future paleoethnobotanical studies targeting mortuary contexts and public rituals to provide novel information regarding ancient lifeways and beliefs. Second, in this study, I consider the relationship between botanical mortuary offerings and the social status of interred individuals at the Zapotec site. This allowed me to determine that there were no clear relationships between status of the deceased and plants placed plant offerings. Finally, I examine the relationship between private mortuary rituals and public rituals that took place at Monte Albán's Main Plaza through the analysis of plant residues. This allows me to examine the key similarities and differences in those rituals that appear to have had different purposes. Indeed, as I argue in the following chapters, mortuary offerings were

likely used to create a connection between the living and the dead, while public offerings allowed the inhabitants of Monte Albán to petition gods, spirits, and different supernatural entities.

Résumé

L'ancienne ville de Monte Albán (Oaxaca, Mexique), construite et occupée par les Zapotèques, a été le sujet de nombreuses études archéologiques. On a longtemps présumé que les offrandes mortuaires retrouvées comprenaient des éléments botaniques tels que le maïs. Toutefois, les études sur les offrandes mortuaires et les rituels publics se sont concentrées sur l'architecture, les assemblages de céramique et les restes humains sans examiner les plantes. Dans cette étude, j'examine les restes botaniques provenant de contenants en céramique et d'échantillons de sédiments prélevés dans des contextes mortuaires et des rituels publics, offrant ainsi de nouvelles informations sur ces rites significatifs sous trois angles différents.

Premièrement, j'examine les liens entre l'utilisation des plantes dans des événements restreints dans le temps (rituels) et les phénomènes à moyen terme (conjonctures économiques, politiques, sociales, etc.) qui se sont déroulés à Monte Albán. Cette étude démontre le potentiel de cette approche théorique pour de futures études archéobotaniques ciblant les contextes mortuaires et les rituels publics, dans le but de fournir de nouvelles informations sur les modes de vie et les croyances anciennes. Deuxièmement, dans cette étude, j'étudie la relation entre les offrandes botaniques mortuaires et le statut social des individus enterrés sur ce site zapotèque. Ainsi, j'ai pu déterminer qu'il n'y avait pas de relation claire entre le statut du défunt et les plantes placées en offrandes. Troisièmement, j'examine la relation entre les rituels mortuaires privés et les rituels publics qui ont eu lieu sur la

Plaza principale de Monte Albán à travers l'analyse des résidus végétaux. Les données obtenues m'ont permis d'observer les principales similitudes et différences de ces rituels qui semblent avoir suivi des objectifs différents. En effet, comme le démontre cette recherche, les offrandes mortuaires étaient probablement utilisées pour créer un lien entre les vivants et les morts, alors que les offrandes publiques permettaient aux habitants de Monte Albán de demander des faveurs aux dieux et aux esprits.

Resumen

La ciudad antigua Zapoteca de Monte Albán (Oaxaca, Mexico), ha sido un punto focal de numerosos estudios arqueológicos. Durante mucho tiempo, se supuso que las ofrendas funerarias incluían una serie de elementos botánicos como el maíz. No obstante, los estudios de las ofrendas mortuorias y las actividades públicas se han centrado sobe la arquitectura, la cerámica y los restos humanos, sin examinar los residuos botánicos. En este estudio, examino restos botánicos extraídos de vasijas y muestras de sedimentos recolectados de contexto mortuorios y de rituales públicos para obtener nueva información sobre esos ritos significativos desde tres ángulos diferentes.

Primero, examino las conexiones entre el uso de plantos en eventos (rituales) temporalmente limitados con fenómenos de plazo medio (coyunturas económicas, políticas, sociales, etc.) que se dieron en Monte Albán. Este estudio demuestra el potencial para futuros estudios arqueobotánicos que se centren en contextos mortuorios y rituales públicos para obtener nuevas informaciones sobre formas de vida y creencias antiguas. Segundo, en este estudio, examino la relación entre las ofrendas mortuorias botánicas y el estatus social de los individuos enterrados en la capital zapoteca. Esto me permitió determinar que no existían relaciones claras entre el estado del difunto y las plantas colocadas como ofrenda mortuoria. Tercero, examino la relación entre los rituales mortuorios privados y los rituales públicos que se llevaron a cabo en la Plaza Principal de Monte Albán a través del análisis de residuos vegetales. Esto me permite observar las similitudes

y diferencias clave en aquellos rituales que parecen haber tenido diferentes propósitos. De hecho, como argumento en los siguientes capítulos, las ofrendas mortuorias probablemente se usaron para crear una conexión entre los vivos y los muertos, mientras que las ofrendas públicas permitieron a los habitantes de peticionar dioses y espíritus.

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1. Plants, the Dead, and the Living

Archaeological studies examining mortuary contexts and large public displays have long served as the primary routes to understanding ancient beliefs and traditions. Ancient people engaged in deeply meaningful ceremonial activities that connected them to deities and ancestors, leaving highly visible traces on the landscape. The ancient Zapotec city of Monte Albán, in Oaxaca, Mexico, has been a focal point of such studies (e.g., Blanton 1978; Joyce 2010; Martínez López et al. 2014; Winter 1995), notably following the discovery of elaborate tomb architecture and mortuary offerings such as the turquoise-encrusted skull of Tomb 7 (Caso 1970). It has long been presumed that grave offerings included a number of botanical elements such as maize and cacao (Martínez López et al. 2014; Winter 1995). Nonetheless, studies of mortuary offerings and public activities have focused on architecture, ceramic assemblages, and human remains—not botanical residues. In this study, I examine botanical remains from vessels and sediment samples collected from mortuary contexts and sites of public rituals to provide novel information on those meaningful contexts.

This research, which is the first paleoethnobotanical study examining ritualized practices at Monte Albán, contributes to anthropological theory in several key ways. First, I examine the connection between the use of plants in temporally limited events (rituals) with medium-term phenomena (economic, political, social, etc.) taking place at Monte Albán. This study demonstrates paleoethnobotanical studies targeting mortuary contexts and public rituals provide novel information regarding ancient lifeways and beliefs. Second, in this study, I consider the relationship between botanical mortuary offerings and the social status of interred individuals at the Zapotec capital. This allowed me to determine that there were no clear relationships between status of the deceased and plants placed as offerings. Finally, I examine the relationship between private mortuary rituals found in residential areas and contexts identified as "relatively public rituals" that took place at Monte Albán's Main Plaza through the analysis of plant residues. This allows me to examine the key similarities and differences in those rituals that appear to have had different purposes. Indeed, as I argue in the following chapters, mortuary offerings were likely used to create a connection between the living and the dead, while public rituals allowed the inhabitants of Monte Albán to petition gods, spirits, and different supernatural entities.

In pursuit of these understandings, I have analyzed 100 sediment and artifact residue samples from both funerary and relatively public ritual contexts, focusing on botanical practices from its founding up to its initial abandonment (500 BCE—800 CE). I have identified starch grains (polymers and sugar glucose) (Hardy et al. 2009) and phytoliths (inorganic silica bodies) (Piperno 2006; Shillito 2013) produced by plants used in these ritualized practices, following an approach never previously used at Monte Albán. Found in soils and on artifacts, these microbotanical residues provide data on foodways, rituals, feasts, and plant consumption (Abramiuk et al. 2011; Aceituno and Loaiza 2014; Aceituno and Martín 2017; Ciofalo et al. 2018; Dickau et al. 2007; Duncan et al. 2009; Hardy et al. 2013; Musaubach and Berón 2016; Shillito 2013). The botanical samples in my study were collected from tombs, graves, and contexts associated with relatively public rituals through the different periods of occupation of the site (500 BCE—800 CE). Focusing on these microbotanical remains allowed me to determine the content of the vessels used as offerings, and the plants placed around the deceased (VanDerwarker et al. 2016:127; Wright 2010:40).

Research Objectives

I have defined three main objectives in my research: 1) connect the use of plants in relatively public rituals and private mortuary ceremonies with medium-term phenomena taking place at Monte Albán following an approach influenced by Braudel and Ricoeur; 2) compare the use of plants in mortuary offerings in relation to the social status of the deceased; 3) compare the use of plants in private ceremonies with those featured in relatively public rituals.

Objective 1: Connect smaller-scale events with larger *conjonctures*, to examine the relationship between the use of plants in ritual contexts and larger social, political, and economic changes happening at Monte Albán. My goal is to assess how plant uses were affected by *conjonctures*, but also to examine how the use of plants might have had an impact on these medium-term phenomena.

To examine this relationship between events and *conjunctures*, I follow the multi-scalar analysis approach developed by Braudel (1972, 1984) and revisited by

Ricoeur (1984, 2000, 2004). These three scales are the *longue durée* (long-term phenomena), *conjonctures* (medium-term conjunctures), and *événements* (short-term events). Studies of the *longue durée* in archaeology generally examine the interrelation between human settlement and ecological shifts over an extended period of time, such as the human occupation of a territory on a scale ranging from centuries to millennia (Bintliff 2010). In paleoethnobotany, the *longue durée* has been used to study different phenomena like the long-term impact of the Islamic Green Revolution at the anthropic and environmental levels (Fuks et al. 2020), or the transformation of the environment following the founding and occupation of a city (Santeramo et al. 2019).

Conjonctures normally refer to medium-term phenomena. In some ways, they can be compared to a cycle, where they "have an A-phase and a B-phase; they rise and they fall" (Wallerstein 2009:162). Their fall then leaves room for new *conjonctures*, that will, in time, follow the same fate. Archaeologists can use *conjonctures* to examine economic systems, demography, social history, etc. (Bintliff 2010:119) over multiple decades or centuries. Paleoethnobotanists have generally referred to *conjonctures* as political changes, such as transitions from small farms towards a feudal society (Galop et al. 2003) or economic innovations like the establishment of a metallurgic industry and its impact on the environment (Santeramo et al. 2019).

Events (*événements)*, in the Braudelian framework, represent individual actions in the short-term (Bintliff 2010:119). Borić (2010:49) has defined events as "brief happenings that are not necessarily seen to have changed structures *and* changes that occur on longer time scales". Paleoethnobotanists have mostly defined events through the contexts of paleoethnobotanical data, including artifact assemblages and architectural features (Fuks et al. 2020; Galop et al. 2003; Santeramo et al. 2019), such as firepits or ovens containing botanical remains. When considered together, these temporal scales allow us to better understand the interrelation between certain important changes, such as episodes of deforestation (events) in association with the creation of agricultural fields (events) or the long-term exploitation of the landscape (*longue durée*) for economic purposes (*conjonctures*) (Galop et al. 2003).

Braudel (1966 [1990:429]) wrote about events: "I am tempted, in front of a Man, to see him imprisoned in a destiny that he is barely constructing, in a landscape that draws behind him and in front of him the infinite perspective of the *longue durée*" (personal translation). This statement clearly illustrates that, in Braudel's opinion, the *longue durée* influences *conjonctures* and events, while events do not really have the potential to meaningfully impact medium and larger-term phenomena (see also Halperin 2017:518). Ricoeur (1984, 2000, 2004), however, offers a little more balance, arguing that events do indeed have the potential to impact both *conjonctures* and the *longue durée* (see also Bintliff 2010:119). Ricoeur (2000:244, personal translation) goes as far as criticizing the "horror" of Braudel regarding events, while he himself tries to "honor" them (2000:229).

My goal here is to examine the relationship between events and *conjonctures*, more precisely how both scales might have influenced each other, thus following Ricoeur's approach. This study does not consider the relationship between these events and the *longue durée* to any great degree, given the spatial and temporal limitations of the dataset. To effectively tie events and the *longue durée,* I argue that data from more contexts would be needed to be able to better understand the dynamics in place, thus offering a more robust picture of the use of plants at Monte Albán and in the region. For example, by examining the use of maize in domestic, agricultural, and ritual contexts, it would be possible to better understand the role of this plant in the *longue durée* of Monte Albán. In **Chapter 3**, I discuss the possibility of adding samples from agricultural terraces to better address the *longue durée,* which is often used in archaeology to examine the interrelation between human settlement and ecological shifts over extended periods of time (Bintliff 2010).

I considered other theoretical approaches when approaching this project, such as a focus on practices of ritualization or deathways. Practices of ritualization can be defined as "a way of acting that differentiates some acts from others" (Bell 2009:xv). This approach provides archaeologists with numerous opportunities to understand individuals and societies, because rituals can play an important role in the creation of identity (Plunket 2002:4). Examining rituals also has the potential to inform us about key elements, such as religion and ideology (Lohse 2007). Rituals have the power to impact people's values and behaviours, as well as culture and society more broadly (Bell 2009:3). Aspects of the shared identity, values, and behaviours of inhabitants of Monte Albán were no doubt guided by rituals (see Joyce and Barber 2015). By following a ritualization approach, it would have been possible to examine more deeply some of these important aspects (ideology, identity, values, behaviours, etc.) and explore the relationships between them.

While some aspects of ritualization were promising for this study, I opted for a different approach. In the end, I focused on the relationship between events and *conjonctures*, to create a framework that could be used in future paleoethnobotanical studies taking place at Monte Albán or in Oaxaca that would combine ritual and domestic samples. I was afraid that, by focusing on ritualization, I would be confronted with a strong separation between ritual practices and the quotidian when interpreting samples collected from domestic contexts. Since people living in Mesoamerica (and in Oaxaca) might have conceived religious practices as part of their quotidian (Hutson et al. 2018:165–166), I was afraid to reinforce a distinction that might have been "alien to the peoples involved" (Bell 2009:72). Therefore, I opted for an approach based on Braudel and Ricoeur, which, in my opinion, offered more fluidity when examining samples collected from non-ritual contexts.

Most of the samples examined in this study come from mortuary contexts. I could have examined those through an approach focusing on deathways, which "include actions and social performances attending the death, mourning, disposal, and remembrance of deceased individuals […] which invoke and articulate a wide range of spheres of social action and belief […]" (Creese 2015:351). I examined certain aspects of deathways in this study, such as the role of mortuary offerings to create and maintain a bridge between the deceased and those who venerated them. I was unfortunately missing key elements that would have made this approach robust. For example, there were no samples collected from altars located above the tombs that might have been used daily to celebrate and remember the deceased (see Markens and Martínez López in press), thus impacting my ability to examine the "remembrance of deceased ancestors" (Creese 2015:351). I also felt that, by focusing on deathways, it might be difficult to compare mortuary samples from nonmortuary samples collected from relatively public rituals, such as offering boxes. For these reasons, I examined key elements of deathways, but followed a different theoretical approach that offered more flexibility.

The multi-scalar analysis approach developed by Braudel and Ricoeur has proved to be fruitful in paleoethnobotanical studies elsewhere in the world (Fuks et al. 2020; Galop et al. 2003; Santeramo et al. 2019), and in non-paleoethnobotanical studies in Mesoamerica (Halperin 2017; R. Joyce 2000a; Smith 1992) and at Monte Albán (A. Joyce 2009). With this approach, my objective is to better understand the use of plants in graves, tombs, and relatively public rituals at Monte Albán. Similar to Santeramo et al. (2019), I limit the *longue durée* to the occupation of the site investigated, in this case the initial Zapotec occupation of Monte Albán (500 BCE–800 CE). This site is ideal to perform a temporally multi-scalar analysis, as it has been investigated by multiple scholars, thus providing valuable information on politics, economy, and social relationships (e.g., Balkansky 1998; Blanton 1978; Joyce and Barber 2015; Levine et al. 2021; Marcus and Flannery 1996; Nicholas and Feinman 2022; Rojas and Beccan Davila 2020; Urcid 2011; Winter 1974; further detailed in **Chapter 3**).

In this study, I focus on events linked with mortuary practices and relatively public rituals, to examine how they influenced and were influenced by social, political, and economic *conjonctures*. I focus on paleoethnobotanical offerings placed in elite tombs and simple graves, as these ritual events served to accomplish many important social functions (Hastorf 2003; Horwitz 2011; Lev-Tov and Maher 2001; Morehart and Butler 2010; Uruñuela and Plunket 2002; Zizumbo-Villareal et al. 2009).

Furthermore, public rituals and mortuary ceremonies were important events that, especially over generations, could influence *conjonctures*. For example, mortuary rituals change over time based on transformations in different spheres, including social and political realms. Funerals are meaningful events because they "[bring] memories of past events, a previous time when the newly deceased was living. The present moment of the funeral itself is episodic, creating memories that will be carried forward" (Johnson 2022:29–30). Therefore, mortuary rituals have the potential, as events, to impact future funerals, slowly leading to the creation of recurrent practices, of a social memory (Johnson 2022). In other words, the events examined in this study are not anectodical moments without clear meanings: the impact of these key moments had the potential to influence other practices later in time (see Gilmore and O'Donoughue 2015; Johnson 2022). This is perhaps even more discernable at Monte Albán, where the death of an individual did not mean the end of a social relationship. Instead, the transformation into an ancestor led to the creation of new bonds between the living and the dead, along with the possibility to establish novel relationships with different spirits and deities. Establishing and maintaining bonds were facilitated through plant practices such as placing foods and drinks to accompany the deceased during their interment or during the revisit of formal tombs.

This study encountered certain methodological limits in regards to the multi-scalar approach. Over the course of this project, I examined 100 microbotanical samples. More data from this site could strengthen or challenge my preliminary interpretations. Therefore, the interpretations offered here are meant to offer a pathway for future testing, and I encourage the readers to keep this in mind. The sediment samples and the artifacts I examined here were collected during the PEMA, a project that took place between 1992 and 1994. The project was led by Dr. Marcus Winter and laboratory analyses were directed by Cira Martínez López. The late Margaret Houston catalogued the sediment samples collected throughout the project.

The contexts examined in this study were dated based on the ceramics found in them. The ceramic phase at Monte Albán is well defined and was further revised in the late 1990s by Marcus Winter, Michael Lind, Cira Martínez López and Robert Markens (see Martínez López et al. 2000) (**Table 3.1**). Since then, this chronology has been used in numerous studies to address changes through time at the site (e.g., Joyce and Barber 2015; Levine et al. 2021; Martínez López et al. 2014; Winter 2002). While radiocarbon or AMS dating could perhaps help to refine the contexts featured in this study, I argue that the ceramic sequence at Monte Albán is secure enough to permit a multi-scalar analysis comparing mortuary and public rituals.

There are numerous expectations from prior studies regarding the plants recovered from mortuary ceremonies and public rituals. Since these activities depend greatly on *conjonctures* particular to Monte Albán, I present my expectations and provide a small summary of the results in **Chapter 3**. In that chapter, I contextualize my initial expectations in much more detail.

Objective 2: Assess how plants used in masonry tombs may have differed from those found in simple graves, to determine if the social status in the household of the interred individuals corelated with a differential access to botanical offerings.

Mortuary food offerings are an important component of ancient cultures that had strong implications, both for the living and the dead (Prufer and Hurst 2007:289; VanDerwarker et al. 2007:16). With the second objective, my goal was to examine the role of botanical mortuary offerings at Monte Albán in the construction and maintenance of social status, for the living and the dead. Differences in the plants placed in formal tombs and simple graves could indicate that the social standing of the living continued after their passing. Plants could have been used to acknowledge social differences and maintain these distinctions in the afterlife. At the opposite end of the spectrum, similarities in the botanical assemblages could suggest similar ritualized practices, independent of social status. Examining the use of plants in mortuary settings at Monte Albán offered a new avenue to study the relationship between the living and the deceased, and between plants and humans at the site.

At the center of the Valley of Oaxaca, Monte Albán lies over a series of hills (Blanton 1978:3; Urcid 2018:31–32) (**Figures 1.1, 1.2**). In the civic-ceremonial core of the site, the Main Plaza, archaeologists encountered numerous temples, buildings, and pyramids, as well as simple graves and formal tombs (Martínez López et al. 2014; Winter 1995). Simple graves appear as earthen burials, further detailed in **Chapter 3.** Formal tombs instead appear as a space built under the residence and accessible by a shaft or stairs. People buried in formal tombs are understood to be leaders of households, while people interred in simple graves were of a lesser status (Martínez López et al. 2014). Such conclusions are supported by the elaborate architecture of the formal tombs and by the quantity and quality of the artifacts retrieved from them. Furthermore, ancestors buried in formal tombs could be revisited, something that was not possible for ancestors in simple graves.

The ancient Zapotec city of Monte Albán (500 BCE—800 CE) is an ideal venue to examine the role of plants in mortuary settings for numerous reasons. First, the Zapotec considered certain deceased individuals who were highly regarded during their lives as entities taking part in activities in the world of the living

(Joyce 2020a:82). These ancestors were able to offer protection to their descendants. To create, maintain, and even strengthen the bond between the dead and the living, people participated in rituals and placed mortuary offerings. These offerings included ceramic vessels, believed to have contained foods and drinks (Martínez López et al. 2014; Winter 1995), an observation not verified until this study.

Second, at Monte Albán, the dead were buried in association with residences, reinforcing a connection between the descendants and their ancestors (Adams and King 2011:3–4; González Licón et al. 2018; Granados Vázques and Márquez Morfín 2020; Joyce and Barber 2015:288; Márquez Morfín and González Licón 2018; Martínez López et al. 2014:1; McAnany 2002:118; Spence 2002:55; Urcid 2005:34–40). Their living descendants could consult them when needed—even revisiting them in formal tombs—and often made offerings to maintain this fruitful connection (Joyce 2020a:73; Lind and Urcid 1983; see also Markens and Martínez López in press).

Figure 1.1: Map of Mexico (Google Maps)

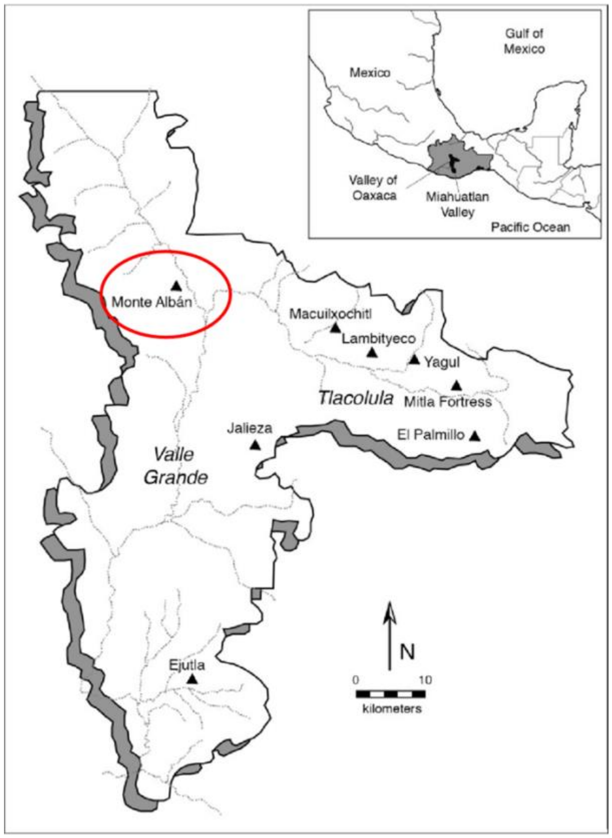


Figure 1.2: Map of the Valley of Oaxaca (Feinman and Nicholas 2019, Fig. 1)

I investigated connections between botanical offerings and the social status of the interred individuals, to address the access and the use of plants in mortuary contexts. To do so, I compared the plant offerings recovered in burials of individuals with broadly different social standings (based on their type of internment, either formal tomb or simple grave). Household leaders have been categorized by archaeologists (Martínez López et al. 1995, 2014) on the basis that they were placed in tombs rather than in graves, as opposed to lesser status individuals. This designation was based on the elaborate level of architecture of these masonry formal tombs and the quality of the artifacts placed as offerings in these contexts. It is worth noting that all the burials examined in this study came from elite contexts. Therefore, the data obtained only allowed me to compare the use of plants between elite contexts in terms of relative social status in the household (household leader or remaining member of the household). Before analyzing the samples, my expectations were that the status of the individuals interred would have an impact on the offerings they received. I thus expected to identify plants of a higher value/level of rarity (such as manioc and sweet potato) and/or find higher overall taxonomic richness in mortuary contexts associated with higher social status, as we find with other types of more durable goods.

To my surprise, there were no clear differences between these two contexts regarding the presence of plants of a higher value or taxonomic richness, as I detail in **Chapter 4**. Tombs had a slightly higher richness of taxa/sample, but the difference was too small to clearly indicate differences in botanical practices. The presence of traces of fermentation from two tombs and its absence from any simple grave could perhaps suggest it was reserved for specific contexts, but more data would be needed to support this possibility.

Maize was the only common taxon found in both formal tombs and simple graves. Apart from the regular presence of this meaningful plant, no clear pattern emerged, as the combination of plants varied greatly, perhaps suggesting that personal preferences or availability of plants at the time of death drove the selection of plants as mortuary offerings. It is interesting to think that cultural norms or the perpetuation of a certain tradition might not have been at the center of the selection and the use of plants in mortuary contexts, with each household following different approaches. This practice might have been very fluid and continually transformed.

Objective 3: Compare botanical assemblages from mortuary offerings to those of relatively public rituals, including materials placed in offering boxes found near public buildings, to identify continuities or distinctions in ceremonies for the living and ceremonies for the deceased.

With this objective, I was interested in comparing practices related to the use of plants in private mortuary ceremonies and relatively public rituals. These events had different purposes: mortuary rituals mainly served to create and maintain an alliance with ancestors, while relatively public rituals were used by elite ritual specialists to petition deities and spirits (see Joyce 2020b; Marcus and Flannery 1996). As demonstrated in **Chapters 3 and 7**, the relatively public rituals involved a limited number of participants, since they took place in a restricted area. I consider them as relatively public, as they likely involved more participants than a private mortuary ritual, since they took place outside of individual household settings.

I was interested in determining if the use of plants differed in these rituals or if the same plants featured in both contexts. If plants found in private mortuary ceremonies and relatively public rituals were the same, it could suggest that botanical elements were used in similar ways to achieve similar outcomes, regardless of ritualized context. Differences in paleoethnobotanical assemblages could indicate that plants were imbued with specific meanings, and used differently dependent on the context, to achieve different outcomes. In both cases, botanical practices would serve to structure future practices to a certain extent, with the repetition of similar practices slowly building a tradition.

Once again, Monte Albán offers a great setting to compare the use of plants from these contexts. As argued in **Chapter 3**, public rituals played a key role in Monte Albán's history. The elite members of this city might have used religion to strengthen their authority at the local and regional levels (e.g., Joyce 2020b; Marcus and Flannery 1996). Numerous relatively public rituals took place in the Main Plaza located at the summit of the mountain, in different places such as temples and smaller plazas. I examined sediment samples from these contexts and compared them to the funerary context samples to achieve my second objective.

I expected to see a high level of homogeneity of plants used in relatively public rituals, potentially demonstrating a perpetuating of traditions. This hypothesis is based on the idea developed by Joyce (2010:148) that the similarities between "high-status residences, mortuary ceremony, public buildings, and ceramics [during the Pe-phase] resulted from the development of a shared identity as well as from political, religious, and economic relations between Monte Albán and surrounding communities". I anticipated that the use of plants in relatively public rituals was dictated by previous practices, which created expectations from the audience guiding ritual specialists. As these norms might have been difficult to change, I thus expected the botanical assemblages to remain quite similar over time in the samples coming from relatively public rituals. I expected to see more changes in mortuary assemblages, leaving more space for personal preferences and other factors contributing to variation, such as age and gender (see Ponce de León et al. 2020). Since the number of participants was much more limited in private rituals, I believed it would be easier to transform practices related to the use of plants as mortuary offerings.

As explained in **Chapter 7**, most of the samples coming from contexts associated with relatively public rituals did not provide meaningful results. The notable exception is Grave 1993-43, a burial that contained the skulls of 18 children (Martínez López et al. 1995; Winter 1998, 2002). Similar to the private mortuary contexts examined, maize was the most important plant taxon, as determined by ubiquity. However, Grave 1993-43 contained a greatly diverse array of plants, suggesting that the use of plants in this context was quite different than private interments. Grave 1993-43 was likely influenced by Teotihuacan beliefs (Martínez López et al. 1995; Winter 1998, 2002), which might explain the differences in the plants selected to be placed as mortuary offerings. Grave 1993-43 is unique at Monte Albán and the plants placed as mortuary offerings seem to have been selected following different criteria.

Dissertation Organization

To address my three research objectives, my dissertation is divided in eight chapters. In **Chapter 2**, I examine how paleoethnobotanical studies have addressed mortuary contexts and public rituals at the global level. This chapter highlights how it is possible to conduct meaningful research heavily focused on plants found in mortuary contexts and used in public rituals. This argument is supported by the work of numerous paleoethnobotanists from various regions of the world and different time periods (e.g., Bouby and Marinval 2004; Chen et al. 2012, Corbineau 2016; Shahat and Jensen in press).

Chapter 3 introduces the larger *conjonctures* that unfolded at Monte Albán between 500 BCE and 800 CE. To do so, the long history (or *longue durée*) of this city is divided in four phases based on the economic, social, and political *conjonctures* in place there. In addition to highlighting the important transformations taking place at Monte Albán throughout its occupation, I examine the strong relationship between the Zapotec people and their ancestors. I also explain how the inhabitants of Monte Albán considered plants and landscape features as entities impacting their world, (Joyce and Barber 2015:830; Robles García 2011:60; Winter et al. 2007:188–190), crucial information in a paleoethnobotanical study.

In **Chapter 4**, I detail the methodology I followed in this study, based on established protocols (e.g., Atchinson and Fullagar 1998; Logan et al. 2012; Mickleburgh and Pagán-Jiménez 2012; Morell-Hart et al. 2014; Pearsall et al. 2014). To do so, I briefly summarize the *Proyecto Especial Monte Albán* (PEMA 1992–1994), source of the samples examined in this study. I then explain the rigorous protocol I followed for the extraction of the microbotanical remains from artifacts. I follow with an explanation regarding how I processed those sediment samples at the McMaster Paleoethnobotanical Research Facility (MPERF), and how I identified microbotanical remains using a number of reference materials.

This methodology chapter is followed by **Chapter 5**. There, I present in detail each taxon identified in this study and provide a broad overview of the botanical assemblage for all time periods and contexts. The plants are briefly introduced, and their potential uses are listed, based on historical documents, ethnographical publications, and previous paleoethnobotanical studies. The plants listed are also accompanied by photographs to contextualize them more efficiently.

In **Chapter 6**, I examine the relationship between the plants placed as mortuary offerings in private contexts and the social status of the deceased in the household. To do so, I compare the botanical assemblages recovered from formal tombs to those from simple graves. In **Chapter 7**, I compare the plants recovered from private mortuary contexts to those coming from relatively public rituals. Finally, **Chapter 8** tackles my first and key objective: connecting the plants identified from those different types of events with the larger social, political, and economic *conjonctures* taking place at Monte Albán.

This paleoethnobotanical study is the first to focus on the use of plants in mortuary offerings and relatively public rituals at Monte Albán. It is also the first time microbotanical remains have been examined from this archaeological site. This study allowed me to contextualize the use of botanical offerings in relation to the lives of the inhabitants of Monte Albán. By doing so, this study offers novel information to better understand ancient Zapotec lifeways and beliefs. Without considering the larger social, political, and economic changes that happened at Monte Albán throughout its occupation, the plants recovered from these meaningful contexts could not have provided the same amount of information. The results obtained also allowed me to better understand the relationship between botanical mortuary offerings and the inferred social status of the interred individuals. This approach allowed me to investigate the nature of the relationship between ancestors and the living. Finally, this study examined differences and similarities between private mortuary rituals and relatively public rituals.

2. Paleoethnobotanical Evidence as a Means for Examining Mortuary Activities and Public Ritual

Examining mortuary offerings and plants used in public rituals provides archaeologists with meaningful ways to investigate ancient practices and beliefs. Those artifacts illuminate the ways that rituals are “both flexible and structured by rules” (Morehart and Butler 2010:589). In this chapter, I highlight how paleoethnobotany contributes to mortuary archaeology and the understanding of public rituals by presenting how botanical remains factor into interpretations of deathways, funerary rituals, and public ceremonies. In the following sections, my focus is directed towards botanical evidence associated with these types of rituals (e.g., use of plants in cremation and embalming, botanical offerings, furniture, etc.).

I demonstrate how the vast array of information we can gather from botanical residues obtained from mortuary and public rituals has contributed directly to understandings of ancient beliefs, daily practices, and ancient plant knowledge. Botanical offerings connected the dead, the living, spirits, and deities in complicated ways, sometimes reflecting the way meals were shared in daily life to structure and maintain alliances and familial relationships. Botanical offerings also connected humans—deceased or living—with the sacred and the otherworldly. In all these cases, the paleoethnobotanical data have provided new information that complements and enhances the archaeological narrative, in some cases providing a unique line of evidence.

Unfortunately, paleoethnobotanical studies examining rituals are rare (see Morehart 2017; Morehart and Morell-Hart 2015). The same is true for Mesoamerica, where there is a paucity of studies focusing on plant remains from graves and public rituals. This is in part because paleoethnobotanical samples clearly tied with ritual activities are not easy to encounter, or sampling strategies do not form a regular part of excavation practice. This has forced paleoethnobotanists to try new approaches to get a glimpse at the role of plants in non-mortuary ritual practices. For example, Cagnato et al. (2021) examined the last meal consumed by sacrificed camelids, through starch grains recovered from their coprolites and stomachal content. The results showed that these animals did receive a unique last meal before being slaughtered. While they were given maize as fodder in their life, they were fed manioc, chile peppers, beans, and cooked foods before their death. These animals, on the verge of being sacrificed, were fed with foods generally consumed by humans, potentially to bridge them together, to create a meaningful connection before their passing.

In this chapter, I present similar examples from studies around the world, to demonstrate how paleoethnobotanists have approached and examined samples collected from both mortuary contexts and public rituals. I take this global approach to highlight the contribution of paleoethnobotanical studies focusing on ritual practices and demonstrate the diversified range of interpretations they provide. I highlight Mesoamerican examples, however, where available for a given practice.

Botanical Practices in Mortuary Contexts and Associations with Social Status

Botanical assemblages from mortuary contexts vary greatly depending on the contexts. They often offer a unique insight into ancient beliefs and practices and need to be carefully interpreted by researchers. While the presence of certain objects recovered from interments might have been dictated by social or cultural norms, other artifacts could have been selected for other reasons, such as personal preferences of the deceased or funerary practitioners. When there are written records, we are sometimes able to connect those contexts with a person and their history, which can profoundly influence our interpretations (Zech-Matterne and Derreumaux 2013:1403). Furthermore, mortuary contexts provide us the opportunity to study a defined "instant" in time (Girard 1987:35; see also Morehart 2017:145). The materials found in burials and tombs most frequently correspond with the moment the deceased was laid for their final rest, or other key moments like the reopening of a tomb to consult an ancestor. At certain times, we are even able to narrow that moment to the season it occurred, thanks to historical documents or to the plants recovered from burials and tombs (Beneš et al. 2012:109; Rollier 1992:349; Tuross et al. 1994:297).

In many cases, the food left and shared with the deceased was meant to connect the living with a new entity: the powerful deceased or the venerated ancestor (Belmar et al. 2020:41). Those ancestors were able to protect and help the living, sometimes by negotiating with deities, in exchange for food and other offerings (McNeil 2010:293; Nelson 2003:65). Those offerings were also meant to appease the dead: if they were not fed properly, they might decide to become hostile and plague the living (McNeil 2010:305; Pollock 2003:26; Wiessner 2001). Härke (1997:20) goes as far as considering those offerings a "legal and social contract between the living and the dead", where offerings were exchanged to obtain the protection of the deceased. In some cultures, people reopened tombs to consult their ancestors and to place new offerings, demonstrating their influence long after their passing (Cutright 2011:84; McNeil 2010:294; Millaire 2004:378).

In this section, I will highlight how botanical practices worldwide have been a) impacted by the status of the deceased/mourners, and b) have impacted the status of the deceased post-mortem (sometimes deified ancestors) and the mourners (in life). Here, I focus on plant practices directly related to mortuary rituals, focusing on prehistoric and historic paleoethnobotanical analyses carried out around the world. Dietary data that can be recovered from human remains, such as dental calculus, (Staller and Thompson 2002), stomachal content (Berg 2002), or isotopic data (Schwarcz and Schoeninger 2011), though critical for answering other research questions, fall outside the scope of this chapter.

In certain contexts, plants used to weave clothes can be used to reinforce the social status of the deceased. This is the case at the Huitzilapa shaft tomb (Mexico, 74 CE) (Benz et al. 2006; Ramos de la Vega and López Mestas 1996). There, paleoethnobotanists identified the presence of cotton (*Gossypium* sp.) and agave (*Agave* sp.) fibres. This tomb was divided in two different chambers, the north one hosting three individuals of a higher social status than the three deceased placed in the south chamber. Agave fibres were found in association with five of the six individuals, demonstrating the importance of this plant in the region at the time.

Cotton fibres were only encountered in the north chamber, possibly indicating that this textile was reserved for individuals of a higher status (Benz et al. 2006), offering a different avenue to determine the social status of interred individuals. At Huitzilapa, the botanical textiles used to weave the clothes worn by the deceased seem to have been influenced by their social rank in the world of the living. I argue that this practice might have been influenced by the role meant to be played by the deceased as ancestors. Ancestors of a different status might have been able to intercede with specific spirits and deities, thus warranting the need to maintain these social markers following their passing.

Sometimes, plants can be found in royal tombs without necessarily reinforcing social differences. This is the case at the van Nassau-Dillenburg mausoleum, found in the main church of Breda in the Netherlands (1475–1526 CE). There, archaeologists examined the remains of ancestors of the Dutch Royal family with a focus on paleoethnobotany (Vermeeren and van Haaster 2002). Based on the strong presence of macrobotanical remains, the researchers were able to establish that the bodies were placed on a bed composed of herbs and spices. Vermeeren and van Haaster (2002:221) offer the idea that those plants were placed there due to "the lack of confidence of the embalmers", who might have felt the need to cover the smell of the body. The presence of the mausoleum in this important church likely served to reinforce the power of the van Nassau-Dillenburg family to all the visitors. However, the decaying smell might have negatively impacted the people's perceptions regarding the ancestors of the Dutch royal family. Here, the plants played a key role to ensure this unpleasant situation did not arise, in a way preserving the legacy of the van Nassau-Dillenburg family.

Plants could serve multiple functions in royal mortuary contexts. In Tutankhamun's tomb (c 1323 BCE), Hamza (2020:73) identified "collars and floral garlands" made of "olive (*Olea europaea* L.), safflower (*Carthamus tinctorius*), pomegranate (*Punica granatum*), and cornflower (*Centaurea* sp.)". Those collars and garlands were often used to show social standing but were also worn for their protective powers (Hamza 2020:73). Here again, we see how plants were impacted by the social status of the deceased and how these botanical elements could influence the dead post-mortem. At the same time, these plants served to represent the ruling power of Tutankhamun, while offering him protection in his path to the afterlife.

Botanical elements also played an important role in children's burials. At the Shengjindian cemeteries (China, 2400 -2000 BP), archaeologists discovered an infant buried in a layer of *Aeluropus pungens* placed over leather (Jiang et al. 2015:173). The burial was also covered in a thatch of this same plant, interpreted by Jiang et al. (2015:173) as a way to ensure that the child could "sleep quietly in another world". If this is accurate, flowers could not only ensure a safe passage to the afterlife, they also had the ability to transform a tomb into another world. At

Deir el-Ballas, in Egypt (c 1525-1425 BCE), Shahat and Jensen (In Press:9) found a dom palm (*Hyphaene thebaica*) endosperm "cut in half and punched with a hole" in the tomb of a child, possibly used as a toy. In these two examples, the use of plants differed than those encountered in adult burials. This can be explained by the fact that the deceased were children. However, by doing so, the mourners also acted as if the children would not grow in the afterlife. These children would thrive in the afterlife, by playing with toys (Deir el-Ballas) or by peacefully sleeping in a safe environment (Shengjindian), a goal in part achieved through the botanical mortuary offerings.

These examples demonstrate the many kinds of information that can be obtained by examining the use of plants in mortuary contexts in relation to inferred social status. These botanical practices are influenced by the status of the deceased and of the mourners, but also have the power to influence the status of the deceased and the living postmortem.

The Use of Plants in Events: Public and Private Rituals

Plants featured in numerous kinds of public and private rituals. In such contexts, botanical elements were selected based on their different meanings and served different purposes in these practices. This can be seen in different ceremonies, such as interments, public offerings, private prayers, etc. In these rituals, plants were selected according to convention and previous ceremonies, but they could at the same time influence the use of botanical elements in subsequent rituals. Even though it is an important component of public rituals, I do not address feasting in this section, as I was not able to access any samples of this nature in my own research.

In Egypt, *Mimusops laurifolia* ("tree of life"), was "consecrated" to the Goddess Hathor (Bui Thi Mai and Girard 2010:14). Remains of this plant were recovered from the Lyon mummy, dating to the Ptolemaic dynasty (Egypt, 323-30 BCE) (Bui Thi Mai and Girard 2010:14; Girard and Maley 1987). Seeds of barley (*Hordeum* sp.) were generally added at the end of the Egyptian embalming process, soaked in water and tucked into the wrappings, allowing the seeds to germinate through time (Corbineau and Bui Thi Mai 2014:49; Girard and Maley 1987:104; Loret 1892). This practice is believed to symbolize Osiris's resurrection. "Tree of life" and barley might have served to ensure the safe passage of the dead to the afterlife. The use of these plants in embalming seems to have come from an already established tradition, but each repetition strengthened even more the symbolic nature of these plants and their role in embalming.

Some plants were also added to the embalming process in Europe for possible religious reasons (Corbineau et al. 2018:162). Frankincense (resin from *Boswellia* sp.) and myrrh, given by the three wise men after the birth of Jesus, as well as aloes (*Aloe* sp.), used to anoint Jesus's body, might have been used in the embalming process because of their biblical connections. While these different plants were mainly selected for their symbolic and religious meanings, other plants used in embalming were chosen for more practical reasons, such as botanical elements with antibacterial properties or strong perfume (see Corbineau and Bui Thi Mai 2014). There again, the selection of myrrh and aloes was dictated by ritual norms, based on years of repetition. Ensuring the presence of these botanical elements in each case helped to reinforce the tradition, making it slightly harder to transform in the next case.

At the site of Morro Grande in Southeastern Brazil (1270 BCE-560 CE), hearths were encountered in close relations with graves, something common in Tupinambá practices (Beauclair et al. 2009). Based on oral tradition, it is understood that these fires were made to offer heat to the deceased and to protect them from evil spirits (Beauclair et al. 2009:1412). When examining the residues from those fires, the researchers encountered high proportions of bark, a material usually used to fire ceramics (see also Scheel-Ybert et al. 2014). The authors concluded that bark was used to transform ceramics, allowing the clay to "glow" and could have been understood as having the "power of transformation" (Beauclair et al. 2009:1414). By adding bark to funerary hearths, the Tupinambá people might have been using those transformative properties to help the deceased become a mighty ancestor, able to protect the living (Beauclair et al. 2009:1414). This mortuary practice is therefore influenced by the practical properties of the bark, as observed from craft production. Bark itself might not have been imbued with symbolic power at first, but this material gained ritualistic power when it started to be used to transform clay into ceramic pots. Then, the Tupinambá started using it to transform deceased into spirits and ancestors, thus modifying the ritual power of bark.

A similar observation can be made regarding the use of bread in Christianism. In this religion, bread symbolizes the body of Jesus Christ. Consuming bread is done to obtain forgiveness for the sins committed (Hastorf 2017:233–234). This connection between bread and Christianity is so important that Spanish friars working in Mexico during the Early Colonial period would mention that "faith was wheat" (Earle 2012:159). Bread was therefore imbued with numerous meanings, as it served as a staple food (Braudel 1967; Earle 2012:55) and as a religious representation. Here again, the use of bread in rituals became an established tradition over time, with every new ceremony involving this food element adding momentum.

Similar to wheat bread in Christianity, maize played a meaningful role in the Americas. At Pacatnamu, Peru (c. 600–900 CE), Moche botanical offerings are overrepresented in burials and tombs when compared with domestic assemblages, where marine resources prevail (Gumerman IV 1994, 1997a; see also Peña-Chocarro et al. 2005 in Iberia). Gumerman IV (1994:409–410) offers the hypothesis that maize had to be grown and could not be found in the wild, possibly making this resource inaccessible in the afterlife. By offering maize to the deceased, people were able to ensure their ancestors could consume this plant alongside more accessible wild marine resources.

In Santiago Nuyoo, a Mixtec village in Oaxaca, Monoghan (1996:183–184). witnessed the role of maize in a wedding. Participants placed a pile of tortillas in front of the lovers before the ceremony began. Near the end of the marriage ceremony, the father of the bride took a tortilla and cut it in half, giving one half to the future husband and wife. By eating this half tortilla, they would "grow and speak together". In festivals in Oaxaca, it is also common to have piles of tortillas shared, so all attendees can "eat 'from the same tortilla'" (Hastorf 2017:234; see also King 2007; Monaghan 1990).

Interpreting botanical elements recovered from private and public ceremonies can be difficult. This is mostly due to the fact that certain plants had numerous entangled meanings—potentially impossible to separate—illustrating the need to tie paleoethnobotanical approaches to anthropological questions to understand these plants and the practices surrounding them (see **Chapter 5**). For example, in Honduras, Morell-Hart (2011) examined plants recovered from ritual contexts and from objects used for ritual purposes (through the extraction of microbotanical remains from these artifacts). There, Morell-Hart identified plants that could labelled both as ritual and medicinal, such as nance and avocado. Anthropological knowledge allows us to better contextualize such plants in regional and worldwide narratives and better understand the role of plants in mortuary contexts.

Paleoethnobotanical Approaches to *Conjonctures:* Larger Social and Political Phenomena

The use of plants in rituals can offer valuable information regarding transformations and continuities in larger social and political phenomena through time. To do so, archaeologists need to track the use of plants over a certain period and compare the results obtained.

For example, at Gordon's Third Cave in the Sesemil River Valley (Honduras, 900-600 BCE), Rue et al. (1989) encountered unidentified flower anthers in ancient mortuary chambers and modern botanical offerings placed in neighbouring caves. This observation highlights the perpetuation of this centuries-old practice that consists of placing flowers in caves found along the Sesemil River Valley by contemporary Maya people. By doing so, the participants are allowed to maintain a connection with their ancestors of the Sesemil River Valley through ancient practices. While the plants used as offerings might have changed through time, this ancient tradition was preserved through the repetition of ritual events.

Other studies have allowed to observe the arrival of new cultural elements in local communities. In Lyon, France, an individual potentially wearing a wig was buried in a lead coffin (Bui Thi Mai and Girard 2003:135). At the bottom of that coffin, paleoethnobotanists recovered a thin layer of ash, the only remains of a small fire that was lighted and extinguished before placing the deceased. This fire might have been lit to purify the burial, a practice that was common in Germany at the time, but not yet identified in France (Bui Thi Mai and Girard 2003:135). While more research would be needed to support this claim, such a practice might help us to better understand regional interactions taking place at the time in Europe. This burial offers a rare glimpse in the arrival of a new cultural tradition that has yet to become a common practice. At the same time, this event is perpetuating German rituals and challenging French mortuary traditions.

Beyond specific functional properties in funerary preparations and symbolic aspects in establishing and maintaining relationships, botanical mortuary offerings also operated as identity markers, whether purposefully or unintentionally. In Germany, Kreuz (2000) examined botanical offerings from Germanic settlements before and after the arrival of Romans to see if mortuary practices changed through time. This researcher identified a series of plants used long before the Romanization of the region, such as cereals, pulses, and wild fruits. When encountered in Roman settlements, Kreuz (2000:47) believes these findings "represent a continuity of rites", associated with a lower level of Romanization. However, when peach, garlic, chestnut, dates, or olives are recovered from mortuary contexts, those are considered as "indicators of a discontinuity" in rituals, highlighting a higher level of Romanization (Kreuz 2000:47).

Rottoli and Castiglioni (2011) followed the same strategy to demonstrate that the Romanization process in northern Italy occurred gradually. Bouby and Marinval (2004) demonstrated that the inhabitants of Central France kept their traditional mortuary botanical offerings under Roman rule, while the people of Mediterranean France and the Rhône Valley included new exotic plants, demonstrating a higher level of Romanization. Beneš et al. (2012:109) encountered remains of orange (*Citrus aurantium*) dating to the 16^{th} or 17^{th} century, the first presence of this plant past the Alps. This study illuminates what might have been the "first wave of globalization" in central Europe (Beneš et al. 2012:103). In these studies, paleoethnobotanists examined which plants had made their way in the mortuary realm. To be used as mortuary offerings, these plants had to obtain symbolic meanings. In some places where Romanization was stronger, it seems that people included more foreign botanical elements in their mortuary offerings. The repetition of the inclusion of exotic plants likely strengthened their status as mortuary offerings in local traditions.

Similar studies in the Americas have addressed identity through plant residues in mortuary contexts. Belmar et al. (2020) focused on mortuary botanical offerings from Chile during the Late period (1400–1536), following the incursion of the Inkas in the region. The plants recovered from tombs and burials consisted of a mix of local wild plants and maize (associated with the Inkas), "as a way to connect together Inka and local practices" (Belmar et al. 2020:56). However, at the Santa Monica Bay (California), during the Colonial Period (1769–1834 CE), the results are at the opposite spectrum (Reddy 2009). While introduced European plants are present in Indigenous domestic spaces, their frequency in mortuary contexts is quite low, likely demonstrating that native plants were preferred in those meaningful contexts, possibly to maintain social identities and sacred traditions (Reddy 2009:6–8).

Studies focusing on identity have also been common in Asia. In Begash, Kazakhstan (510 BCE-1 CE), Frachetti et al. (2010) have examined plants from burials to understand the plants consumed by the inhabitants of this region located at the crossroads between western Asia and China, where two different sets of plants dominated the assemblages. Frachetti et al. (2010:1007) identified both wheat (western Asia) and broomcorn millet (China) in mortuary contexts but could not encounter those plants in domestic spaces, possibly demonstrating that the pastoralist inhabitants of Begash did not rely on those plants for their subsistence, but rather gave them some ritual importance.

In the Xinjiang region, China, archaeologists focused on mortuary offerings to better understand the introduction of new plants in the region and movements of populations, including the arrival of the Han dynasty (202 BC—9 AD) (Chen et al. 2012). By comparing traditional foodways (Gong et al. 2011; Yang et al. 2014) to sites from the Han dynasty (Chen et al. 2012, 2016), they saw an increase in the consumption of crop production following the migration of new people that brought new agricultural equipment and techniques (see also Jiang et al. 2013). Jiang et al. (2009, 2015) were able to demonstrate that grape vines (*Vitis vinifera*) started to be produced at a small scale around that time as well, which might indicate the introduction of new techniques like irrigated fields or gardens to support viticulture.

Examining plants selected for mortuary offerings and public rituals provides an ideal way to study cultural perceptions of new foods and the arrivals of outsiders. Inhabitants of cities located at the crossroads of important trade routes, impacted by the slow transition towards a globalized world, or influenced by new cultures, had access to a vast array of foods. The inclusion or omission of these plants in the ritual settings—unique contexts associated with spiritual beliefs—informs us about the various meanings of local and introduced species. By considering the varying roles of local and introduced species in mortuary settings and public rituals, it is possible to examine changes and continuities in personal and collective identities. Those examples have allowed us to understand the role of plants by connecting them with larger social, political, and economic processes that were taking place at the time. I follow a similar approach in this study, by connecting the long history of Monte Albán to the *conjonctures* that transformed it.

Emerging Paleoethnobotanical Approaches in Ritual Settings

Paleoethnobotanical residues add a critical line of evidence in mortuary and ritual studies by revealing ancient beliefs, daily practices, and ancient plant knowledge. Paleoethnobotanical sampling (sediment and artifacts) should thus be a regular part of excavation practice, whether within mortuary contexts or outside of them. Many paleoethnobotanists (Bouby and Marinval 2004:78; Van der Veen et al. 2007:206–207) have expressed the need to examine mortuary assemblages from more sites to be able to draw comparisons and develop broad regional narratives. While collecting more data is essential, it is also important to follow rigorous sampling protocols and strategies (Bouby and Marinval 2004:84–85) to maximize residue recovery and avoid contamination, preferably by developing paleoethnobotanical methodologies before initiating a project instead of collecting samples post-facto (Marinval 1993:56). Systematic sampling allows researchers to target key contexts and develop the best sampling method based on the site's characteristics. Furthermore, different paleoethnobotanical analyses yield different results, and thus combining different types of datasets (e.g., anthracology, carpology, phytoliths, pollen, starch grains) is optimal (Morell-Hart 2019; Morell-Hart and Bérubé In Press; Pearsall et al. 2004:423–424; VanDerwarker et al. 2016:127–129). Targeting macrobotanical samples is logical when examining cremation residues, but many botanical offerings placed in burials and tombs were not carbonized and likely disappeared long ago (Bouby and Marinval 2004:77). By incorporating microbotanical analyses of pollen, starch grains, and phytoliths, it is possible to detect the presence of fragile plants such as succulent fruits, tubers, and flowers (Iriarte Chiapusso and Arrizabalaga Valbuena 2010:78).

However, it can be difficult to associate botanical remains directly with ritual activities (Marinval 1993:46), as plant residues may enter mortuary contexts through wind, animals, erosion, and other vectors. Artifact residues are complex as they are sometimes associated with mortuary offerings and sometimes with previous uses in domestic contexts (see Belmar et al. 2020:54–55). We must also consider ancient practices that might have affected the recovery of botanical remains, like the cleaning of a formal tomb before placing a newly deceased individual, thus discarding important information about its reuse (Smith et al. 2014:268). The "funerary landscape" (Dietrich and Corbineau 2015:242; see also Bui Thi Mai and Girard 2003:129) that includes the plants and trees growing in ancient cemeteries, as well as the flowers placed outside of burials, may introduce botanical residues that complicate our interpretations.

Nonetheless, plants factored critically into ancient ritual practices, and analyses of their residues can contribute significantly to understandings of deathways, alongside lifeways (see Morehart and Morell-Hart 2015:492–496). In this chapter we have seen the critical sorts of questions that can be addressed by botanical evidence—sometimes exclusively through such evidence. Such insights are invaluable, especially when we consider how plants index a larger set of practices. With more regional data, lacking in many regions around the world, we would better be able to contextualize such practices. Attention to botanical remains obtained from ritual contexts, and regularly including them in broader discussions, will improve our knowledge of regions, societies, and practices. In this spirit, I compare the plants found from mortuary contexts and public rituals to larger *conjonctures* that took place at the Zapotec site of Monte Albán. In the next chapter, I provide an overview of *conjonctures* at Monte Albán, as gleaned from prior archaeological research.

3. Mortuary Traditions and Public Rituals at Monte Albán

Monte Albán has had a long history of research, with investigators focusing on the site's settlement and architecture (e.g., Acosta 1958; Blanton 1978; Caso 1932; Caso and Bernal 1952; Fähmel Beyer 1991; Levine et al. 2021; Marcus 2012; Nicholas and Feinman 2022; Peeler and Winter 1994; Robles García 2009; Rojas and Beccan Davila 2020; Urcid 2011), the formation of statehood and political dynamics in place (Balkansky 1998; Joyce 2010; Joyce and Barber 2015; Joyce and Winter 1996; Marcus and Flannery 1996; Urcid and Joyce 2014), and the religious and spiritual importance of the city (Joyce 2020a, 2020b; Marcus 1978; Urcid 2011; Winter et al. 2007). Such studies illuminate key *conjonctures* I explore in this study, including the foundation of a new city made possible through the possible collaboration between its inhabitants, the establishment of new trade routes with neighbouring regions, the potential transition towards a society with increased inequalities, and the impact of Teotihuacan cultural influence at Monte Albán. In my research, I focus on the evolving role of plants in private mortuary contexts and relatively public rituals over the history of the site, to track changes and continuities in these practices and their relationship to larger medium-term phenomena.

Monte Albán is located in the Valley of Oaxaca, near contemporary Oaxaca de Juárez in the State of Oaxaca. The "valley floor ranges from 1420 m to 1740 m in elevation", with mountains reaching up to 3000 m (Blanton 1978:1). The rain precipitation in the region is limited, with the annual precipitation average varying between 600 mm to 1,000 mm in some sectors (Blanton 1978:1). During the rainy season (May—September), there are small springs among the slopes of Monte Albán hilltops (González Licón 2011:65; Winter et al. 2007:190). This season was an important one, as inhabitants had to store and collect as much water as they could for their yearly usage (González Licón 2011:65). Otherwise, it is estimated that Monte Albán's inhabitants would have run out of water during the dry season (October—April) (González Licón 2011:65). When this happened, people would potentially have had to travel up to three kilometres in the eastern direction and collect water from the Río Atoyac (Blanton 1978:1; González Licón 2011:65).

Many researchers believe (Joyce 2010:128; Marcus and Flannery 1996) that Monte Albán was founded in 500 BCE (**Table 3.1**) by people coming from San Jose Mogote and other neighbouring communities. Monte Albán was occupied until 800 CE, when it was abandoned following a decline that started in 650 CE (Joyce 2000:71). The site, initially occupied by Zapotec people (Joyce 2010:43), was then reoccupied sporadically, though these later phases were limited. After its founding, Monte Albán quickly became one of the first Mesoamerican cities, as well as a powerful political and economic entity (Blanton 1978:36; González Licón 2011:63; Joyce 2000:71).

Table 3.1: Monte Albán chronology (Winter 2011, Figure 2)

Years	Period		Valley of Oaxaca	Monte Albán
1521	Postclasic	Late	Chila	V
1400				
1200		Early	Liobaa (Late / Early)	
1000				
800	Classic	Late	Xoo	III B-IV
600			Peche	Transition III A-III B
400		Early	Pitao (Dxu´Complex)	III A
200	Preclassic	Terminal	Tani	Transition II-III A
1 A. D. / B. C		Late	Nisa (Late / Early)	II
200			Pe	I
400		Middle	Danibaan	
600			Rosario	
800			Guadalupe	
1000		Early	San José (Late / Early)	
1200			Hacienda Blanca Complex	
1400			Tierras Largas (Late / Early)	
1600			Espiridión Complex	

The first archeological excavations at Monte Albán took place in the late nineteenth century, led by Leopoldo Batres and Marshall Saville (Joyce 2010:10). Then, in 1931, Alfonso Caso, assisted by Ignacio Bernal and Jorge R. Acosta led 18 field seasons, the last one taking place in 1958 (Acosta 1958; Caso 1932, 1935, 1938, 1970; Caso and Bernal 1952; Caso et al. 1967; see also Joyce 2010:10; Marcus and Flannery 1996:27). Richard Blanton (1978) also completed an elaborate survey of the site, which improved our understanding of its settlement and development. Other archaeological projects have taken place at Monte Albán since then, including the *Proyecto Especial Monte Albán 1992–1994* (PEMA) led by Marcus Winter (Martínez López et al. 2014; Winter 1995, 1997a; Winter et al. 1997b-e, 1999a-b, 1994). In 1992, Monte Albán was one of the 12 archaeological sites selected for the *Fondo Nacional Arqueológico*, aiming at "studying and protecting the pre-Hispanic cultural heritage at the national level" (Winter 1997a:1, personal translation). The PEMA had seven objectives, including leading new excavations on the Main Plaza, particularly in the South and North platforms (Winter 1997a:1-2). All the samples analyzed in this study come from the excavations that took place on the Main Plaza and its immediate surroundings during the PEMA **(Figures 3.1, 3.2)**.

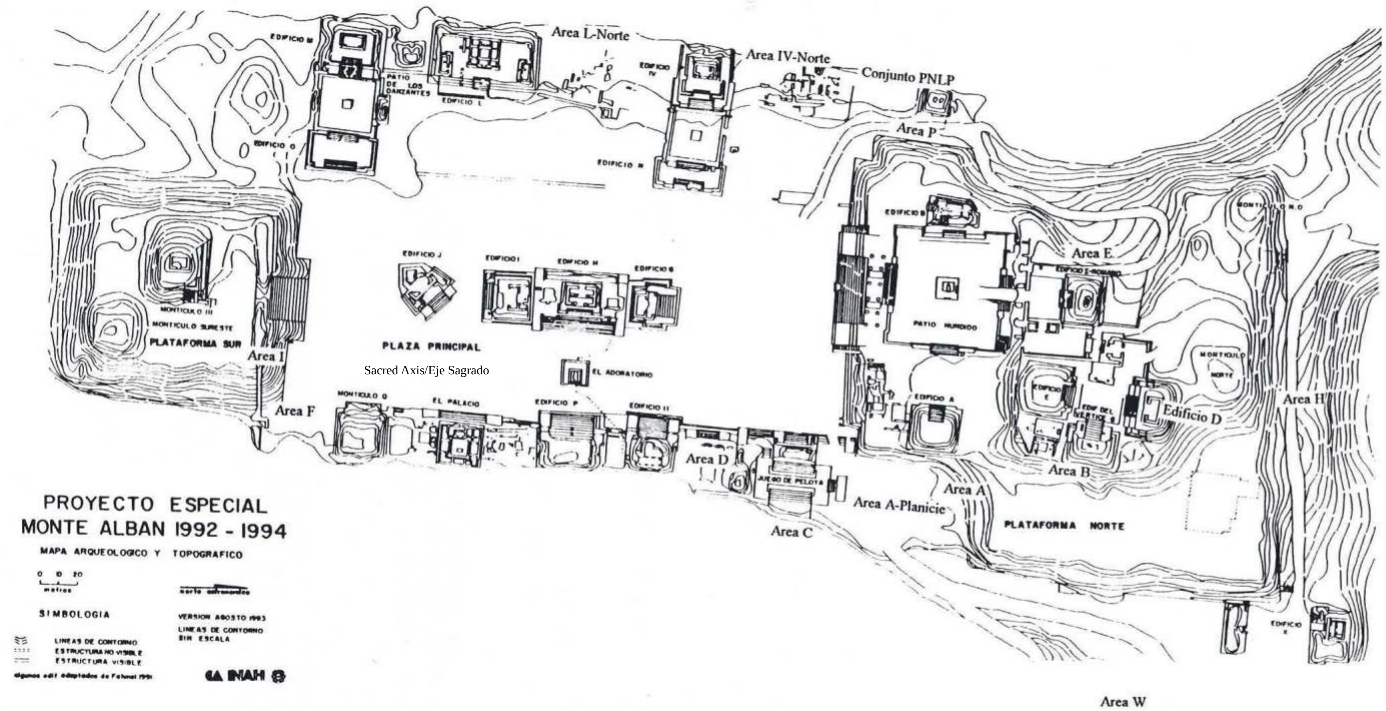


Figure 3.1: Map Made During the PEMA and Highlighting Areas Featured in this Study (Based on Winter 1997a Fig. 5.1)

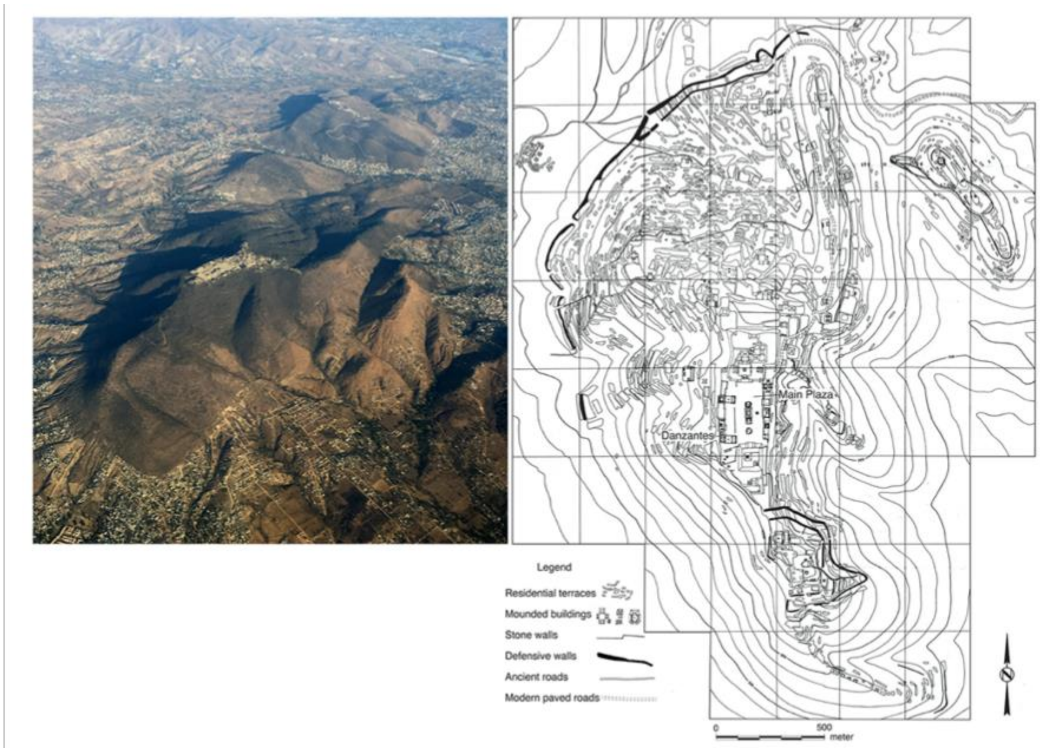


Figure 3.2: Photography and Map of Monte Albán Showing Terraces Below (Nicholas and Feinman 2002, Fig. 3).

Numerous investigations followed the PEMA. In 1999 and 2000, Robles García (2009) led a project to restore sections of Monte Albán following an important earthquake that damaged parts of the site. She then started the *Proyecto Arqueológico del Conjunto Monumental de Atzompa*. Following the interventions of Robles García, Duverger and Letouzé (2017) led excavations between 2009 and 2012 in the *Sistema de Siete Venado* complex, located south of the Main Plaza. Finally, Levine and colleagues (2021) directed the *Monte Albán Geophysical Archeology Project* in 2017, which allowed scholars to better understand the architecture of the site.

In this chapter, I present the history of Monte Albán and focus on the larger social, political, and economic trajectories that unfolded over time. I argue that these *conjonctures* influenced the use of plants in private and relatively public rituals at the Zapotec capital, but that these medium-term phenomena were also reinforced and transformed by botanical offerings (targeting Objective 1). Finally, I provide context regarding the role of mortuary and public rituals at the site. This allows me to better contextualize the relationship between the social status of the deceased and the use of plants as offerings (Objective 2) and to understand the differences that might have affected plant uses in relatively public and private rituals (Objective 3).

Monte Albán's History

Following its foundation in the Middle Formative Period, Monte Albán quickly grew and became a powerful polity in the region. By the Terminal Formative (100 BCE—200 CE), Monte Albán had expanded to reach 442 hectares (Blanton 1978:44; Joyce and Barber 2015:830). Its population at the time is estimated at a minimum of 10,200 (Joyce and Barber 2015:830), before reaching a population height of more than 20,000 people (Urcid 2014a:208—209). Interestingly, as the population grew, so did the consumption of turkey, which led Martínez-Lira (2014:425) to suggest that this animal might have played a role in the city's "subsistence strategy" (see also Martínez-Lira and Corona-M. 2016). Considering the site was uninhabited before 500 BCE, this demographic explosion is quite impressive. The founding of Monte Albán transformed the Valley of Oaxaca and its political balance. Many archaeologists also consider Monte Albán to have played a central role in the "development of novel […] religious ideas and practices" (Urcid and Joyce 2014:151).

I have divided the long history of Monte Albán into four different phases as described below, rooting these phases in previous studies that developed the basic chronology for the site. These phases are based on the medium-term phenomena taking place at Monte Albán that impacted both the life of its inhabitants and the larger societal, political, and religious developments that took place at the Zapotec capital.

Danibaan and Pe (500 – 100 BCE): The Genesis

Monte Albán was erected on a hilltop at the very centre of the Valley of Oaxaca (Blanton 1978:1–3, 36, 1983a:84; Blanton et al. 1999; González Licón 2011:67; Joyce and Barber 2015:830; Marcus and Flannery 1996; Winter 1974:981, 1989). Placed on high mountains at the centre of the Valley of Oaxaca, this new polity "visually and perhaps symbolically [dominated] the valley" (Joyce and Winter 1996:37–38). Joyce (2020a) argues that this location was "a mountain of creation and sustenance" that allowed occupants to connect with ancestors and deities.

The hilltop was to some extent inhospitable, as it was a place difficult to access due to its steep slope (Blanton 1978). Even so, the location presented some interesting advantages for its settlers. It was up to then unoccupied and located at the centre of the Valley of Oaxaca, offering a prime trading location for a city that was to expand its influence on neighbouring regions (Winter 1984, 2011). Monte Albán's settlers might also have chosen those hilltops for defensive purposes: it was difficult to access for enemies, and assailants could be seen coming from afar (Orr 2001:64; Urcid 2014a:206; Whitecotton 1977:36). It also has a commanding view of the valley and of north and northwest entry points.

Joyce and Barber (Joyce 2000:81; Joyce and Barber 2015:830) argue that Monte Albán's location and topographical components included many key elements that might have helped in cementing the authority of the new polity through its sacred character (Urcid 2014a:206). First, according to Joyce and Barber (Joyce 2000:81; Joyce and Barber 2015:830), the fact this new city was built on a mountain, a sacred component for many Mesoamericans, would have brought an aura of sanctity to its inhabitants, monuments, and rulers to come. Second, the small springs among the slopes of Monte Albán hilltops (Winter et al. 2007:190; see also Nicholas and Feinman 2022; Rojas and Beccan Davial 2020), only present during the rainy season (González Licón 2011:65), might have connected the mountain with water, a crucial element associated with fertility and maize harvest (Joyce 2020a). Third, during the rainy season, Monte Albán was "often enveloped in clouds, making it literally a rain place" (Joyce 2020a:82). If we agree with these arguments, those elements made it possible to transform the Main Plaza into an *axis mundi*, connecting the human world with celestial entities in earlier periods and the underworld in later periods. As explained later, the perception of this city as an *axis mundi* might have played a central role in mortuary rituals, with ancestors mediating with spiritual entities, and in public rituals as well, often aimed at reinforcing the unique status of the city and its inhabitants.

The Main Plaza is located on the biggest and highest mountain in the sector (400 m elevation from the valley floor) (Blanton 1978:3; Urcid 2018:31–32). The Plaza itself measures 300 m on the north—south axis, and 100 m east—west (Blanton 1978:3; Joyce 2000:81) (**Figure 3.3**). The construction of this Plaza started during the Danibaan Period (Monte Albán Early I) (González Licón 2011:64; Joyce 2020a:77—78) and can be considered as "one of the earliest activities at the site […], which was an unprecedented labor project" (Joyce and Barber 2015:830; see also Joyce 2020a:77—78). The first buildings constructed on the Main Plaza were located along the western axis and on the North Platform (Joyce 2020a:77-78; Joyce and Barber 2015:830). New data obtained by the *Monte Albán Geophysical Archaeology Project* (Levine et al. 2021), through a combination of ground-penetrating radar, gradiometry, and electrical resistance, shows that the initial layout of the Main Plaza may have followed an East-West orientation, contrary to the belief that the Plaza had always been oriented in the North-South axis (Blanton 1978:45).

Figure 3.3: Model of Monte Albán's Main Plaza located at the entry of the site (North Platform is seen at the bottom)

Since the construction of the Main Plaza began soon after its foundation, this could support the idea that Monte Albán was also meant to play a role as a "ceremonial center" (Joyce 2010:131). During the following periods (Pe [Monte Albán Late I] and Nisa ([Monte Albán II], 300 BCE—200 CE), the Main Plaza was expanded, with the construction of many other buildings and the levelling and plastering of new sections (Blanton 1978:35, 1983a:85; Flannery 1983a:103), and transformed to follow a new North-South orientation (Levine et al. 2021). The Plaza's continuous improvement through the addition of new buildings also highlights its role through time and the intent to maintain and enhance its ceremonial and civic powers importance (González Licón 2011:64; Joyce 2000, 2004, 2009:32; Joyce and Barber 2015:830). The growth that occurred during the Danibaan and Pe periods was essential for the rest of the occupation, somehow establishing the basis of Monte Albán's legacy.

It is believed by some archaeologists (Urcid and Joyce 2014:165; see also Joyce 2020a; Nicholas and Feinman 2022; Urcid 2011) that, during the Danibaan and Pe periods, elite and commoners, to a certain degree, shared powers, including in the political and religious realms (Urcid and Joyce 2014:165). There are still a lot of uncertainties around this time period, since most of the buildings dating from Danibaan and Pe at Monte Albán are now hidden under later constructions (Urcid and Joyce 2014:150). The discovery of three Danibaan buildings, unknown until now, could provide us with more information on this period in the following years (Levine et al. 2021).

At Monte Albán, the existence of a collective governance is supported by archaeological elements. First, Nicholas and Feinman (2022:6) mention the presence of ceramic vessels in non-noble domestic contexts, objects previously tied to high-status families. Second, commoners' houses are built with adobe bricks at Monte Albán, while mud and thatch were generally used to construct houses of low-ranking people in the Valley of Oaxaca at the time (Nicholas and Feinman 2022:6). Nicholas and Feinman (2002:6) use these two examples to demonstrate that there was a “level of cooperation and coordination, a social charter and norms” that might hint towards a model of collective governance.

Third, the existence of collective governance for the first period of occupation is also based on a recent re-interpretation of the *danzantes* glyphs located on building-L, which are believed by Urcid (2011; see also Urcid and Joyce 2014:152–157) to have portrayed elite members and non-nobles playing an important role in religious rituals. This interpretation of the *danzantes* contradicts previous hypotheses, where these images were thought to represent captives from other polities being sacrificed (Coe 1962; Flannery and Marcus 1983b; Marcus 2012:95–96; Winter 1989).

The presence of a certain number of elites at the time is seen archaeologically through the presence of elaborate residences built right after the founding of Monte Albán on the North Platform of the Main Plaza. These are believed (Joyce 2000:84) to have been occupied by members of an elite class. The *danzantes* also contain the names of three rulers (names and enthronements), demonstrating the presence of strong rulers alongside a more corporate-style power base (Urcid 2011; Urcid and Joyce 2014; Joyce and Barber 2015). As explained by Joyce and Barber (2015:833), “the two potentially competing forms of authority—communal and noble—carried inherent contradictions and latent points of tension.” Both shared powers and responsibilities (for example, rulers were depicted as performing human sacrifices, while non-nobles were pictured “performing autosacrifice and invoking ancestors”) (Joyce and Barber 2015:833; see also

Urcid 2001; Joyce 2020a:84). That balance seems to have remained throughout Danibaan-Pe, before the elite gained more power in the following Nisa phase, deeply impacting the political and social processes taking place at Monte Albán.

To summarize, according to Joyce and Urcid (Joyce 2020; Urcid 2011; Urcid and Joyce 2014) and Nichols and Feinman (2022), during the Danibaan and Pe Periods, following the foundation of Monte Albán, people might have lived in a more collective governance, where elite shared powers and responsibilities with low-ranking people. The founding of this city involved the participation of many people coming from different places, unifying their strengths to reach certain common goals (Nicholas and Feinman 2022). Starting from the Pe Period, the food produced at Monte Albán was not sufficient to nourish all its inhabitants, forcing the polity to trade with neighbouring communities (Joyce 2010:148). Taking control of this trade and limiting the access to exotic resources offered an opportunity for elite members trying to establish their dominance (Joyce 2010:144).

Through Danibaan-Pe, one of the key *conjonctures* is the creation of collective governance (that would move towards increased inequalities in the following Nisa phase). For Danibaan-Pe, I expected to encounter a limited number of plants from private mortuary contexts, with a great deal of overlap in plant species between private mortuary contexts. I believed that the nobility would have focused their attention almost exclusively on public rituals, based on the idea that they mobilized a vast quantity of resources for public events in order to gain power and influence. By including important staples like maize in public rituals and offerings, elite members would have been able to demonstrate their wealth and increase their prestige through time. To be successful, the elite of Monte Albán likely had to put in play a large quantity of their resources, possibly impacting the quality and the quantity of the foods placed alongside the deceased in a more private setting. Monte Albán was still a young polity at the time, possibly limiting the power of these early ancestors and warranting lesser mortuary offerings.

Nisa (100 BCE—200 CE): Shifting the Balance

During the Nisa Period (Monte Albán II), archaeologists have documented an overall increase in social inequality between different groups of people (Joyce 2020a:84; Marcus 2012:89). This phenomenon is seen throughout the site, especially at the household level, thanks to the artifacts recovered, including those placed in burials (Flannery 1983a:136). Obsidian and marine shells, previously associated with elite members, are seen more frequently starting during the Nisa Period (Flannery and Marcus 1983a:54-55; Joyce 2010:157). During Nisa, a study done by Martínez-Lira (2014) on faunal remains allowed scholars to suggest that the elite members of Monte Albán residing on the Main Plaza ate more venison than during the previous Danibaan-Pe phase.

Those changes are also visible in the religious realm, as nobles might have become ritual specialists, possibly to cement their ruling position (Joyce 2020b:339; Marcus and Flannery 1996:14). During the Nisa Period, Monte Albán's elite members transformed the Main Plaza: they added new buildings

(Flannery 1983a:102; see also Marcus 2012), "destroyed and buried a temple platform and at least two other structures at the site's center" (Levine et al. 2021:93–94), and they changed the orientation of the Main Plaza (Levine et al. 2021). The Main Plaza was conceived as an *axis mundi*, offering a way to connect the Zapotec visitors to the sky entities and the underworld, through elite intermediaries (Joyce 2009:33; Joyce and Barber 2015:830; Robles García 2011:60).

The role of this Plaza has been identified through the deliberate layout of the architecture, reflecting ancient Zapotec cosmology (Joyce 2000:81) and religious practice through the presence of multiple temples (Marcus 2012:90–93). All this site planning was meant to "[sanctify] authority by positioning nobles as powerful intermediaries between commoners and the divine forces" (Joyce 2009:33; see also González Licón 2011:64; Joyce and Winter 1996:37). In other words, the monumental architecture became more clearly associated with elite members over time, increasingly supporting their role as legitimate ritual specialists (Joyce and Winter 1996:37). These changes highlighti important shifts in political, social, and ritual processes.

The Main Plaza was constructed as an "arena" that could host thousands of people at the same time, thus allowing foreign community members and people of different social status to participate together in public ceremonies, directed by elite members (Joyce 2009:37; Joyce and Barber 2015:830–831; Urcid 2014a:206). Previously, people could attend public rituals when invited or through adjacent terraces below, since the Main Plaza remained opened (Joyce 2009:37). However, during the Nisa Period, the space was enclosed, possibly to further limit access to the ceremonies, thus strengthening those who controlled the access to the Main Plaza (Joyce 2020a:85-86; Marcus 2012:90). Other scholars such as Nicholas and Feinman (2022) have argued that this transformation might have been done for defence purposes. At one of the "control points for entry onto the Main Plaza" archaeologists found 27 projectile points, which led researchers (Joyce 2010:159; Martínez López and Markens 2004) to suggest that force could be used to control the access to the Plaza. These findings point towards a sharp departure from earlier practices, with the Main Plaza transitioning from an unrestricted access area to controlled space.

The contexts associated with relatively public rituals examined in this study all date to the Nisa or following phases. Since they correspond to a time when access to the Main Plaza was likely restricted, it appears these rituals were not open to everyone. However, it is likely these events still attracted a larger number of people than private mortuary rituals since they took place outside of the private household context in larger, more open spaces. This is why I categorize them as "relatively public" events.

While the initial construction of the Main Plaza and its imagery might have been perceived in "communal terms […] the unforeseen tragedy was that commoners were also inadvertently contributing to their own subordination" (Joyce 2000:83–84). This change might have happened gradually, with the Main Plaza slowly becoming the "[house of] politico-religious institutions [that] provided a stage for public ceremonies" (Joyce 2009:32; see also Flannery 1983a:132-133; Marcus 2012). Then, elite members came to use the Main Plaza's symbolic elements to demonstrate the extent of their power. It is also near the end of the Nisa Period that the communal glyphs, such as the *Danzantes*, were taken down. The remodeling of the Main Plaza that involved the destruction of a possible temple and the removal of the *Danzantes* could perhaps be the result of a rival fraction potentially gaining power and deciding to get rid of these references to the past (Joyce 2010; Levine et al. 2021). The Main Plaza was an architectural project of a scale that had never been executed before in the region (Joyce and Winter 1996:38; Urcid and Joyce 2014:150), perhaps demonstrating the strong intent of its makers to differentiate Monte Albán from other polities. It might have allowed the leaders of Monte Albán to legitimize their political authority over their city and the region through the control of the Main Plaza and the *axis mundi*.

This strategy seems to have worked, as Monte Albán is believed to have "incorporated" the entire Valley of Oaxaca during the Nisa Period. Certain archaeologists believe this control might have been established through warfare (Elson and Sherman 2007; Marcus 1976; Spencer et al. 2008). Joyce (2010:157; see also 2014) argues Monte Albán's large sphere of influence might have been achieved through a combination of military conquests, diplomatic negotiations, alliances, and spiritual persuasion. Archaeological evidence suggests the presence of Monte Albán's influence in neighbour communities.

First, Marcus (1976) argues that the 40 slabs located on Building J list regions that might have been conquered by Monte Albán (see also Redmond 1983). This interpretation has been challenged by Carter (2017), who argues that Marcus' interpretations do not follow the Zapotec convention. Urcid (2011) and Joyce (2014) have also criticized Marcus' interpretations and rather suggest these might represent deceased ancestors. Second, El Palenque, a rival center located 20 km from Monte Albán, was conquered during Nisa. There, a temple and the ruler's residence were destroyed. A Zapotec temple was then built at Cerro Tilcajete, a site found 1 km from El Palenque, thus suggesting a conquest by Monte Albán (Elson 2006; Spencer and Redmond 2001; see also Joyce 2010:157). Third, architectural features such as "specialized multiroom temples" that first appeared at Monte Albán then became popular among neighbouring communities, suggesting a cultural influence spreading in the Valley of Oaxaca (Spencer et al. 2008).

Joyce and Winter (1996) have argued that the Main Plaza might have played a key role in Monte Albán's relationship with neighbouring communities by allowing its inhabitants to use ideologies and religious beliefs to their advantage (Joyce and Winter 1996). Through time, they argue that Monte Albán and its Main Plaza would have served to showcase the ingenuity of the elite members and became a physical representation of their legitimacy. This architectural complex allowed them to use "astronomy, architecture, engineering, [and] urbanism" in a way that could reflect and reinforce their prestige (Robles García 2011:52), making it a key element of the political dynamic of the city.

During the Nisa period, Monte Albán and its rulers were often portrayed as the mediators between Zapotec deities and the human world as seen on ceramic effigy bottles and tomb lintels (Urcid 2005, 2011, 2018, 2020). This may have been done in an effort to maintain their authority over the region by legitimizing the status of Monte Albán in the Valley of Oaxaca. To do so, they might have used different means, including the spread of crema ware ceramics with a new iconography that would become highly popular in the region (Elson and Sherman 2007; Joyce and Winter 1996:6). During Monte Albán's Nisa Period, this type of ceramic consisted of "highly decorated serving vessels", such as "tripod and tetrapod bowls" (Elson and Sherman 2007:266). Many of these also bore lightning iconography, generally associated with the deity *Cociyo*, the rain/lightning god (Elson and Sherman 2007:271). Elson and Sherman (2007:266, 271) believe that these ceramics created an association between their users and *Cociyo* himself. These symbolic artifacts were then given to rulers of allied polities of the Valley of Oaxaca by Monte Albán elite members to "'buy' their loyalty" (Elson and Sherman 2007:266, 271).

This new use of the crema ware ceramics allowed for the elite of Monte Albán to expand their ritual power in the Valley of Oaxaca, while strengthening their political alliances. Elson and Sherman (2007:267) suggest that the choice of the crema ware might have been motivated by the limited geographic spread of the necessary materials, "located immediately north of Monte Albán", thus limiting to a certain extent the ability of other polities to replicate them. This strategy worked for some time, but a similar iconography involving lightning made its appearance on other types of ceramics in the Valley of Oaxaca during the same period, both in elite and commoner residences (Elson and Sherman 2007:266). The appearance of this type of ceramic, associated with the veneration of *Cociyo*, tends to support a symbolic connection between the inhabitants of the Valley of Oaxaca and its capital. This type of ceramic became a way for archaeologists to identify the presence of Zapotecs at certain archaeological sites, demonstrating how popular it became (Martínez Tuñón and Higelin Ponce de León 2015). Those new alliances and trade routes allowed them to bring certain products in Monte Albán as well, including products from Chiapas, Veracruz, and Puebla (González Licón 2011:67), leading to an important period of political and economic growth.

To summarize, things seem to have changed drastically during the Nisa Period. The political balance shifted in the city, possibly moving from collective governance to a society with increased inequalities. Levine et al. (2021:78) argue this change was likely a "tumultuous transformation that shook" the inhabitants of Monte Albán. The destruction of buildings, the transformation of the Main Plaza, and the removal of communal glyphs might demonstrate an important power struggle and a political shift that took place at the time. At the regional level, Monte Albán's influence reached new heights, through the incorporation of new polities (Elson and Sherman 2007; Spencer et al. 2008:321). These new alliances, economic and political, meant that public events taking place at Monte Albán were not limited to locals anymore, they could attract foreign audiences, through the powerful Main

Plaza. Therefore, public rituals may have needed to be more spectacular to reinforce Monte Albán's leaders' spiritual hegemony.

The Nisa phase is marked by a few key *conjonctures*. During this phase, Monte Albán might have switched from a collective governance model toward one marked with evidence for increasing inequality, transforming the social and political landscape at the local and regional levels. The establishment of new trade routes diversified the economy, as seen by the presence of exotic produces at Monte Albán and of the crema ware in neighbouring polities. Finally, by monitoring the access to the Main Plaza and by becoming ritual specialists, elite members also influenced the religious realm. Based on these *conjonctures*, I expected to find new, exotic plants making their way into relatively public rituals, as these might have been perceived as signs of wealth and social prestige (see Morehart and Morell-Hart 2015:492). As the elite members of society might have felt the need to demonstrate their prestige to the inhabitants of Monte Albán and to rulers in the region, I expected that high-value plants featuring in relatively public rituals during the Nisa period might have reached their peak in quantity and diversity. I expected this tendency to also have been visible in the mortuary realm, to ensure a connection with *Cociyo*, rain, fertility, and for descendants to retain their prestigious place in the world of the living thanks to their connection with powerful ancestors.

Tani and Pitao (200–500 CE): The Slow Exhaustion of Power

Starting during the Tani transitional period (Monte Albán II-IIIA) and continuing during the Pitao (Monte Albán IIIA) up to the early part of the Xoo Period (Monte Albán IIIB-IV), Monte Albán kept growing demographically and geographically. Then, its population suddenly dropped, eventually leading to the abandonment of the Main Plaza and its neighbouring terraces in the following Peche-Xoo phase (Marcus and Flannery 1996:225, 234). During the Pitao Period, Monte Albán's beating heart seems to have slowed following the multiple changes that occurred in the Nisa Period. On the Main Plaza, the architectural developments dramatically decreased (Joyce 2010:197). Politically, the influence of Monte Albán started fading, with many polities withdrawing themselves from its authority and creating new alliances, leading to the creation of rival secondary centres (Balkansky 1998:475), thus transforming the political dynamics in the region. Coinciding with this loss of power, Martínez-Lira (2014) observed that the elite ate less venison during Tani-Pitao than they were used to during the earlier Nisa phase.

The Zapotec capital had some issues at the regional level. However, this did not stop the creation (it perhaps even encouraged it) of a relationship between Monte Albán and Teotihuacan. At Teotihuacan, this is seen through the establishment of Tlailotlacan, also known as the Oaxaca Barrio (Cowgill 1997:139; Gibbs 2010:255; Paddock 1983:170). At Monte Albán, the influence of Teotihuacan is supported through different archaeological elements. First, we see the introduction of new Teotihuacan pottery (Blanton et al. 1981:89; Caso et al.

1967:311–362; Martínez López 2014; Winter 2002:76). While the traditional ceramic was made of grey paste with incised decorations, we see new *café* paste ceramics with a slip and new decorative Teotihuacan motives (**Figures 3.4, 3.5**). A Thin Orange Bowl (generally found in Central Mexico) was also recovered from Burial XI-5, a context excavated before the PEMA (Winter 2002:76). Second, new mortuary practices (Caso et al. 1967:102-103; Winter 2002:76) made their way into Monte Albán including seated burials (Winter 2002:76) and Burial 1993-43 (**Figure 3.4)**, a grave containing the skulls of 18 children (discussed in this study). Third, the renovation and the construction of Zapotec public buildings seems to have stopped, suggesting a sudden realignment of religious practices (Winter 2002:78) and a rupture with earlier ritual customs. Fourth, the use of certain offering boxes found in the Sacred Axis of the Main Plaza that animated buildings during Nisa seem to have been interrupted during Tani-Pitao, before starting again in the Peche-Xoo (Gámez Goytia 2002:217). Based on those observations, Winter (1998) argues that Monte Albán was put under the direct control of Teotihuacan.

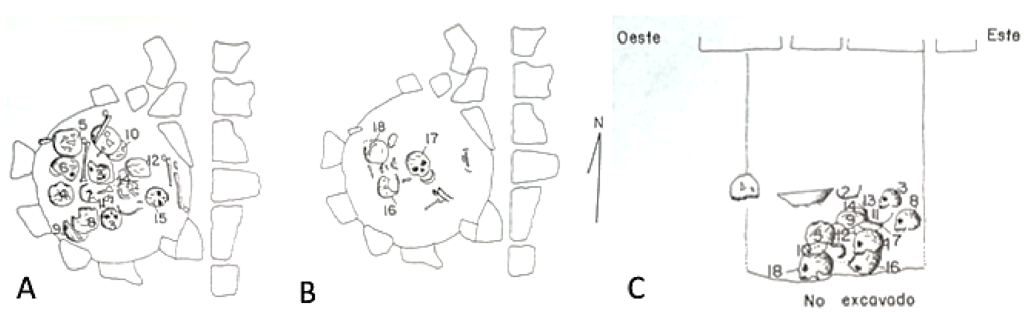


Figure 3.4: Drawings of Grave 1993-43. A) Level 2; B) Level 3; C) Profile (Martínez López et al. figures 54 b-d)

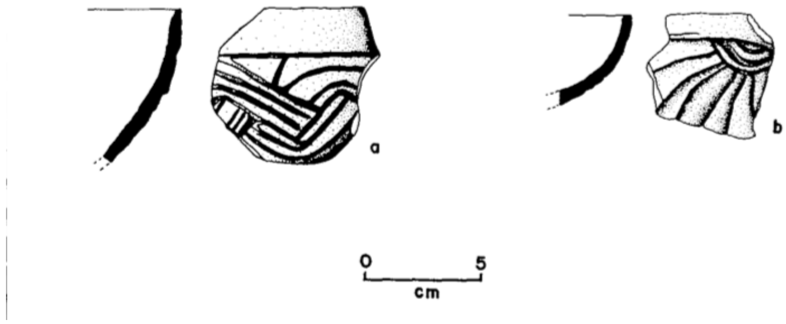


Figure 3.5: Zapotec Ceramic Vessels (Martínez López. Fig. 2)

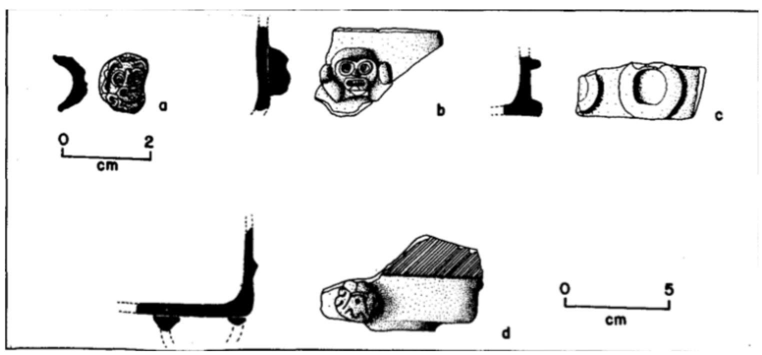


Figure 3.6: Teotihuacan Ceramic Vessels (Martínez López. Fig. 4)

Up until the Pitao Period, local Zapotec leaders at Monte Albán lived on the North platform (Winter 2002:76–77). This section of the site was associated with the most elaborate residences, as well as some of the most impressive temples. In the Pitao period, platforms with *tableros* make their appearance on Monte Albán's North Platfiom, following a pattern very similar to the Teotihuacan architecture (Winter 2002:76–77). Marcus Winter (2002) believes that the architectural modifications that occurred on the North platform, along with the arrival of many Teotihuacan components, might be the result of an invasion of Teotihuacan troops in Monte Albán (Winter 2002:76–77). He also offers the possibility that this could be the result of a strong wave of immigration coming from Teotihuacan. Finally, Winter also mentions the possibility that these changes were made by local Zapotec elite members (Winter 2002:78). Joyce (2010:201–206) suggests that these changes might be explained by the establishment of "reciprocal economic and political relations between the rulers of Monte Albán and Teotihuacan" rather than a symbolic imposition. Certain Zapotec nobles could have introduced Teotihuacan objects on their own, through trade and commerce, suggesting a transformation in economic and political processes, rather than the sudden imposition of a rupture with earlier practices.

If we agree with Joyce's idea that the changes in the material culture represent the creation of diplomatic ties between Monte Albán and Teotihuacan, then this Tani-Pitao can be described as one of cultural transformation. While the polity started to lose control over some of its neighbours, Monte Albán was still prosperous and attractive enough to lead to the creation of a relationship between the Zapotec capital and Teotihuacan. I suggest that the changes in ritual observed by Winter might have been a way for Monte Albán's elite to associate themselves with Teotihuacan to try to reinforce their status.

I am interested here in two key *conjonctures* that marked Tani-Pitao. First, the rise of rival centres that challenged the authority of Monte Albán's leaders, impacting the political system in place. Second, the changes following the Teotihuacan cultural influence at the site that transformed the ritual and religious system set in place in the earlier phases of occupation. Based on these important changes taking place at Monte Albán, I expected to observe a rupture between the assemblages from the previous periods, explained by these new cultural influences. I thought this would be visible through the appearance of new plants in relatively public and private practices, influenced by broader Teotihuacan traditions (Blanton et al. 1981:89; Caso et al. 1967:311–362; Joyce 2010:201–206; Winter 1998, 2002:76), and by the disappearance of key elements found in earlier burials. I also expected to see a different botanical assemblage in Grave 1993-43, dating from the Pitao phase. This burial contained 18 children's skulls and bones of adults (Martínez López et al. 1995:151–175). Because of the unique nature of this burial, testifying of a rare event taking place at Monte Albán, I expected to encounter botanical elements not seen previously, or at least in greater quantity than what had been recovered in other burials.

Peche and Xoo (500–800 CE): Tensions, Upheaval, and the Fall of a Legacy

Monte Albán's Peche (Monte Albán IIIA-IIIB) and Xoo (Monte Albán IIIB-IV) Periods were marked by the sudden revival of earlier Zapotec traditions (Winter 2002:81–82). Temple reconstruction that had stopped in the earlier periods started again, while Zapotec deities made their reappearance in iconography (Winter 2002:81–82). Teotihuacan-influenced mortuary rituals (seated burials, burial containing numerous children's skulls) were abandoned as well (Winter 2002:76–82). Up to now, archaeologists have yet to identify concentrations of artifacts with any Teotihuacan influence from Peche and Xoo. Therefore, I argue that we can associate the Xoo Period with a Zapotec traditional resurgence. Politically, the influence of Monte Albán was fading even more. After seeing the emergence of rivals like Dainzú and Guadalupe in Peche earlier, new centres made their appearance in this period like Lambitiyeco and El Choco (Joyce 2010:200–201). A few centuries later, Monte Albán was largely abandoned, with populations moving to those centres and elsewhere (Winter 2002:78–79).

Joyce (2020:218–219) argues that, in trying to secure their power, elite members transformed once again the layout of the Main Plaza, turning it into "a residential area" occupied by nobles. We also see the construction of smaller temples, once again limiting the participants allowed to visit those spaces (Joyce 2010:219–220; Martínez López 2002). In other words, the sudden revival of traditional practices such as the reconstruction of temples or the abandonment of seated burials and the attempt by the elite to restrain even more the access to ritual activities might have been a last attempt at connecting with a more prestigious past.

If the past emphasis on Teotihuacan rites came from local Zapotec rulers trying to legitimize their regional authority by connecting themselves to the rising foreign city, then returning to traditional practices might seem like an admission of failure. Slowly accepting that the association with Teotihuacan did not allow them to reconsolidate the status of Monte Albán, the elite might have decided to try a new approach to regain authority. Unfortunately for them, the slow abandonment of Monte Albán would suggest that the city's history and symbolic power were too weak at that point to even retain its own population. This is how the long history of

Monte Albán ended, marked by the loss of the city's political, spiritual, and economic grip on the region and on its own inhabitants.

In this section, I highlighted two *conjonctures* of Peche-Xoo. First, the resurgence of the Zapotec beliefs that were present during the Nisa phase. Second, the fall of Monte Albán's political system, mostly impacted by the decision of its people to leave, perhaps deciding to move to neighbouring polities deemed more attractive. During the last Peche and Xoo phases, I expected to encounter botanical assemblages quite similar with those found during the Nisa phase, demonstrating a realignment with earlier traditions (Joyce 2010:219–220; Martínez López 2002; Winter 2002:76–82). However, I expected the quantities of offerings to be reduced, following the loss of Monte Albán's political and economic influence in the Valley of Oaxaca (Joyce 2010:200–201; Winter 2002:78–79). In other words, I expected plants would have been very similar to those of the Nisa period, with some restraint regarding their amount.

Mortuary Distinction and Ancestor Veneration at Monte Albán

In this study, I examine the potential relationship between the social status of the deceased and the plants placed as offerings in their burials, following a strategy similar to those summarized in **Chapter 2.** If funerary treatment in general could be used in Oaxaca to examine similar and differential treatments based on social status, perhaps this relationship could also be examined at a micro-scale, in this case through plant residues. To follow this objective, I compared botanical remains recovered from formal tombs and simple graves.

At Monte Albán, most of the bodies recovered were placed in very close proximity to a residential building. This follows a pattern that started to emerge centuries previously in the Valley of Oaxaca, including at the site of San Jose Mogote (Marcus and Flannery 1996:133). In contrast with cemeteries, residence tombs and simple graves reinforced a connection between the descendants, the deceased, and their home (Adams and King 2011:3–4; McAnany 2002:118). The dead ancestors offered protection to the remaining members of their households and received offerings in exchange (Joyce 2020a:73; Lind and Urcid 1983). Most importantly perhaps, deceased ancestors were considered mediators that were able to petition gods and negotiate with them on behalf of their descendants (Joyce 2010:58). After their passing, ancestors remained active members of the household due to their unique position as mediators with the supernatural realm.

The leaders of households were buried in formal masonry tombs placed directly under their residences (Joyce 2004:201; Markens and Martínez López in press; Martínez López et al. 2014:8; Urcid 2005:28–44; Winter 1974), referred to in this dissertation as "formal tombs". Built at the same time as the house, they could be accessed by a shaft or stairs (**Figure 3.7)**. The entries of the tombs were then sealed. The people buried in formal tombs have been identified as "household leaders" as it is believed they had a higher social status than those buried in simple graves. This hypothesis is based on corroborating lines of evidence, including the elaborate architectural structures of the tombs (Martínez López et al. 1995, 2014) and the great quantity of offerings recovered from them, interpreted as indicators of status differences (González Licón 2003:229).

Other members of the household were placed in earthen burials dug under the residence floor (Martínez López et al. 2014), referred to as "simple graves" in this dissertation (**Figure 3.8)**. Some of these burials were stone-lined, while others only consisted of a simple hole dug in the ground. The inhabitants of the house selected a space to bury their dead, excavated this location, placed the body, and filled the grave with dirt.

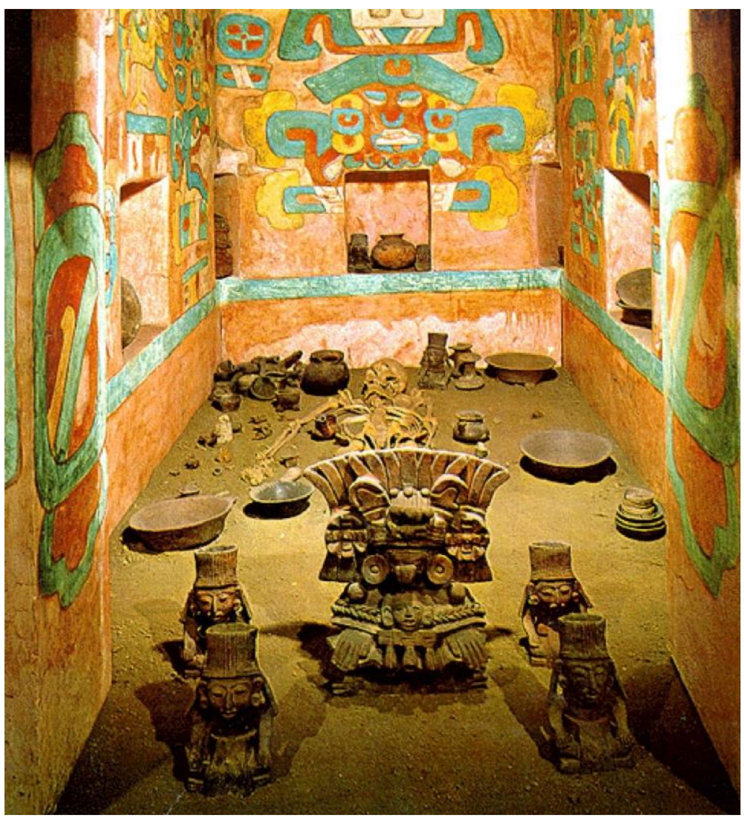


Figure 3.7: Photo of Tomb 104 Presented at the Museo Nacional de Antropología, Mexico City (Photo from Wikipedia)

Figure 3.8: Grave 1994-69 (Martínez López et al. 1995 Fig. 99a)

Márquez Morfín and González Licón (2001) have examined social differences at Monte Albán in relation to the size of the domestic space from different neighborhoods. Since all the samples examined in this study come from the Main Plaza or from contexts in close proximity to this area, I was not able to follow a similar approach. Fortunately, González Licón (2003; see also 2011) has also examined social differences at Monte Albán at the household level. He argues (González Licón 2003:23) that inequalities inside households increased during Nisa, as formal tombs became more common. This hypothesis is also supported by the fact that people buried in formal tombs consumed meat at a higher frequency than those placed in simple graves (González Licón 2003:231). During Tani-Pitao, González Licón (2003: 234) argues that inequalities inside the household increased because men received more offerings than women in mortuary contexts. He also observed that those placed in formal tombs during Tani consumed more meat than before, while those buried in simple graves ate less meat than the ratio observed in Nisa. This differential access to meat increased even more in the following Peche-Xoo phase (González Licón 2003:238), suggesting social differences in the household increased even more at that point in time. These results tend to demonstrate that the social differences in the household kept increasing from the Nisa phase up to the Peche-Xoo phase.

Formal tombs were constructed in a way that would allow people to repeatedly access their ancestors and to be buried with them, creating a strong bond between the living family members and their ancestors (Joyce and Barber 2015:829; Martínez López et al. 2014). Ancestors buried in formal masonry tombs could be revisited, something that was impossible for simple graves, as there was no ready access. The interment of the dead or the reopening of tombs were crucial moments to create a meaningful bond with the ancestors and benefit from their protection (McAnany 2002:116). During those times, offerings may have served to connect the present with "memories of the past" (the ancestors) and "future anticipations" (the hypothetical outcomes of these periods of stress) (see Harding 2005:94). Since the interment of an ancestor or the revisiting of a tomb "likely [involved] limited numbers of participants in the cramped, humid setting of the tomb" (Joyce 2020a:73), I argue that these events were not used as a way to more publicly challenge or enhance the social position or the authority of the household, but were rather aimed at creating and reinforcing a connection between the descendants and their ancestors.

While agreeing that tombs could be revisited to place a newly deceased leading member of the family or to remove certain bones (see Feinman et al. 2010:1093–1098; Joyce 2010:111–112; Lind and Urcid 2010:189-207), Markens and Martínez López (in press) have argued that the opening of the tomb might have been done less frequently than initially thought. They argue that having to unseal the tombs before each visit would have discouraged to some extent the descendants from reopening them. They also mention that the tombs were likely flooded during the rainy season, thus limiting the timeframe when they could be reopened. Markens and Martínez López argue that instead of revisiting the tomb to venerate their ancestors, people used the space directly above the tomb, thus celebrating their ancestor in a setting accessible all year long (see also Urcid 2020). This would have allowed for "rites [to be] performed on a regular basis, and even daily" (Markens and Martínez López in press).

This interpretation would mean that the offerings in tombs were likely placed there when laying a newly deceased member of the family. Those offerings varied depending on the social status of the interred individuals as well as the celebrants, but generally included ceramics, thought to have held food and beverages, many of them plant-based (Markens and Martínez López in press;

Martínez López et al. 2014; Winter 1995). In many cases, the food left and shared with the deceased was meant to connect the living with a new entity: the powerful deceased or the ancestor (Belmar et al. 2020:41; McNeil 2010:293; Nelson 2003:65). Scherer (2015:173), describing Maya mortuary rituals, explains that "[to] ensure that the souls of the dead are content, great care is taken in regard to the treatment of the body at the funeral and the selection of its burial place". Funerals and mortuary offerings were essential to establish and maintain a good relationship with ancestors, who could greatly influence the living. The living might have asked those powerful ancestors to maintain the *status quo* in the phases most favourable to the elites (such as Nisa) while the ancestors could have been petitioned for help in challenging times (Peche-Xoo).

Studying the final meals placed along with the deceased allows us to examine the connection between the dead and the living at Monte Albán and in the Valley of Oaxaca in a way that has yet to be explored to its full potential (Markens and Martínez López in press). The foods selected to be placed alongside the deceased are especially important if we consider the role of Monte Albán as a place of water and fertility, and the role the ancestors were meant to play to maintain this status. Burying a dead loved one must have been very stressful for the descendants. While still grieving the loss of a household member, the living had to ensure their transformation into an ancestor would be a successful one. The foods and plants placed there, like the other mortuary offerings, had the power to appease the ancestors (McNeil 2010), which could then dramatically impact the life of the remaining household members. Funerals and the placement of mortuary offerings were crucial events that had the potential to drastically impact descendants' lives. These events were in part influenced by religious beliefs, economic systems, political structures, and social norms. At the same time, the links established with the deceased ancestors had the potential to transform unfolding *conjonctures* and lead to the emergence of new medium-term phenomena.

Relatively Public Rituals on the Main Plaza

By tracking the use of plants in relatively public rituals such as offerings and specific burials that involved numerous participants, we are able to see how these particular events were afforded or constrained within broader *conjonctures*, such as the transition towards increased social inequality, the establishment of new trade routes, and the profound changes following the influence of some Teotihuacan cultural elements. Zapotecs believed in a world where animate things had a spirit, a *pée* (Joyce 2020a:329; Marcus and Flannery 1996:19). When Zapotecs hunted an animal, or harvested their fields, they were hurting some of these beings. To re-establish the balance, humans had to repay their debt through offerings (Marcus and Flannery 1996:19). In most cases, simple offerings (maize dough or copal incense) would be sufficient (Joyce 2020a:69). While certain ceremonial activities were taking place at the Main Plaza, commoners could still participate in rituals on their own and re-establish this balance themselves (Joyce 2000:75). These activities included "certain forms of sacrifice" (Joyce 2000:75), which can be attested by the presence of shrines in domestic spaces where offerings could be placed (Urcid 2018:43). Therefore, the inhabitants of Monte Albán were not "dependent on elites" to be able to interact with the supernatural realm (Joyce 2000:75). This hypothesis is also supported by the fact that commoners could become "low-ranking priests" (Marcus and Flannery 1996:14–16). Dying was also considered to be a sacrifice (Monaghan 1990, 2009) and so was burying the dead under the earth (López Austin 1988:321; see also Joyce 2020a:330). Since dying is an inevitable fate, this sacrifice was accomplished by both the elite and commoners. Because death and funerals were recurrent events at Monte Albán, it offers an interesting way to compare mortuary practices throughout time, in relation to larger events happening at the site. This is where the modified Braudelian approach is so valuable, as it allows us to address the impact of medium-term phenomena on these practices, while acknowledging the role of such events in the perpetuation and the transformation of larger traditions.

More elaborate rites took place on the Main Plaza. Many of those were held in temples, which included the sacrifice of animals like quail and dog (Joyce 2010:46; Marcus and Flannery 1996:14–15). Offerings were also placed in relatively public settings throughout the Plaza. In some cases, incense burners and other artifacts were recovered under temple floors (Marcus and Flannery 1996:26). Many caches have also been discovered at Monte Albán, which included ceramic vessels, exotic shells, and jade (Marcus and Flannery 1996:220–221). Many times, those caches consisted of boxes filled with offerings, referred to as "*cajas de ofrenda*" or "offering boxes" (Joyce 2020a:334).

Joyce (2020a; 2020b) argues these offering boxes, generally placed before or right after the construction of buildings, were aimed at animating these monuments. Gámez Goytia (2002:200, personal translation), who examined the reports completed by Caso during his 18 field seasons (e.g., 1932, 1935, 1938, 1970), suggests that there were offering boxes in the "majority of the religious buildings at Monte Albán". Joyce (2020a:332) argues that the "earliest evidence of animating practices in the Oaxaca Valley comes from San José Mogote". There, at the top of Mound I, Marcus and Flannery (1996, 2015) encountered five pits filled with human bones accompanied by red pigment, and artifacts such as ceramic vessels and a figurine. While Flannery and Marcus (2015:104) have argued that these are burials of high-ranking people, Joyce (2020b:332) believes these offerings might have served to inanimate Mound I, as it follows patterns observed at other Mesoamerican sites. Joyce (2020b) believes that the practice of animating buildings that might have started at San Jose Mogote was then brought to Monte Albán, before spreading in the Valley of Oaxaca. At Lambitiyeco, archaeologists encountered a "small offering box, built of cut stones and adobe" on the exterior wall of a residence built on Mound 165 (Feinman et al. 2016:48). The authors argue that the residence, that dates to the Classic Period (Pitao-Xoo), was inhabited by ritual specialists.

Many of the public offerings found on Monte Albán's Main Plaza were very elaborate, some of them likely designed to attract a large audience (Joyce 2020a:339-340). However, archaeologists also uncovered smaller public offerings, consisting of a few ceramic vessels. Those might have been placed by commoners while building these monuments, once again demonstrating their important role in the spiritual realm (Joyce 2020a:339). Nobles were able to establish a powerful relationship with Zapotec deities that could not be achieved by commoners, by associating themselves with the monumentality of the Main Plaza and through their role as ritual specialists. This special status allowed them to perform sacrifices of a higher value (Joyce 2000a:83-84, 2010:62–63). Those valuable offerings and sacrifices were needed to achieve certain grand objectives, the most important one probably consisting of ensuring the land's fertility. The maize harvest was governed by many different forces: maize itself, rain, and earth (Joyce 2020a:69-70). Monte Albán's Main Plaza allowed people to connect—at the same place—entities from different realms: the underworld (through ancestors and formal tombs), the earth (plants, animals, and the fields located on the terraces), and water (association with *Cociyo*, streams and clouds during the rainy season) (Joyce 2020a:82). Because of the unique spiritual power embedded in and embodied by the Main Plaza, Monte Albán might not only have been conceived as a "place of water", but also as a "place that brought fertility and well-being to the earth" (Joyce 2020a:65). While clouds were certainly present at Monte Albán before its founding, the ongoing associations between this polity, rain, and fertility emerged from the repetition of key ritual events on the Main Plaza. Through time, these events gained more attraction and led to a change in beliefs, highlighting the role of events in larger phenomena.

Normal offerings did not suffice to ensure fertility at Monte Albán and in the Valley of Oaxaca. Nobles needed to provide more elaborate offerings, including some forms of sacrifice by the living (see Joyce 2020a, 2020b). *Tini* ("blowing blood"), obtained from bloodletting, was considered an important sacrifice, especially when the blood being drawn was of noble lineage (Marcus and Flannery 1996:19). While nobles received tribute from the commoners, they had the obligation to maintain and improve their relationship with supernatural beings, including through this method (see Joyce 2020a). In rare cases, like the "accession of a new ruler, or during times of political crisis, sickness, or drought" those elaborate sacrifices were not enough to appease deities, as seen through glyphs and ethnohistorical evidence (Joyce 2010:62). Then, humans needed to be sacrificed, as offering a beating heart freshly taken from a sacrificial victim was considered the "greatest sacrifice" (Marcus and Flannery 1996:19).

In other words, these relatively public rituals, where elaborate offerings or sacrifices were made, allowed nobles to negotiate with deities and supernatural beings and repay Monte Albán's inhabitants' debt. Because an important part of those rituals was aimed at ensuring the land's fertility and the successful harvest of plants (including maize), the analysis of paleoethnobotanical residues obtained from these contexts is a critical approach. By examining which plants nobles used in relatively public events taking place on the Main Plaza, it is possible to understand changes in the spiritual (like the impact of Teotihuacan cultural elements), political (strategies used by elite members to strengthen their authority), and economic realms (establishment of new trade routes), in relation to mortuary practices and relatively public rituals.

Conjonctures, Mortuary Offerings, and Relatively Public Rituals at Monte Albán

Following the whole occupation of a city, from its founding to its end, allows us to examine its long history in depth. At Monte Albán, a city that moved from relatively collective governance to a hierarchical society, we see radical transformations over time, with elites first establishing their authority as ritual specialists before taking on political and economic power. Monte Albán's economic *conjonctures*—such as the establishment of new trade routes during the Nisa phase or the arrival of Teotihuacan goods during the Tan-Pitao phase—were transformed through the incorporation of new polities, the defection of these polities centuries later, and the temporary relationship with Teotihuacan. Monte Albán also featured prominently in broader religious *conjonctures*, such as the use of the Main Plaza by elites to gain authority at the local and regional levels during Nisa, and in the resurgence of Zapotec religious traditions during Peche-Xoo. Through well-executed site planning, and with the help of certain artifacts, like the crema wares associated with *Cociyo*, the city was able to gain special status, becoming an *axis mundi* for the inhabitants of the Valley of Oaxaca.

The *longue durée* can be used in archaeology to examine the interrelation between human settlement and ecological shifts over an extended period of time (Bintliff 2010). While I was not able to examine this interrelationship due to the nature of my samples, it is worth mentioning the long-term dynamics that affected the daily lives of Monte Albán's inhabitants. The founding of the Zapotec capital was accompanied by an accelerated level of erosion (González Licón 2011:65). This process was caused by many factors, including recurrent episodes of deforestation (González Licón 2011:65). An enormous quantity of trees was cut to create living spaces, to be used as construction materials, and to create agricultural terraces that would allow to sustain the ever-growing population (Robles García 2011:56; Urcid 2018:32).

This initial period of erosion had to be controlled, to ensure the viability of Monte Albán. As demonstrated at Lake Pátzcuaro (Fisher 2005) and in the Mixteca Alta (Pérez Rodríguez 2016; Pérez Rodríguez and Anderson 2013; Pérez Rodríguez et al. 2011) terracing can allow inhabitants to control erosion levels. The construction of terraces affects "slope angles", allowing agriculturalists to limit soil loss and runoff, as well as enhancing levels of "water retention, and soil preservation" (Pérez Rodríguez et al. 2011:86). The construction and the maintenance of those terraces involved organized labour, to limit the degradation that could potentially lead to new erosion episodes (Fisher 2005:91–92; Pérez

Rodríguez et al. 2011:95–96). At Cerro Jazmín, in the Mixteca Alta, Pérez Rodríguez and her team (2011:96) were able to identify "periods of landscape stability and soil formation […] during periods of high population, and erosion when terraces [were] not maintained", which happened during periods of abandonment and decreases in population.

Similar periods of abandonment also happened at Monte Albán, mainly starting in the Tani-Pitao phase (González Licón 2011:65). After being abandoned, different houses and terraces collapsed, which created small rockslides (González Licón 2011:65). Archaeologists identified some houses that had likely been occupied until they were covered by metres of debris following devastating landslide episodes (González Licón 2011:65). Most inhabitants of Monte Albán, who were residing on the hill slopes or in the valley at the bottom of those mountains, would have been at risk of losing their homes and even their lives during erosion related accidents, stressing the importance of maintaining viable terraces.

Data obtained from terraces, including construction and efforts to prevent their erosion, could provide meaningful insights into the daily life of ancient inhabitants. However, the data examined in this study allow me to explore lifeways from another angle. By examining the role of plants used in key practices and ceremonies at Monte Albán, I argue that it is possible to explore how ancient Zapotec people also used spiritual means to ensure survival and avoid calamity. Given evidence of how Zapotec people envisioned their world at different points in time, the increase in quantities of common plants in ceremonial contexts during challenging times could demonstrate efforts by the living to change their circumstances, thus modifying *conjonctures*. Conversely, the use of exotic plants in ceremonial contexts could highlight new religious symbolism marshalled to address new challenges.

4. Paleoethnobotanical Methods to Reconstruct Ancient History

As discussed in previous chapters, plants play a key role in human activities, from the quotidian to the highly specialized. To address the role of plants in mortuary and relatively public rituals at Monte Albán, and broader economic, political, and social *conjonctures*, I analyzed starch grains (polymers and sugar glucose) (Hardy et al. 2009; Pearsall 2015:341) and phytoliths (inorganic silica bodies) (Pearsall 2015:253; Piperno 2006) produced by plants, two approaches never previously used at Monte Albán. In this chapter, I briefly demonstrate how paleoethnobotany has been used to examine anthropological questions. Then, I introduce the *PEMA 1992-94* and summarize the sampling protocols I followed for this project. I explain how I completed microbotanical extractions from artifacts, processed sediment samples, and identified the microbotanical remains. I finish the chapter setting up the specific measures I used to interpret these remains (detailed in subsequent chapters).

Paleoethnobotany can be defined as the study of ancient botanical remains associated with human practices (Albarella 2001:9; Wilkinson and Stevens 2008:15). Paleoethnobotanical studies have focused on different types of remains, from huge macrobotanical remains like ships made of wood to microbotanical remains like pollen. Paleoethnobotanists have examined different topics including ancient foodways (Bérubé 2017; Bérubé and Forde In Press; Bérubé et al. 2020; McCafferty 2008; Mickleburgh and Pagán-Jiménez 2012; Morell-Hart and Bérubé

In Press; Morell-Hart et al. 2014; Pearsall et al. 2004; VanDerwarker and Kruger 2012), environmental reconstructions (Asouti and Austin 2005; Urrego et al. 2009), agricultural and horticultural practices (Abramiuk et al. 2011; Aceituno and Loaiza 2014; Grikpédis and Matuzevicinte 2018), and deathways (see **Chapter 2**).

For this study, I have focused on phytoliths and starch grains, two types of microbotanical remains. Found in soils and on artifacts, they provide invaluable data on foodways, rituals, feasts, and plant consumption (Aceituno and Martín 2017; Ciofalo et al. 2018; Morehart 2017). Focusing on these remains allowed me to determine the contents of the vessels placed as offerings, and the plants deposited around the deceased even if macrobotanical remains did not preserve (Logan et al. 2012:240; Wright 2010:40).

Ideally, macrobotanical and microbotanical remains should be studied together to overcome the limitations of each approach and to better understand ancient plant practices (Pearsall et al. 2004:423–424). For example, starch grains do not preserve well when exposed to heat, which unfortunately limits their identification in contexts where food was cooked (see Henry et al. 2009). By examining both phytoliths and starch grains, I was able to identify more taxa (certain plants only produce diagnostic phytoliths or starches), including some plants that might have been exposed to heat. I was not able to examine macrobotanical residues, as those were not collected during the *PEMA* project. I am, however, able to rely on a study made by the late Margaret Houston (1983), who was, before this current study, the only researcher to analyze plant remains at Monte Albán. Her study was based on macrobotanical remains recovered in 1972–1973 from households, and primarily focused on the transition from teosinte to maize. Her work informs us about cultivated plants in ancient Oaxaca but does not examine their role in ritualized practices. Although her research questions were different than mine, her results have allowed me to better interpret the microbotanical data I have obtained and build a more detailed picture of plant use.

I examined 50 artifacts and 50 sediment samples previously collected on the Main Plaza during the *Proyecto Especial Monte Albán 1992–1994*. I selected these samples to cover the whole temporal occupation of the site and to compare the plants placed in tombs, graves, and relatively public offerings during the same periods. The samples extracted from artifacts indexed the content of the vessels placed as offerings (Wright 2010:40) and the plants processed by lithic tools, allowing me to address the role of botanical elements in establishing and maintaining the link between ancestors and live descendants. The sediment samples yielded botanical offerings in mortuary and relatively public contexts that had since decomposed (VanDerwarker et al. 2016:127), allowing me to address the differences between the use of plants in private mortuary practices and relatively public rituals. I selected samples and carried out initial processing in 2019 at the Oaxaca Laboratory of the *Instituto Nacional de Antropología e Historia* (INAH; the *Mexican National Institute of Anthropology and Archaeology*) at Cuilapam de Guerrero. Under permission of INAH and local authorities, I exported these samples in 2019 to the *McMaster Paleoethnobotanical Research Facility* (MPERF), where I carried out my analyses in 2020 and 2021.

This work contributes to a broader project (PEMA) initiated in 1992 that allowed us to better understand the long history of Monte Albán (Martínez López et al. 2014; Winter 1995, 1997a; Winter et al. 1994, 1997b-e, 1999a-b). By examining the role of botanical elements in mortuary offerings, I provide new information on practices related to formal tombs (Martínez López et al. 2014) and simple graves (Winter 1995), two important elements of that project. I also provide novel data on the use of plants in relatively public rituals, thus providing new ways to analyze ancient practices at the Zapotec capital. When examined in relation with the medium-term *conjonctures* taking place at Monte Albán, we see how events were impacted by these unfolding phenomena, as well as how such events could affect broader social trajectories.

Proyecto Especial Monte Albán (PEMA 1992–1994) and Sampling

As mentioned in **Chapter 3**, the PEMA project that took place at Monte Albán between 1992 and 1994 was funded by the *Fondo Nacional Arqueológico* (Winter 1997a:1). The project was led by Dr. Marcus Winter and the laboratory analyses were placed under the direction of Cira Martínez López. The PEMA pursued seven objectives (Winter 1997a:1-2): 1) Participate in new archaeological excavations on the Main Plaza to better understand the site and expand the touristic area; 2) Map the archaeological zone; 3) Prepare the site for the construction of new infrastructure to expand the museum and the parking lot; 4) Improve the protection of the site; 5) Train local archaeologists; 6) Share the results through different means, including publications and conferences; 7) Create a database of the archaeological evidence collected during the project.

With the authorization of the *Consejo de Arqueología del INAH* and of Dr. Marcus Winter and Cira Martínez López, I was permitted to examine a selection of ceramic vessels and lithic artifacts recovered from tombs and graves during the PEMA project. I was also given access to all the sediment samples collected by the late Margaret Houston for phytolith and pollen analyses. I followed two different strategies to select specific artifacts and sediment samples for analysis, as I detail below. It is important to note that the artifacts had been previously washed after their excavation, which possibly removed some of the botanical remains initially adhering to their surface.

Sampling of Artifacts for the Microbotanical Extraction

I elaborated a strategy guiding selection of artifacts for microbotanical extraction (**Table 4.1; see Appendix B**) based on a few criteria. From the start, to limit the risks of botanical contamination post-deposition, I avoided materials from burials that had strong evidence of looting (Martínez López et al. 1995, 2014). Then, I visually inspected each remaining artifact. For the ceramic vessels, I targeted base sherds, as this section was more likely in contact with the material that it contained (Morell-Hart 2015). I selected artifacts from different vessel shapes and styles excavated from tombs and graves that covered the whole temporal occupation of the site (Martínez López et al. 1995, 2014). I targeted various artifacts (e.g., hemispherical bowls, tripod bowls, conical bowls, etc.) to represent the diversity of the used vessels (Martínez López et al. 1995, 2014). I selected ceramic sherds measuring at least 3 cm x 3 cm, thus providing a larger surface area, to maximize the yields of botanical residues (Morell-Hart 2015). I tried to avoid samples with visible glue residue, to limit potential contamination. I also deliberately collected a representative glue sample for analysis in the MPERF to determine if it contained botanical elements. (There were no visible botanical remains in the glue sample.)

I selected every lithic artifact available for analysis (N=4). These lithic artifacts consisted of a ground stone, a shallow carved bowl, and two blades. These artifacts were likely used for plant processing and provide a limited view of another type of tool use. Finally, I selected eight ceramic vessels (microbotanical samples #12, 28, 29–33, 37) where there were still visible residues adhering to the surface of the artifact.

Table 4.1: List of the Microbotanical Extraction Samples

Microbotanical Extraction Sample Number	Provenience	Description of the artifact	Time Period (ca.)	PEMA Sample Number	Private/ Public Context
ME-1	Grave 1993-17	Small hemispherical bowl, coffee ware	350-500 CE	CU-018-10	Private
ME-2	Grave 1993-17	Hemispherical incense burner	350-500 CE	CU-018-11	Private
ME-3	Grave 1993-17	Tripod conical bowl, gray ware	350-500 CE	CU-018-09	Private
ME-4	Grave 1994-69	Conical bowl, gray ware	500-800 CE	CU-018-34	Private

Microbotanical Extraction Sample Number	Provenience	Description of the artifact	Time Period (ca.)	PEMA Sample Number	Private/ Public Context
ME-5	Grave 1994-69	Low and incomplete hemispherical bowl, gray ware	500-800 CE	CU-018-36	Private
ME-6	Grave 1994-69	Small tripod conical bowl, gray ware	500-800 CE	CU-018-37	Private
ME-7	Grave 1994-69	Fragmented small tripod conical bowl, gray ware	500-800 CE	CU-018-35	Private
ME-8	Grave 1994-69	Tripod conical bowl, gray ware	500-800 CE	CU-018-38	Private
ME-9	Grave 1993-56	Ground stone (with stucco on the extremities)	500-800 CE	C-018-43	Private
ME-10	Grave 1994-62	Conical bowl, crema ware	100 BCE-200 CE	C-018-28	Private
ME-11	Grave 1994-62	Composite silhouette bowl, gray ware	100 BCE-200 CE	C-018-29	Private
ME-12	Grave 1994-62	Asymmetric bottle, gray ware	100 BCE-200 CE	C-018-30	Private
ME-13	Grave 1994-61	Hemispherical plate, crema ware with black/coffee slip	200-350 CE	C-018-25	Private
ME-14	Grave 1994-61	Asymmetrical cylindric vessel, crema ware	200-350 CE	C-018-20	Private
ME-15	Grave 1994-61	Cylindric vessel, crema ware	200-350 CE	C-018-23	Private
ME-16	Grave 1994-61	Small bottle, crema ware	200-350 CE	C-018-21	Private
ME-17	Grave 1994-61	Cylindric vessel, crema ware	200-350 CE	C-018-26	Private
ME-18	Tomb 1993-3	Small obsidian blade	500-600 CE	8 (322)	Private
ME-19	Tomb 1993-9	Incomplete hemispherical bowl, grey ware	350-500 CE	66 (380)	Private
ME-20	Tomb 1994-24	Fragmented pot, gray ware	350-500 CE	15	Private
ME-21	Tomb 1994-24	Fragmented conical bowl, gray ware	350-500 CE	27	Private
ME-22	Tomb 1994-24	Fragmented tripod conical bowl, gray ware	350-500 CE	143 (457)	Private
ME-23	Tomb 1994-24	Incomplete and fragmented conical bowl, coffee ware	350-500 CE	148 (462)	Private
ME-24	Tomb 1994-24	Conical bowl, gray ware	350-500 CE	144 (458)	Private

Microbotanical Extraction Sample Number	Provenience	Description of the artifact	Time Period (ca.)	PEMA Sample Number	Private/ Public Context
ME-25	Tomb 1994-24	Incomplete and fragmented hemispherical bowl, gray ware	350-500 CE	151 (465)	Private
ME-26	Tomb 1994-24	Incomplete and fragmented hemispherical bowl, crema ware	350-500 CE	147 (461)	Private
ME-27	Tomb 1994-24	Half of a conical bowl, gray ware	350-500 CE	4	Private
ME-28	Tomb 1994-23	Conical bowl, gray ware	350-500 CE	137 (451)	Private
ME-29	Tomb 1994-23	Hemispherical bowl, gray ware	350-500 CE	134 (448)	Private
ME-30	Tomb 1994-23	Conical bowl, gray ware	350-500 CE	138 (452)	Private
ME-31	Tomb 1994-23	Tripod conical bowl, gray ware	350-500 CE	135 (449)	Private
ME-32	Tomb 1993-14	Reddish sandstone shallow carved bowl	500-800 CE	LP1342	Private
ME-33	Tomb 1993-14	Ceramic vessel	500-800 CE	1	Private
ME-34	Tomb 1993-11	Incomplete and fragmented hemispherical bowl, gray ware	500-100 BCE	9-1	Private
ME-35	Tomb 1993-11	Incomplete and fragmented tube, gray ware	500-100 BCE	13	Private
ME-36	Tomb 1993-11	Trimmed base of a conical bowl, gray ware	500-100 BCE	7	Private
ME-37	Tomb 1993-11	Obsidian blade	500-100 BCE	9-2	Private
ME-38	Tomb 1993-11	Hemispherical bowl, gray ware	500-100 BCE	1	Private
ME-39	Tomb 1993-11	Incomplete hemispherical bowl, gray ware	500-100 BCE	8	Private
ME-40	Tomb 1993-11	Conical bowl, gray ware	500-100 BCE	16	Private
ME-41	Tomb 1993-11	Incomplete and fragmented conical bowl, gray ware	500-100 BCE	11	Private
ME-42	Tomb 1993-11	Fragmented large conical bowl, gray ware	500-100 BCE	10	Private
ME-43	Grave 1993-19	Conical bowl, gray ware	350-500 CE	CU-018-13	Private
ME-44	Tomb 1994-16	Miniature hemispherical bowl, coffee ware	800-1200 CE	99 (413)	Private
ME-45	Tomb 1994-16	Miniature pot, coffee ware	800-1200 CE	104 (418)	Private

Microbotanical Extraction Sample Number	Provenience	Description of the artifact	Time Period (ca.)	PEMA Sample Number	Private/ Public Context
ME-46	Tomb 1994-16	Miniature pot, coffee ware	800-1200 CE	106 (420)	Private
ME-47	Tomb 1994-16	Miniature hemispherical bowl, coffee ware	800-1200 CE	109 (423)	Private
ME-48	Tomb 1994-16	Ceramic tray, gray ware	800-1200 CE	110 (424)	Private
ME-49	Tomb 1994-16	Hemispherical bowl, gray ware	800-1200 CE	97 (411)	Private
ME-50	Tomb 1994-16	Composite silhouette bowl	800-1200 CE	95 (409)	Private

I selected sediment samples (**Table 4.2**) to complement the information from mortuary practices provided by the microbotanical extractions, and to include as many samples as possible that would inform us about relatively public rituals. The sediment samples collected from these relatively public ritual contexts illuminate plants placed in public offerings (*cajas de ofrendas*) and used in temples, something not covered by the artifact extractions.

First, I selected a set of sediment samples collected from the same loci as artifacts also selected for analysis, to better understand the plants they contained as mortuary offerings. The sediment samples collected in the vessels have the potential to corroborate or contradict the results obtained from the microbotanical extractions of the same artifacts, allowing me to validate the use of this method and the risks of contamination. The other sediment samples complement the record by allowing me to identify plants placed in the tombs and graves, in vicinity of the bodies. These sediments were collected to provide more information about the use of plants in mortuary contexts through time (Objective 1) and in regards with social standings

(Objective 2). I then selected sediment samples collected from additional tombs, graves, public offerings in (offering boxes or *caja de ofrendas*), and temple floors to complement the current data and provide a more robust data set for comparison. Those samples allowed me to compare the use of plants from private and relatively public rituals (Objective 3), and examine changes and continuities through time (Objective 1).

Table 4.2: List of the Sediment Samples

Sediment Sample Number	Provenience	Description of sample	Time Period (ca.)	PEMA Sample Number	Private/ Public Context
S-1	Grave 1993-43	Collected near Skull 12	350-500 CE	1–12	Public
S-2	Grave 1993-43	Collected near Skull 14	350—500CE	1–14	Public
S-3	Grave 1993-43	Collected near Skull 16	350—500CE	1–16	Public
S-4	Grave 1993-43	Collected near Skull 17	350—500CE	1–17	Public
S-5	Grave 1993-43	Collected near Skull 18	350-500 CE	1–18	Public
S-6	Grave 1994-62	Collected under shell necklace	100 BCE-200 CE	19	Private
S-7	Grave 1994-62	Collected above Grave	100 BCE-200 CE	20	Private
S-8	Grave 1994-62	Collected under Grave	100 BCE-200 CE	21	Private
S-9	Grave 1994-62	Collected inside Object 3 (Asymmetric bottle)	100 BCE-200 CE	22	Private
S-10	Grave 1994-69	Collected inside Object 3 (Miniature tripod conical bowl)	500-800 CE	55	Private
S-11	Grave 1994-69	Collected inside Object 6 (Miniature tripod conical bowl)	500-800 CE	58	Private

Sediment Sample Number	Provenience	Description of sample	Time Period (ca.)	PEMA Sample Number	Private/ Public Context
S-12	Tomb 1993-11	Collected close to the skull	500-100 BCE	13	Private
S-13	Tomb 1993-11	Collected near bones with paint	500-100 BCE	14	Private
S-14	Tomb 1993-11	Collected in the SW corner of the tomb	500-100 BCE	15 (5)	Private
S-15	Tomb 1993-11	Collected over the tomb floor (central part)	500-100 BCE	17 (7)	Private
S-16	Tomb 1993-11	Collected over the painted tomb floor	500-100 BCE	18	Private
S-17	Tomb 1994-22	Collected over tomb stucco	100 BCE-50 CE	31	Private
S-18	Tomb 1994-22	Collected over Tomb Level 2	100 BCE-50 CE	32	Private
S-19	Tomb 1994-24	Collected under the bones, near bedrock	350—500CE	63 A	Private
S-20	Structure W1	Element W1-3. Offering. Sediment in Object 4 (Vessel)	Unknown	1	Public
S-21	Sacred Axis, South Platform	Element 2. S-in the offering box	Unknown	27	Public
S-22	Tomb 1993-11	Element 17. Ash over stucco floor 6	500-100 BCE	46	Private
S-23	Sacred Axis, South Platform	Element 5. Altar. Level 5	100 BCE-800 CE	48	Public
S-24	Sacred Axis, South Platform	Element 5. Altar. Levels 9–10	100 BCE-350 CE	49	Public
S-25	Sacred Axis/Mound III, South Platform	Element 8. Altar. Floor 4	100 BCE-350 CE	50	Public
S-26	Sacred Axis/Mound III, South Platform	Altar. Element 8	100 BCE-200 CE	51	Public
S-27	Sacred Axis, South Platform	Element 4. Level 17. Green soil	100 BCE-350 CE	55	Public

Sediment Sample Number	Provenience	Description of sample	Time Period (ca.)	PEMA Sample Number	Private/ Public Context
S-28	Grave 1994-61	Collected inside Object 7 (Cylindrical vessel)	200-350 CE	39	Private
S-29	Tomb 1993-11	Collected inside Object 7 (Vessel)	500-100 BCE	104 (37)	Private
S-30	Tomb 1993-11	Collected inside Object 16 (Tripod vessel)	500-100 BCE	117 (27)	Private
S-31	Tomb 1993-14	Collected inside Object 2 (Incense burner)	500-800 CE	22	Private
S-32	Tomb 1993-14	Collected inside Object 1 (Bowl)	500-800 CE	23	Private
S-33	Tomb 1994-23	Collected in the antechamber	350-500 CE	61	Private
S-34	Tomb 1994-23	Collected in the niche	350-500 CE	62	Private
S-35	Sacred Axis, South Platform	Altar. Offering box. Level 5	Unknown	14	Public
S-36	Sacred Axis, South Platform	Element 4. Altar. Offering. Level 3	600-800 CE	22	Public
S-37	Grave 1994-62	Element 7. Collected in Object 2 (bowl)	100 BCE-200 CE	38	Private
S-38	Structure W1	North enclosure. Floor W1-15	600—750CE	5	Public
S-39	Structure W1	North area. Floor W1-8	600—750CE	15 (76)	Public
S-40	Structure W1	North area. Floor W1-17	350—500CE	16 (79)	Public
S-41	Structure W1	North area. Floor W1-14	600—750CE	4	Public
S-42	Sacred Axis/Mound III, South Platform	Collected in the altar	Unknown	8 (57)	Public
S-43	North Mound, North Platform	Floor 6.	Unknown	20 (101)	Public
S-44	Patio VG, North Platform	Bedrock.	Unknown	40	Public
S-45	North Mound, North Platform	North Patio. Drain	Unknown	41	Public

Sediment Sample Number	Provenience	Description of sample	Time Period (ca.)	PEMA Sample Number	Private/ Public Context
S-46	North Mound, North Platform	North Patio. Drain (2nd section)	Unknown	42	Public
S-47	North Mound, North Platform	Collected in ceramic bowl	Unknown	58	Public
S-48	Mound III, South Platform	Floor 19	600—800CE	61	Public
S-49	Mound III, South Platform	Collected on the slope	Unknown	89	Public
S-50	Patio VG, North Platform	Drain	600-800 CE	107	Public

Microbotanical Extractions from Artifacts

Microbotanical extractions from artifacts yield starches and phytoliths still adhering to the surface of objects or in their crevices. To recover these residues, paleoethnobotanists generally follow a three-step wash process including a dry, a wet, and a sonicated wash (Atchinson and Fullagar 1998; Logan et al. 2012:240; Mickleburgh and Pagán-Jiménez 2012:2471; Morell-Hart et al. 2014:72–73, 2019; Pearsall et al. 2004:427). In this study, I followed a similar protocol successfully used in previous microbotanical studies in Mexico (see Bérubé 2017; Bérubé et al. 2020; Morell-Hart 2015) (see **Appendix B**). In general, it is believed that the botanical residues obtained from the dry wash can inform us about the immediate environment surrounding the artifact (Mickleburgh and Pagán-Jiménez 2012:2471; Morell-Hart et al. 2014:72–73, 2019; Pearsall et al. 2004:427). The wet wash allows researchers to recover residues located on the surface of the artifact, thus offering valuable information likely associated with artifact use (Bérubé et al. 2020:4).

Finally, the sonicated wash allows us to recover microbotanical residues still lodged on the artifact, offering the possibility to examine residues most closely associated with artifact use (Bérubé et al. 2020:4; see also Mickleburgh and Pagán-Jiménez 2012:2471; Morell-Hart et al. 2014:72–73, 2019; Pearsall et al. 2004:427).

All the artifacts examined in this study had already been previously washed after excavation. Normally, however, the (first) dry wash allows paleoethnobotanists to recover the material still adhering to unwashed artifacts. For each artifact, wearing a fresh set of powder-free gloves, I slowly removed this layer of material by gently stroking my fingers on the artifact surface, then collecting this extract as the first dry wash sample (Logan et al. 2012:240; Pearsall et al. 2004:427–428). The residues recovered from these dry washes were immediately collected and stored in cleaned, previously unused centrifuge tubes. Although I completed a dry wash for each artifact, I was not able to recover any residues from this first dry wash for most of the artifacts, except for eight samples (#12, 28, 29–33, 37; detailed further **in Chapter 5**).

After completing the dry wash of all the artifacts, I proceeded to the wet wash. The process is quite similar to the dry wash, with the addition of distilled or Ultra-Pure water (Mickleburgh and Pagán-Jiménez 2012:2471; Morell-Hart et al. 2014:72–73; Pearsall et al. 2004:427). For this study, I used sterile water for injections produced by PiSA and available in Mexican drugstores. I applied this water directly to the artifact surface using a squeeze bottle. Once the targeted surface of the artifact was wet, using a new pair of powder-free gloves, I gently cleaned the use-surface of the artifact and collected the muddy extract as the second wet wash sample. Once again, I immediately placed the extracted residues in clean and previously unused centrifuge tubes.

Finally, for the sonicated wash, paleoethnobotanists use ~30 kHz sound waves to drive out residues still adhering to the artifacts, often lodged in crevices and pores of the artifact material (Mickleburgh and Pagán-Jiménez 2012:2471; Morell-Hart et al. 2014:72–73; Pearsall et al. 2004:427). For this study, I used a hand-held sonicator produced by Kinga (**Figure 4.1**). For each artifact, I applied water to the use-surface of the artifact, using a squeeze bottle, then put the spatula of the sonicator into the water for five minutes, avoiding direct contact with the artifact. The soundwaves, transmitted through the distilled water, then made their way on the artifacts and dislodged the remaining sediment still adhering to the artifact, thus allowing me to collect valuable information on its use. Throughout the process, I collected the solution of water and residues using a clean disposable pipette before storing this aqueous solution in clean centrifuge tubes.

Figure 4.1: Sonication of a small ceramic vessel (Microbotanical Extraction Sample #1 from Grave 1993-17)

I completed the three-wash extraction of microbotanical residues from 50 artifacts at the INAH laboratory in Cuilapam de Guerrero, Oaxaca. As mentioned above, I then sent these samples (the residues only, not the artifacts) to the MPERF lab with the authorization of the Mexican government, through the *Consejo del INAH*. Once back in Canada, to prepare each sample for microbotanical analysis, I centrifuged the aqueous solution (distilled water and residues), still in the original centrifuge tube used for collection, for 5 minutes at 3000 RPM. This process concentrated the phytoliths and starch grains at the bottom of the tubes (Bérubé et al. 2020:4). Then, I mounted those residues on glass thin slides and analyzed them using a ZEISS polarizing transmitted light microscope at 400X and 650X. I photographed microbotanical residues throughout the analysis, using Zen photo software.

When examining microbotanical residues obtained from an artifact, it is currently impossible to determine if those correspond to the last use of the artifact, or it they result from the "superposition of distinct events of food deposition" (Belmar et al. 2020:54–55, personal translation). In other words, there is currently no way to be certain that the microbotanical residues recovered from those artifacts come from mortuary offerings and not from a domestic meal consumed one week before the interment of the dead, creating a palimpsest of activities and potentially meanings (Bailey 2007:207–208). To address this issue, when possible, I examined sediment samples recovered from the same graves and tombs as the artifacts and, in a few cases, from the same vessels. I was thus able to compare the results obtained from the artifact extractions and the sediment samples, to verify if some vessels might have provided drastically different results. A total of eight artifacts were matched directly with sediment samples. In the next chapter, I assess the results obtained from the microbotanical extractions of artifacts from each tomb and grave individually.

Processing of Sediment Samples

Paleoethnobotanists often examine microbotanical remains obtained directly from sediment samples to better understand the plants present in the archaeological contexts (Pearsall et al. 2020; Perry et al. 2007; Rowe and Kershaw 2008:432–437; VanDerwarker et al. 2016:127; Zimmermann 2019). I followed a protocol established by Morell-Hart (2018) in consultation with Dolores Piperno and Rob Cuthrell to isolate phytoliths from sediment samples (**Appendix C**), and used a protocol created by Zimmermann (2019:157–158) to recover and examine starch grains from sediment samples (**Appendix D**).

During the 1990s *PEMA* project, Margaret Houston, along with her team, collected small samples of sediment for future phytolith and pollen analyses. Those samples (weighing approximately 200 g each) were placed in plastic bags, then sealed in paper envelopes that were wrapped in another layer of plastic to seal them (**Figure 4.2**). All these samples were numbered on-site and recorded in a catalogue, where they were given a separate archival number. Unfortunately, the renumbering of these samples has made it difficult to assess the exact provenience of all of them.

I therefore did not include samples I could not situate with confidence. Once back at the MPERF, I discovered that some samples contained a label inside the package with information contradicting the outside label. For this reason, I was unfortunately unable to determine the exact provenience of some of the samples, as discussed in **Chapter 7**.

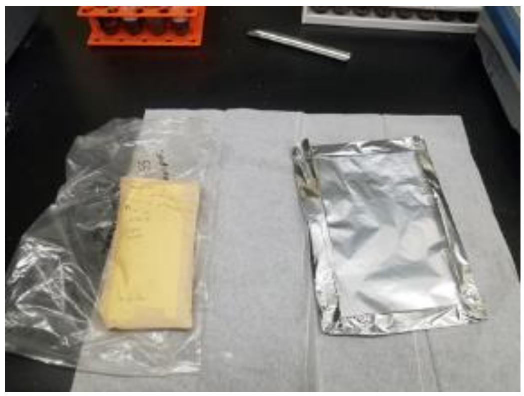


Figure 4.2: Sediment envelopes (left) being prepared for the sterilization

I selected 52 envelopes at the INAH lab in Cuilapam de Guerrero corresponding to 50 different archaeological contexts (two of those contexts had two envelopes per sample, as discussed in **Chapter 5**). I then exported those sediment samples to the MPERF, where I processed them to examine starches and isolate phytoliths.

To follow protocols required by the Canadian Food Inspection Agency (CFIA), the first step followed to isolate the phytoliths usually consists of sterilizing the sediment samples at 200˚ C for six hours (Morell-Hart 2018). However, starches present in the sediments were at risk of being damaged in the process (Henry et al. 2009), thus forcing me to follow a different approach to study them. I followed the protocol elaborated by Zimmermann (2019:157–158) on ten sediment samples (#

26, 27 [1], 27 [2], 28, 29, 37, 38–41) as a pilot study to assess the potential recovery rates for starches in the remaining sediment samples.

For each of those test samples, I collected 0.25 mL of sediment that I placed in a 2 mL plastic centrifuge tube. Then, I filled the tube with a solution of HCl at a concentration of 10%. This step allowed me to destroy potential calcium carbonate crystals present in the sediment (Zimmermann 2019:158). Once the reaction stopped (which took between 15 and 30 minutes), I centrifuged these tubes for 10 minutes at 3500 RPM. Then, I poured out the acid and replaced it with UltraPure water. I then centrifuged the tubes again for 10 minutes at 3500 RPM to rinse the samples from any remaining acid. I repeated this rinse two additional times. Then, I mounted the remaining residues on thin slides following the same steps as the microbotanical extractions from artifacts. I was unable to find any diagnostic starches from any of the ten tested samples and decided not to pursue the same approach for the rest of the samples, focusing my attention on the phytoliths isolated and more highly concentrated through the normal chemical digestion process.

Sediments samples were processed following an 8-step protocol (Morell-Hart 2018). First, sediments were sterilized to kill potential pathogens in foreign soils. To do so, I placed each sample in a furnace at 200˚ C for six hours. Second, after cooling overnight, the samples were broken up into smaller particles through deflocculation. To do so, I transferred each sterile sample to a 1L beaker and added 2 tbs. of deflocculant (sodium bicarbonate). Then, I filled the beakers with hot water and placed them in a sonicating bath for 10 minutes, following Lombardo et al.

(2016). I stirred each sediment sample 20 times every 15 minutes to ensure all the sediment was fully deflocculated.

Third, once the sediment samples were ready, I sieved them through a set of two geologic sieves to collect the S (sand, 250-53 µm) and AB (silt, <53 µm) fractions (from the base pan), before moving these two samples into labeled beakers. After quickly scanning the largest sediment fraction for potential charcoals (>250 µm), I only kept the S and AB fractions for analysis under the microscope. Fourth, I removed clays from the AB fraction. To do so, I placed the AB fraction (in the base pan of the geologic sieves) in clean 1L beakers. I filled these beakers with hot water and stirred vigorously before letting them sit for 60 minutes. Then, I poured half of the water, redoing this step until the water was relatively clear and free of clays (between 20 and 43 pours per sample). Once completed, I placed the AB and S fractions separately in clean 50 mL centrifuge tubes. I centrifuged the samples at 1000 RPM for five minutes and poured off the supernatant.

In the fifth step, I collected 10 g of sediment from each AB and S fraction, placing this sediment in 600 mL beakers in preparation for chemical digestion. To each beaker I added 6 mL of hydrochloric acid (10%), 10 mL of nitric acid (68–70%), and 2 mL of hydrogen peroxide (30%), stirring each sample in its beaker with a glass stirring rod. Once the mix stopped reacting, in the sixth step, I poured each of the samples into a CEM MARS microwave tube. Sets of samples were then microwaved in these pressurized tubes following an established protocol for organic samples with a temperature set at 180˚ C for 55 minutes (plus a ramp time of 20 minutes). I then let the samples cool overnight.

In the seventh step, once cooled, I placed each sample in a clean and labeled 50 mL centrifuge tube. I centrifuged the tubes at 3000 RPM for 5 minutes before pouring out the chemical supernatant into a labeled disposal jar, following McMaster chemical safety protocols. I then filled the tubes with UltraPure water and centrifuged them at 3000 RPM for 5 minutes, before repeating this step twice to ensure all the chemical supernatant was discarded. In the final and eighth step, I completed heavy liquid flotation to further isolate phytoliths from heavier residues. To do so, I added 10 mL of a heavy liquid solution (2.3 g/mL of sodium polytungstate solution). I shook the centrifuge tubes to mix the samples and then centrifuged the samples at 1000 RPM for 5 minutes. I then slowly opened the tubes and used a clean disposable pipette to remove the phytoliths located in the upper part of the liquid. I centrifuged the mix once again, to collect floating phytoliths twice from each sample. I transferred all the collected phytoliths into a clean 15 mL centrifuge tube. I then removed the heavy liquid by adding as much UltraPure water as possible in the 15 mL tubes to decrease the solution density. Then, I centrifuged the tubes at 1000 RPM for 10 minutes. I poured off the liquid and filled the tube with water, repeating this process three times for each sample. After the last rinse with UltraPure water, I filled the centrifuge tubes with acetone to dry the phytolith concentrate. Once filled, I centrifuged the tubes at 1500 RPM for 10 minutes, before discarding the acetone. The tubes were then placed in a fume hood and loosely covered with parafilm to dry. Once the phytoliths were completely dry (a few days), I added Type B immersion oil with a 1250 cSt ± 10% @ 23 °C viscosity. I then placed the samples on thin slides to analyze them under the microscope.

Identification of Microbotanical Remains

I analyzed each slide using a ZEISS polarizing transmitted light microscope at 400X (AB fraction and artifacts wash) and 200X (S fraction) (Morell-Hart 2015, 2018). I took pictures of the microbotanical remains at 650x using the ZEISS Zen software throughout the process. I identified microbotanical residues using the MPERF reference collection, published materials (e.g., Ball et al. 1999; Duncan et al. 2009; Messner 2011; Pearsall and Piperno 1993; Piperno 2006; Piperno and Holst 1998; Torrence and Barton 2006), and online resources (e.g., Pearsall et al. 2006). For the sediment samples (AB and S fractions), I stopped examining each slide after reaching 100 microbotanical remains. I also ignored the grass (Poaceae sp.) elongate and bulliform phytoliths, as they are ubiquitous and contribute little information (Morell-Hart 2018; Strömberg et al. 2018:254). Otherwise, I would have analyzed each slide for only a few minutes before reaching the 100 microbotanical remain count.

In this study, I identified 10,932 microbotanical remains and 24 taxa from the 100 samples I examined (see **Appendix A**). These residues cover a wide range of economic plants, such as maize (*Zea mays*), chile (*Capsicum* sp.), beans (*Phaseolus* sp.), and squash (*Cucurbita* sp.), with the addition of many grasses like

(*Panicoideae* sp. and *Chloridoideae* sp.). I was also able to identify an aquatic plant, arrowhead (*Sagittaria* sp.).

Secondary Analyses of Recovered Microbotanical Remains

Once the identification of all the microbotanical remains was completed, I tabulated these findings in Excel. I then pursued two key types of analysis: ubiquity analysis (Dickau et al. 2012; Morell-Hart 2019) and taxonomic richness (see Lennstrom and Hastorf 1992:210–212; Morell-Hart 2019:235). Ubiquity analyses allow us to identify the level of rarity or commonness of each taxon. I used this measure to make hypotheses about the economic or spiritual value of certain plants and confirm if mortuary offerings differed between formal tombs (hosting people of a higher social status) and graves. Ubiquity has allowed paleoethnobotanists to identify shared foodways (Langlie 2020:710–711; Pearsall et al. 2020:135–139) and to identify changes in plant consumption practices through time (Langlie 2020:713–715). I followed a similar approach in this study, which allowed me to identify differences in the botanical assemblages found in mortuary offerings, over time and across contexts. I use these patterns and discontinuities in consumption practices of particular plants to track continuities and changes that could have been influenced by political, religious, social, and economic medium-term phenomena, as well as how practices could have influenced these *conjonctures.*

Taxonomic richness allows paleoethnobotanists to determine how the number of taxa found per sample varies from an averaged number of taxa (see Lennstrom and Hastorf 1992:210–212; Morell-Hart 2019:235). I used this measure to identify contexts where botanical offerings might have stood out by their richness (quantity of plant species present). Although there would not have been great differences regarding preservation, I expected to see higher richness in formal tombs. These differences might have demonstrated social disparities between people buried in tombs and simple graves. This hypothesis was based on the social and political *conjonctures* unfolding at Monte Albán, both marked by increased inequalities starting in the Nisa phase up to the abandonment of the city.

By combining these two types of measures, I was able to compare offerings placed in tombs and graves in relation to social status, examine the similarities and differences between the plants used in private mortuary settings and relatively public rituals, and examine uses of plants at Monte Albán in relation to economic, social, political, and religious *conjonctures*. Ubiquity and taxonomic richness allowed me to illuminate patterns and anomalies in mortuary practices and relatively public ceremonies, as demonstrated in the following chapters. When combined with the simple presence of certain plants, and in some cases the potential processing of them, I was able to track similarities between practices during the Nisa phase and the resurgence of the Zapotec tradition during the Peche-Xoo phase. I was also able to highlight important differences with the Teotihuacan-inspired relatively public burial 1993-43 (discussed in **Chapters 7** and **8**).

5. Results: Connecting Dead, Living, and Supernatural Through Plants

This chapter is divided in two parts. First, I present research expectations, given prior studies of Monte Albán's history (**Chapter 3**), prior studies of botanical residues elsewhere in the world (**Chapter 2**), and previous paleoethnobotanical studies in the region. Then, I briefly describe the plants identified in this study (see **Appendix A**) and their potential uses in antiquity. These results serve as the basis for the interpretations detailed in the three following chapters: comparing offerings placed in tombs and graves in relation to social status, to understand social and political *conjonctures* (**Chapter 6**); examining similarities and differences between plants used in private mortuary settings and relatively public rituals (**Chapter 7**) to understand economic and religious *conjonctures*; and examining the use of plants in these contexts over time, in relation to larger *conjonctures* at Monte Albán (**Chapter 8**) such as the transition towards increased social inequalities, the establishment of new trade routes, the strong influence of Teotihuacan culture, and the revival of Zapotec traditions. In the following sections I present a set of expectations and an overview of findings.

Expectations for Plant Use: Prior Botanical Studies

Given prior paleoethnobotanical research in Oaxaca and broader Mesoamerica, there were many plants I expected to encounter in this study, from staple crops to incense. First, I expected to identify maize (*Zea mays*) across temporal phases, and hypothesized that use of this plant would be one of the few consistencies over the *longue durée*. This plant was (and still is) an essential food item, consumed throughout the Valley of Oaxaca and well beyond (Bérubé and Forde in press; Bérubé et al. 2020; García Ríos and Robles García in press; Feinman and Nicholas in press; King and Morell-Hart in press; Marcus and Flannery 1996:16–17; Markens and Martínez López in press; Morell-Hart and Bérubé in press; Pérez Rodríguez in press; Royce in press; Saumur and Manin in press; Soleri et al. in press). Maize was also connected to the concept of fertility and was often used in simple offerings (Joyce 2020a). Maize has been recovered in many mortuary contexts throughout the Americas (including in Mesoamerica) (see Belmar et al. 2020; Cavallaro 2013; Lentz 2000; Lentz et al. 1996; McClung de Tapia and Martínez-Yrizar 2017; Morehart 2016; Pearsall and Hastorf 2011; Pearsall et al. 2004, 2020; Piperno 2011; Piperno and Flannery 2001; Piperno et al. 2009; VanDerwarker and Kruger 2012; VanDerwarker et al. 2016).

At Monte Albán, Houston (1983:76) found maize in different contexts, although the report does not offer enough information to identify their nature. One of these contexts dated to right after the founding of the city (Period Ia). Houston (1983:70) identified more maize cupules and cobs than kernels, which led her to hypothesize that maize was likely stored "still on the cob". Based on this information, I expected to encounter high quantities of maize phytoliths (produced by leaves and cobs) and maize starches (produced by the kernels) (Bozarth 1993; Mulholland et al. 1988). I also expected that the ubiquity levels would demonstrate maize was a common plant used in most contexts as it was a fundamental part of their diet.

We also know that the inhabitants of the Valley of Oaxaca consumed other domesticates such as beans (*Phaseolus* spp.), squash (*Cucurbita* spp.), and chile peppers (*Capsicum* sp.) (Bérubé et al. 2020; Bérubé and Forde in press; Dante García Ríos and Robles García in press; Feinman and Nicholas in press; King and Morell-Hart in press; Marcus and Flannery 1996:16–17; Markens and Martínez López in press; Morell-Hart and Bérubé in press; Robles García in press a, b; Royce in press). I expected that the ubiquity levels would demonstrate that these three plants were commonly placed in ritualized contexts, if not as commonly as maize. I also expected to encounter multiple combinations of these plants alongside maize, based on their prevalence in ancient and current Oaxacan cuisine. The presence of these domesticated crops in relatively public and private ceremonies could demonstrate a perpetuation of tradition influenced by larger Oaxacan practices.

However, it is also important to emphasize the role of nondomesticated resources in ancient Oaxacan diets (Feinman and Nicholas in press; Houston 1983; Morell-Hart and Bérubé in press; Pérez Rodríguez in press). Nondomesticated species, likely targeted for their edible seeds, include buckwheat (*Polygonum* sp.) and foxtail millet (*Setaria* sp.) (Morell-Hart and Bérubé in press). At Monte Albán, Houston (1983:68–76) identified three important cultivated species that can also be found in their wild form: amaranth (*Amaranthus* sp.), goosefoot (*Chenopodium* sp.), and purslane (*Portulaca* sp.). More recent paleoethnobotanical studies in

Oaxaca have also led to the identification of amaranth and goosefoot (Bérubé and Forde in press; Feinman and Nicholas in press; King and Morell-Hart in press; Morell-Hart and Bérubé in press; Pérez Rodríguez in press). The leaves of those two plants can be consumed as greens, and their seeds are also edible and can be toasted or ground for recipes (Dressler 1953:128–129; Ebeling 1986:682, 776; Lentz and Dickau 2005:66–67). The presence of purslane at Monte Albán might indicate that its inhabitants consumed its leaves (Houston 1983:68–76; see also Morell-Hart and Bérubé in press). In addition to these greens, *chipil* (*Crotalaria* sp.) is also commonly used to flavor dishes in Oaxaca (Levine and Puseman in press). Other nondomesticated plants have been identified frequently in Oaxaca, including various species of maguey (*Agave* sp.), *guajes* (*Leucaena leucocephala*), cacti pads and tunas (*Opuntia* sp.), acorns (*Quercus* sp.), dahlia (*Dahlia coccinea*), *flor de conejo* (*Tridax coronopifolia*), and peppergrass (*Lepidium* sp.) (Bérubé and Forde in press; Dante García Ríos and Robles García in press; de Ávila 2010; Feinman and Nicholas in press; Houston 1983; King and Morell-Hart in press; León Avendaño and Vásquez Dávila 2003; Markens and Martínez López in press; Morell-Hart and Bérubé in press; Pérez Rodríguez in press; Robles García in press a, b; Saumur and Manin in press). Similar to domesticated plants, the presence of common wild species in rituals taking place at Monte Albán and surrounding Oaxacan communities could demonstrate shared beliefs and practices.

I also expected to encounter plants that would have been used not necessarily for their edible properties, but for other functions. Wood obtained from trees can be used as a construction material (Bonomo et al. 2017:105; Rostain 2017:12) or to craft objects such as mortuary offerings (Bardel and Perennec 2004; Chabal 1995; Fabre et al. 2003; Figueiral et al. 2010; Vidal-Matutano et al. 2021; see also **Chapter 2**). I also expected to encounter remains of copal (*Protium copal* and other Burseraceae species), plants exploited in Mesoamerica for their resin, used as incense (de Ávila 2010:99, 126; Dussol et al. 2016:65-66; Folan et al. 1995:320; Morehart et al. 2005:265). Other plants, such as palm trees (Arecaceae spp.) or agave species, could be used to obtain fibres to weave cloth or accessories (Lentz et al. 1996:250; Scheel-Ybert and Bachelet 2020:278; see also **Chapter 2**).

I expected to encounter starch grains showing damages produced by fermentation, thus hinting towards the presence of alcoholic beverages. By consuming fermented drinks, the living might have reinforced their connection with ancestors (Belmar et al. 2020:48, 55). In Mesoamerica, a wide variety of fermented drinks existed, including *pulque* (made from agave species) and *balche* (made from the *Lonchocarpus* tree), drinks that were at times consumed during rituals and feasts (Dussol et al. 2016:66; Feinman and Nicholas in press; Morehart 2011:113). In addition to these two plants, Markens and Martínez López (in press) have identified seven fermented plants mentioned in historical accounts dating to the colonial era related to Oaxaca: maize, maguey, prickly pear (tuna), pitahaya, plums, cherries, and perhaps pineapple. Honey is also listed as a food item that was fermented at the time (Markens and Martínez López in press).

Smith et al. (2003:245) have argued that *pulque* was "consumed quite often at Aztec ritual and feasts". This argument challenges another hypothesis that suggests that the consumption of alcoholic beverages might have been limited to elders or for ritual purposes only (see Berdan 2021:141). In Oaxaca, it is generally believed that *pulque* was an important beverage often consumed (see Evans 1986; Martín del Campo 1938; Feinman and Nicholas in press). This is in part due to the illustrations from the Codex Vindobonensis (Furst 1978), a Mixtec document, that shows the consumption of alcohol. Fermented beverages played an important role in rituals (Dussol et al. 2016:66; Evans 1990; Feinman and Nicholas in press; Markens and Martínez López in press; Morehart 2011:113; Moyes et al. 2009:179; Nichols et al. 2009; Saumur and Manin in press; Spence et al. 2020:728; Sullivan 2006:42). Dante García Ríos and Robles García (in press) mention that *tepache* is still offered in rare occasions by "those who want to follow traditions". This is a fermented beverage made from pineapple rinds that needs an elaborate preparation that must start four days in advance, likely characteristics of other fermented beverages. Frassani (2016:443) examined the translation of the Chant of Xine from the Florentine Codex, a chant that mentions the consumption of fermented drinks. The term *yovallavana* has generally been translated as the "night drinker", but Frassani (2016:443) argues that *yovalla* refers to "the visionary effect (and purpose) of the drink". This suggests that the main objective when consuming fermented beverages might have been to create an altered state where inhabitants of the terrestrial world could be in contact with the realm of the spirits (see Belmar et al. 2020).

Prior studies in the Valley of Oaxaca suggest a mixed diet, where domesticated foods like beans, chile, and maize, were consumed alongside wild species like maguey, goosefoot, and cactus fruits. However, this broad picture only hints at other social processes and meanings. For example, would the use of plants in private mortuary settings and relatively public rituals be equivalent to consumption of plants in daily life, as noted by studies in Mesoamerica and elsewhere in the world (Cooremans 2008; Ellison et al. 1978; Fahmy et al. 2008; Fourteau-Bardaji et al. 1993; Hamza 2020; Morcote-Ríos 2006)? Or would different types of activities represent a subset of ancient foodways distinct from daily practices, with a focus on specific meaningful species, following similar studies elsewhere (Cutright 2011; Gumerman IV 1994; Kirleis et al. 2012; McNeil 2010; VanDerwarker et al. 2016)? There is great heterogeneity in mortuary practice across places and time periods, with varying mixtures of wild and domesticated plants, possibly representing the available resources at the time. However, some archaeological records also present assemblages strongly dominated by certain key domestic species like maize, similar to the Maya site of Dos Pilas, where kernels placed in the mouth of the deceased dominated the overall assemblage (Cavallaro 2013:64–65). In the current study, the overall assemblage seems to have followed individual preferences or relative availability of plants at time of interment, as there were no clear patterns. The establishment of new trade routes is visible through the incorporation of exotic plants, but maize remains the main component of these offerings, demonstrating a perpetuation of tradition as well.

Previous studies also suggested that I should expect to encounter cacao (*Theobroma cacao*) in funerary contexts, an important plant associated with the Underworld and death across Mesoamerica (McNeil 2010:312; Prufer and Hurst 2007:274; see also Markens and Martínez López in press). Unfortunately, this plant does not produce diagnostic phytoliths or starches. Furthermore, for this study, I did not have access to macrobotanical samples and did not carry out analyses of chemical signatures. Therefore, I was unable to detect the presence of cacao in any samples. Soleri et al. (2014) have used liquid chromatography-mass spectrometry on vessels found in the Valley of Oaxaca and dating to the Postclassic in an attempt to find evidence of the production of *tejate*, a beverage that combines different ingredients, including maize, cacao, *Pouteria sapota*, and *Quararibea funebris*. While their results did not allow them to identify *tejate*, they were able to confirm the presence of cacao in three of the eight vessels examined, with two of them also containing maize phytoliths. Since cacao was present in the Valley of Oaxaca during the Postclassic, it is therefore possible to argue that this plant might have been present in mortuary and relatively public offerings at Monte Albán as well.

It is worth noting that Margaret Houston (1983), who gathered the samples examined in this study, also did not find any cacao at Monte Albán in the macrobotanical record. She argued (1983:273) that the plant was likely present at

Monte Albán, but that it was "too costly in the highlands to waste or burn", thus impacting its chances to end up charred, a key element in the preservation of macrobotanical remains. Combining macrobotanical and microbotanical sampling and chemical analysis (Soleri et al. 2013) in future excavations at Monte Albán would allow us to complement the paleoethnobotanical record and provide a better understanding of the plants being placed as mortuary offerings and used in public rituals, including cacao.

Finally, with the development of new trade routes during the Nisa phase (González Licón 2011:67), I expected to see new plants from the lowlands arriving at Monte Albán, such as manioc (*Manihot esculenta*). As mentioned by Houston (1983:216–217), tubers like manioc rarely preserve as macrobotanical remains, possibly explaining the absence of this plant from the previous record. However, root and tuber crops, such as manioc, sweet potato (*Ipomoea batatas*), and lerén (*Calathea* sp.), have been recovered from multiple sites in Mesoamerica (see Bérubé and Forde in press; Isendahl 2011; MacNeish and Eubanks 2000; Pohl et al. 1996; Wilson et al. 1998). Marcus and Flannery (1996) have argued that during the Nisa phase, Monte Albán was in a phase of expansion and might have received tribute from other polities. While the nature of this tribute is difficult to assess, it might have contained botanical elements from other regions. The acquisition of lowland root crops, among other species, would demonstrate how the expansion of trade routes and perhaps certain political *conjonctures* might have impacted religious beliefs through changes in practices associated with private and relatively public rituals.

Overview of microbotanical analyses

In this study, I analyzed 100 samples, representing 23 contexts, over the whole occupation of the site. I recovered a minimum of 24 taxa, from ceramic vessels, lithic artifacts, and sediment samples (see **Appendix A)**. The results thus represent an overview of botanical ritualized practice at Monte Albán, though are limited to elite contexts and what was recoverable through microbotanical analysis. Below, I provide a brief description of each of the 24 taxa identified in this research (**Table 5.1**), followed by a discussion of ethnographic information about use and prior recovery elsewhere in Mesoamerica. Although I did recover a number of expected taxa, remains of squash, beans, and chile were less common than expected given prior work in the region.

Table 5.1: Taxa Repartition Over Samples
Cf. identifications in parenthesis

Taxa	Total Count	Phyto	Starch	Formal Tombs	Simple Graves	Offering Boxes	Semi-Public Mortuary Contexts	Other Semi-Public Contexts
Arecaceae spp. Palm family	50 (9)	50 (9)		X	X		X	X
Acrocomia sp. Coyol genus	(1)	(1)					(X)	
Asteraceae spp. Sunflower family	10 (4)	10 (4)		X	X			

Taxa	Total Count	Phyto	Starch	Formal Tombs	Simple Graves	Offering Boxes	Semi-Public Mortuary Contexts	Other Semi-Public Contexts
Boraginaceae spp. Borage family	3 (7)	3 (7)		X	X			
Burseraceae spp. Copal family	(1)	(1)						(X)
Marantaceae spp. Arrowroot family	7 (32)	7 (32)		X	(X)	X		(X)
Calathea sp. Lerén genus	2	2		X				
Maranta sp. Arrowroot genus	(1)		(1)	(X)				
Capsicum sp. Chile pepper	3 (3)		3 (3)	X	X		(X)	
Cucurbita spp. Squash family	3 (4)		3 (4)	X	X		X	
Cyperaceae spp. Sedge family	19 (4)	19 (4)		X	(X)	X		X
Cyperus sp. Sedge	1 (2)	1 (2)		(X)			X	(X)
Fabaceae spp. Bean family	5 (5)	3 (3)	2 (2)	X			X	X
Phaseolus sp. Common bean	1		1		X			
Ipomoea batatas Sweet potato	8 (6)		8 (6)	X	X			
Manihot sp. Manioc genus	1		1	X				
Piperaceae spp. Pepperleaf family	(1)	(1)			(X)			
Poaceae spp. Grass family	9245 (2)	9240	5 (2)	X	X	X	X	X

Taxa	Total Count	Phyto	Starch	Formal Tombs	Simple Graves	Offering Boxes	Semi-Public Mortuary Contexts	Other Semi-Public Contexts
Zea mays Maize	147 (328)	124 (319)	24 (8)	X	X	X	X	X
Sagittaria sp. Arrowhead	2 (1)		2 (1)	(X)	X			

Arecaceae spp. and *Acrocomia* sp.

I identified phytoliths of palm trees (Arecaceae spp., **Figure 5.1**) and a phytolith potentially coming from the coyol palm (cf. *Acrocomia* sp.). Palms could be used as construction materials (Bonomo et al. 2017:105; Rostain 2017:12), to obtain fibres for weaving (Scheel-Ybert and Bachelet 2020:278; see also Lentz et al. 1996:250), and for edible fruits from species like coyol or cohune (*Attalea cohune*) (Abramiuk et al. 2011:260; Morell-Hart et al. 2014:74). It is also possible to extract oil from the fruits of cohune (*corozo* in Spanish) (Bozarth and Guderjan 2004:209), a practice observed in Maya contexts (McKilopp 1996:290). In Northern Oaxaca, Rangel-Landa et al. (2016:18) interviewed Ixcatec people to better understand plant management and uses. Species of the Arecaceae family were generally identified by the people interviewed as ornamental plants or firewood.

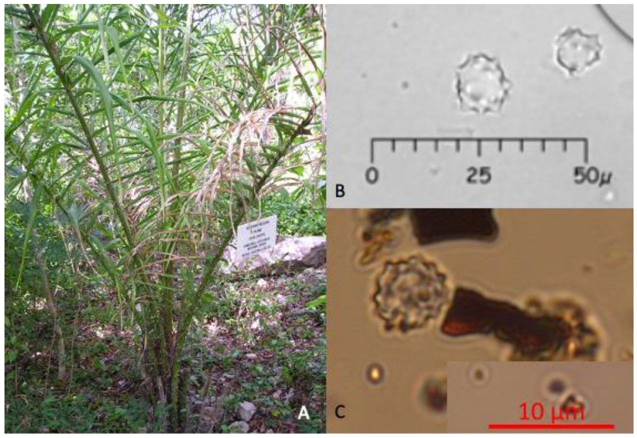


Figure 5.1: Arecaceae spp. A) live specimen of Acrocomia Mexicana (Photo by S. Morell-Hart); B) reference sample phytoliths (Pearsall et al. 2006:4); C) archaeological sample (S-4, Grave 1993-43)

Asteraceae spp.

I found 10 phytoliths of Asteraceae spp. (the sunflower family; formerly Compositæ family, **Figure 5.2**) in two different contexts. The phytoliths of these taxa are diagnostic only to the family level. This family includes a wide variety of flowering plants, the most famous in North America being the sunflower (*Helianthus* sp.). While it is impossible to determine which species of Asteraceae were present at Monte Albán, some earlier ethnohistorical work can inform us about certain uses of this family in Oaxaca. In 1993 and 1994, León Avendaño and Vásquez Dávila (2003) examined the plants at San Juan Cacahuatepec (Mixteca de la Costa, Oaxaca), and listed their utilization. Four species of Asteraceae spp. are mentioned in this study. Ajenjo (*Artemisia ludovisiana*) is listed as a medicinal plant used to "relieve gallbladder pain" (León Avendaño and Vásquez Dávila 2003:25), anís (*Tajetes micrantha*) can be given to someone who has diarrhea (p.

26), corazón de yolazoche (*Eupatorium collinum*) can be used to appease gut pain (*coraje* p. 39), and epazotillo (*Eclipta alba*) is given to children suffering from malnutrition (p. 44). Ancient Mixtecs also used diente de león (*Taraxacum officinale*) to appease stomach pain and toothache (de Ávila 2010:201). Pérez-Ochoa et al. (2018:12–14) interviewed healer families in Oaxaca, including Zapotec families, and identified 29 species of Asteraceae used for medicinal properties.

Figure 5.2: Asteraceae spp. A) live specimen of Tithonia diversifolia (FlickR); B) reference sample phytolith (Pearsall et al. 2006:5); C) archaeological sample (S-11, Grave 1994-69

Boraginaceae spp.

I identified phytoliths of Boraginaceae spp. (**Figure 5.3**) from eight different samples. The phytoliths I recovered are identifiable only to the family level. The borage family includes herbs, trees, and shrubs, and is widespread around the world (Marie-Victorin 2002 [1935]:454). This family combines ornamental plants like *Heliotropium* sp. and edible ones such as *Cordia* sp. (de Ávila 2010:110, 120; Marie-Victorin 2002 [1935] : 454). De Ávila (2010:126) also mentions that *Cordia dentata* produced good quality wood, thus hinting towards a potential use as construction material. 10% of the Ixcatec people interviewed by Rangel-Landa et al. (2016:20) identified semonilla (*Antiphytum caespitosum*) as a plant with medicinal properties, although the exact nature of its use was not listed in their chapter.

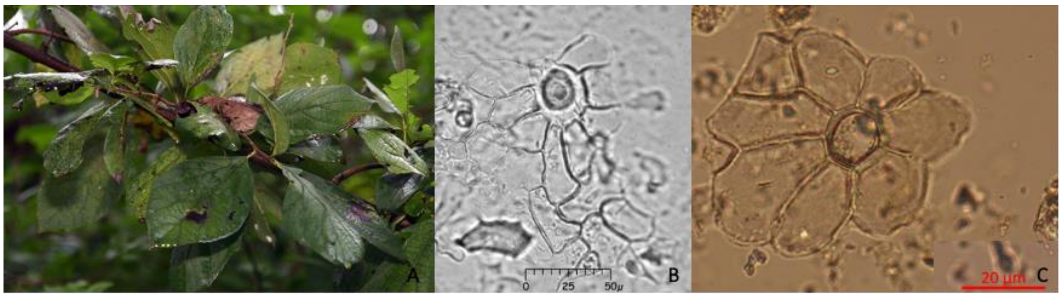


Figure 5.3: Boraginaceae spp. A) live specimen of Cordia dentata (Wikipedia); B) reference sample phytolith (Pearsall et al. 2006:34); C) archaeological sample (S-32, Tomb 1993-14).

Burseraceae spp.

In this study, I found one potential phytolith of Burseraceae spp. (**Figure 5.4**). The phytolith I recovered is identifiable only to the family level. The torchwood family groups many incense trees worldwide like myrrh (*Commiphora* sp.) and copal *(Protium copal).* In Oaxaca, copal or mulato (*Bursera* spp.) might be the most popular genus. Its fruits can be used to appease intestinal pain or to treat fever (León Avendaño and Vásquez Dávila 2003:38, 65), but perhaps most importantly, it is possible to obtain resin often used as incense (de Ávila 2010:99, 126; Dussol et al. 2016:65-66; Folan et al. 1995:320; Morehart et al. 2005:265; Rangel-Landa et al. 2016:21). Pérez-Ochoa et al. (2018:14) note that two species of copal can be used to treat stomach pain and dysentery (*Bursera microphylla* and *Bursera simaruba*). Another species from this family, cuachalalá (*Juliania* *adstringens*), can be used to cure stomach infection and to clean superficial wounds (León Avendaño and Vásquez Dávila 2003:39).

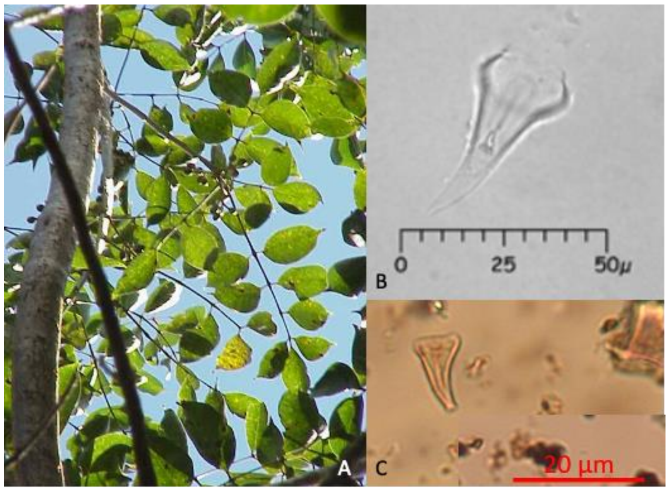


Figure 5.4: Burseraceae spp. A) live specimen of Bursera simaruba (Wikipedia); B) reference sample phytolith (Pearsall et al. 2006:49); C) archaeological sample (S-39, Structure W1).

Marantaceae spp., *Calathea* sp. and *Maranta* sp.

In this study, I identified numerous phytoliths of species from Marantaceae (arrowroot family, **Figure 5.5**), two phytoliths of lerén (*Calathea* sp.) and one potential starch grain of arrowroot (cf. *Maranta* sp.). The phytoliths I recovered are identifiable to the family and genus levels and the starch grain to genus level. Lerén produces an edible tubercule that was consumed by Mixtecs (de Ávila 2010:193). Lerén has been found at different archaeological sites, and its remains are often identified along other types of tubers like manioc (*Manihot esculenta*), yams (*Dioscorea* sp.), arrowroot (*Maranta arundinaceae*), and sweet potato (Morell-Hart et al. 2014:74; Pearsall et al. 2020; Perry 2005:412).

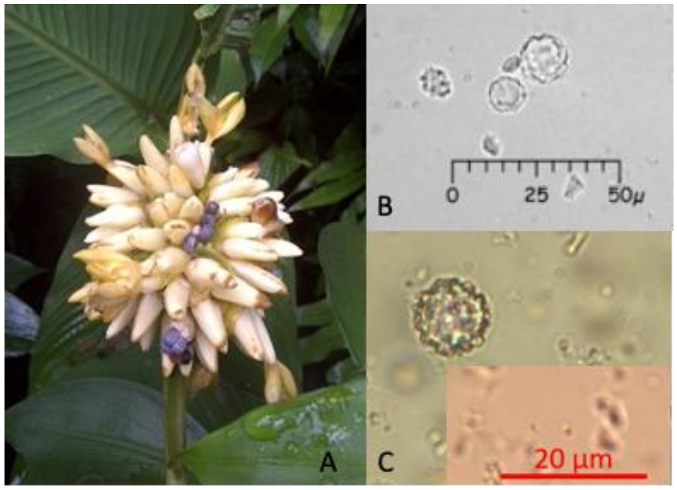


Figure 5.5: Marantaceae spp. A) live specimen of Calathea allouia (Wikipedia); B) reference sample phytolith (Pearsall et al. 2006:165); C) archaeological sample (S-13, Tomb 1993-11).

***Capsicum* sp.**

I found six starch grains of chile pepper (*Capsicum* sp., **Figure 5.6**), identifiable to the genus level. Chiles are often consumed as spices and mixed with other ingredients (Belmar et al. 2020:51; de Ávila 2010; Lentz et al. 1996; León Avendaño and Vásquez Dávila 2003:41; Valdez et al. 2020:266). De Ávila (2010:143, 169) identified recipes mixing chiles with tomatoes (*Solanum* sp.), guavas (*Psidium* sp.), amaranth (*Amaranthus* sp.), maize (*Zea mays*), and many other plants. Chile is identified as one of the most eaten foods in Oaxaca, alongside maize, beans (*Phaseolus* sp.), squash (*Cucurbita* sp.), tomatoes, and avocados (*Persea americana*) (Joyce 2010:51; see also Cook and Borah 1968:9). While Houston (1983:76) did not identify remains of chile peppers at Monte Albán, she found remains of avocado, maize, and amaranth, ingredients sometimes mixed with chiles. Whether it be jalapeños, anchos, guajillos, or chipotles, chiles play a dominant role in Oaxacan gastronomy.

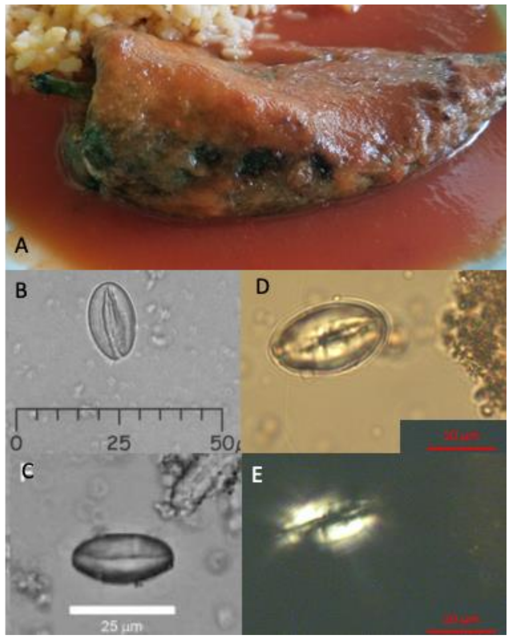


Figure 5.6: Capsicum sp. A) chile relleno; B-C) reference sample starch grains (Berman and Pearsall 2008 Fig. 5d; Perry et al. 2007 Fig. 2f); D-E) archaeological samples (ME-5, Grave 1994-69).

Cucurbita spp.

I identified three phytoliths of another set of important economic plants, squashes (*Cucurbita* spp., **Figure 5.7**). In Oaxaca, the most common species are *Cucurbita pepo*, *C. moschata*, *C. ficifolia*, and *C. argyrosperma* (de Ávila 2010:215-216). The phytoliths I recovered are identifiable only to the genus level. Squashes can be eaten in different ways: the flesh of the fruit can be consumed, the seeds can be toasted, and the flowers, leaves, and tender stems are also edible (de Ávila 2010:169, Lentz et al. 1996:254; León Avendaño and Vásquez Dávila 2003:33; Morell-Hart et al. 2014:74). Squash was part of the staple Mesoamerican diet, alongside maize and beans, often referred to as the three sisters or the crop triumvirate.

Figure 5.7: Cucurbita spp. A) assortment of squashes; B) reference sample phytolith (Pearsall et al. 2006:69); C) archaeological sample (S-5, Grave 1993-43).

Cyperaceae spp. and *Cyperus* sp.

I identified phytoliths produced by sedges, both family-specific Cyperaceae spp. and the genus-specific *Cyperus* sp. (**Figure 5.8**). The phytoliths I recovered are identifiable only to the family and genus levels. The sedge family is well spread around the world and has species "adapted to all zones and all climates" (Marie-Victorin 2002 [1935]:681, personal translation). There are around 700 species of the genus Cyperus (sedge), including papyrus (*Cyperus papyrus*) (Marie-Victorin 2002 [1935]:682). De Ávila (2010:190) refers to one unidentified species from the Cyperaceae family, which was likely labelled as a "grass" by the Mixtecs. The Mayas of Yokot'an (Tabasco) have used sedge fibres as a weaving material, including sleeping mats (*petates*) (Cavallaro 2013:70; Simpson and Inglis 2001). In the Lake Titicaca Basin, the inhabitants used those fibres to craft different things, including roofs and boats (Langlie 2020:702). Some species of this genus also produce edible tubers that were consumed at the site of Yokot'an (Tabasco, Mexico) (Cavallaro 2013:70; Simpson and Inglis 2001).

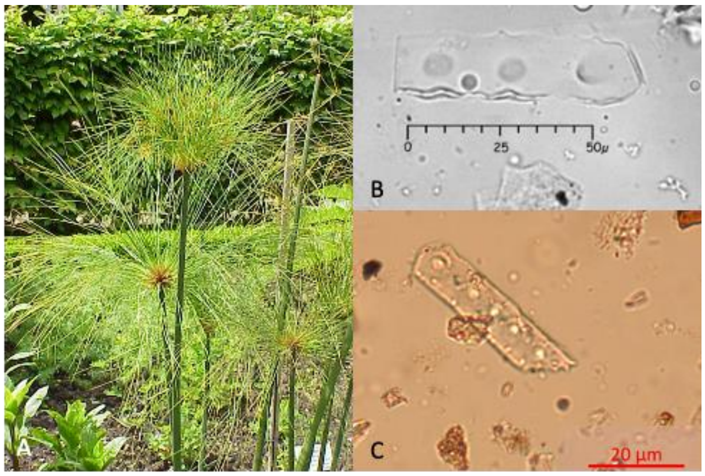


Figure 5.8: Cyperaceae spp. A) live specimen of Cyperus papyrus (Wikipedia); B) reference sample phytolith (Pearsall et al. 2006:79); C) archaeological sample (S-33, Tomb 1994-23).

Fabaceae spp. and Phaseolus sp.

I identified one starch grain of domesticated bean (*Phaseolus* sp., **Figure 5.9**) in this study, as well as ten starch grains and phytoliths produced by the larger family (Fabaceae spp.). The phytoliths I recovered are identifiable only to the family and genus levels. As mentioned previously, bean is one of the three pillars of the traditional Mesoamerican diet. Beans (or frijoles) are very common in Oaxaca. At San Juan Cacahuatepec, most of the species are harvested between August and October (León Avendaño and Vásquez Dávila 2003:46). These two authors mention that beans are mainly consumed in stews in this village. De Ávila (2010) also mentions different species of beans that were consumed by ancient Mixtecs.

While the remains identified to the family level in this study could have come from beans, they could also have been produced by other important plants still used by contemporary Oaxacan people. At San Juan Cacahuatepec, León Avendaño and Vásquez Dávila (2003:29) identified peanuts (or *cacahuates* in Spanish, thus explaining the name of the village) that are exploited for their oil and consumed for their seeds. They also mention the presence of *chipil* (*Crotalaria pumila*), a "delicious" plant. Its leaves can be boiled and then consumed with lemon, or they can be added to tamales (León Avendaño and Vásquez Dávila 2003:29). Finally, *pata de cabra* (*Bauhinia latifolia*) are exploited for their wood, which serves as combustible (León Avendaño and Vásquez Dávila 2003:72).

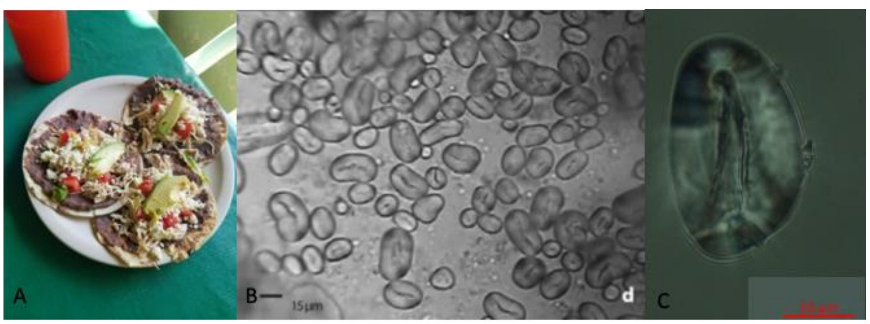


Figure 5.9: Fabaceae spp. A) Frijoles on tostadas; B) reference sample starch grains (Aceituno and Martín 2017, Fig. 4d); C) archaeological sample (ME-1, Grave 1993-17).

Ipomoea batatas

I found starch grains of sweet potato (*Ipomoea batatas*, **Figure 5.10**) in some of the samples I examined. This plant (camote in Spanish) is referred to under different names by de Ávila (2010:192), demonstrating its presence and importance for the Mixtecs living in Oaxaca. This plant is a tuber and can sometimes be recovered in relation with other tubers, such as lerén (*Calathea* sp.) and manioc (*Manihot esculenta*) (Morell-Hart et al. 2014:74).

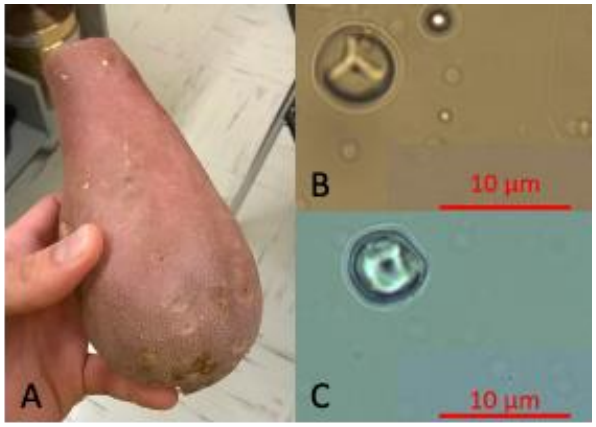


Figure 5.10: Ipomoea batatas A) live specimen being sampled; B) reference sample starch grain; C) archaeological sample (ME-19, Tomb 1993-9).

Manihot sp.

I identified one starch produced by *Manihot* sp. (**Figure 5.11**), a genus including manioc (see Isendahl 2011). While this starch might have been produced by manioc, it could also have been produced by other species present in the region like *quelite de toro* (*Manihot angustifolia*) or *quelite de cuchi* (*Manihot aesculifolia*), which were consumed for their leaves (de Ávila 2010:170-171, 177). However, the starch grain recovered in this study was in the general size range of those produced by domesticated manioc. Domesticated manioc has been identified in Mesoamerica before, including at the site of Joya de Cerén, in El Salvador (Sheets et al. 2012:259).

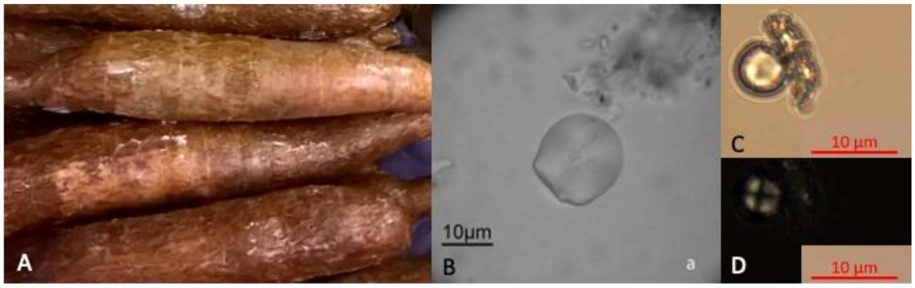


Figure 5.11: Manihot sp. A) live specimen; B) reference sample starch grain (Aceituno and Loaiza 2014 fig. 8c); C-D) archaeological sample (ME-39, Tomb 1993-11).

Piperaceae spp.

I identified one phytolith potentially produced by a plant of the black pepper family (Piperaceae spp., **Figure 5.12**). The phytoliths I recovered are identifiable only to the family level. In Oaxaca, two genera are often consumed: *quelite* (*Peperomia* sp.), and *hierba santa* (*Piper auritum*) (de Ávila 2010:169–173). Quelite produces edible leaves often placed in tortillas alongside salt and chile peppers. It was identified by 95% of the Ixcatec people surveyed by Rangel-Landa et al. (2016:42) as an edible plant, demonstrating its importance in the Oaxacan cuisine. Hierba santa can be consumed or used to cure wounds (de Ávila 2010:169–173) and is most famous for its use in the mole amarillo (yellow mole sauce).

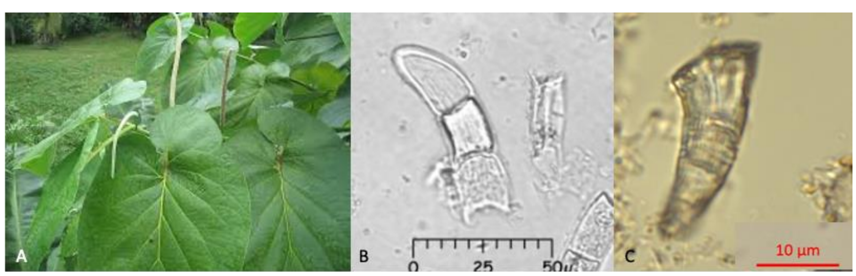


Figure 5.12: Piperaceae spp. A) live specimen of Piper auritum (Photo by S. Morell-Hart); B) reference sample phytolith (Pearsall et al. 2006:205); C) archaeological sample (S-28, Grave 1994-61).

Poaceae spp. and *Zea mays*

I identified maize (*Zea mays,* **Figure 5.13**) starch grains and phytoliths, as well as grass (Poaceae spp.) microbotanical remains. Those grasses came from different sub-families, including phytoliths identified as *Panicoideae* spp., produced by the same subfamily as maize. Maize played a key role in ancient Mesoamerican foodways, including Zapotec foodways (Bérubé 2017; Fussell 1992; León Avendaño and Vásquez Dávila 2003:62). It can be prepared in many ways, including dishes such as tortillas and tamales, or thick drinks like *atoles*. For the ancient Zapotecs, maize was also associated with the concept of fertility (Joyce 2020a), making it both an important food plant and a symbolically meaningful one. This strong connection with maize in Oaxaca is also seen in the Mixtec language associated with maize, with this plant having "the most elaborate vocabulary in Mixtec, by far" (de Ávila 2010:209). Pérez-Ochoa et al. (2018:20) mention that maize can be consumed to treat diarrhea and stomach pain.

Maize was an important component of Zapotec ritualized practices as well. Sellen (2011) examined effigy vessels dating to the Postclassic period that were decorated with iconographies of maize at different levels of growth. In this study, Sellen (2011) argues that Zapotec participated in blood-letting rituals to obtain fertility. By offering the sacrifice of blood in those maize-decorated effigy vessels, they maintained alive a "sacred pact" between the living and deities. In Oaxaca, some Ayöök (Mixe) people use maize as a divination tool (Rojas 2016). To do so, they read maize kernels. Generally, the reader uses between 13 and 30 grains (Rojas

2016:463). The grains are deposited on a tortilla and the reader then examines how the grains felt (Rojas 2016:464). Generally, if the embryo of the kernel is visible, this is seen as a positive sign, but if the grain falls on its back, then in bears a negative connotation (Rojas 2016). In certain contexts, grains that fall on their back can represent deceased ancestors instead. These two examples demonstrate the importance of maize in ritualized practices, and practices related to the dead.

I identified the cross-body phytoliths I encountered in this study as tentatively produced by maize (cf. *Zea mays*) leaves. Generally, those phytoliths are often produced by *Zea* grasses (teosinte and maize), but cross-shaped phytoliths can also be produced by other types of grasses. Because these phytoliths are often produced by *Zea* grasses, I tentatively identified them as being produced by this genus. I identified them as tentatively coming from maize (cf. *Zea mays*) based on two factors: 1) the presence of maize and the absence of teosinte at Monte Albán based on Houston's results (1983:76); and 2) the presence of maize in Oaxaca well before the founding of Monte Albán (Piperno and Flannery 2001; Ranere et al. 2009; Sluyter and Dominguez 2006). It is therefore likely that those cross-body phytoliths were produced by maize, but because of the potential ambiguity regarding the diagnostic level of those remains, I preferred to keep the identifications as tentative (cf.).

I identified wavy-top rondel phytoliths in this study as produced by maize (*Zea mays*) cobs. As argued in a previous paper (Bérubé et al. 2020), in Central and Southern Mexico, wavy-top rondels are identified as coming from maize (Piperno and Flannery 2001:2102-2013; Pohl et al. 2007:6871). It is worth mentioning, however, that this is not the case for all of Latin America, as some grasses found in the Andes also produce wavy-top rondels phytoliths, thus making the identification of maize in this region more challenging (Logan 2006:100–101). Wavy-top rondels are produced by maize cobs, while maize starches are produced by kernels, allowing us to examine plant processing and uses more easily (Bozarth 1993; Mulholland et al. 1988). Maize produces diagnostic starch grains that can be recovered from archaeological contexts, as demonstrated by the extent literature on the topic (e.g., Aceituno and Loaiza 2014; Ball et al. 2016; Berman and Pearsall 2008; Ciofalo et al. 2018; Dickau 2010; Dickau et al. 2007; Mickleburgh and Pagán-Jiménez 2012; Pearsall et al. 2006; Piperno et al. 2009).

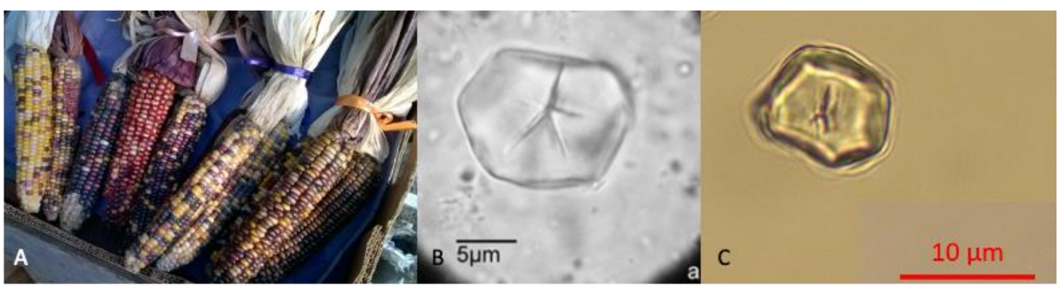


Figure 5.13: Zea mays A) live specimen of Zea mays; B) reference sample starch grain (Aceituno and Loaiza 2014 Fig. 6a); C) archaeological sample (ME-15, Grave 1994-61).

***Sagittaria* sp.**

I found starches of arrowhead (*Sagittaria* sp.) in this study. Arrowhead is an aquatic plant that can grow in lakes, rivers, and canals in sections of less than 1 m of depth (Miranda Arce 2014:46). There are various species in Oaxaca including *S. guayanensis*, *S. longiloba*, and *S. lancifolia* (Reid Keener 2005:60, 79, 106). *S. latifolia* and *S. macrophylla* have been identified in other Mexican states (Miranda

Arce 2014:46). Arrowhead is represented twice in the Aztec Códice Florentino (de Sahagún 1926, book XI), where it is identified as *Cacateztli* ("dough to bake" in Náhuatl). It is mentioned that this plant can be cooked and is praised for its taste (de Sahagún 1926; Miranda Arce 2014:47). In Mexico, arrowhead is harvested in the dry season, generally between November and May (Miranda Arce 2014:47). At first, I categorized those starches as unknown before encountering a picture of starches of *Sagittaria latifolia* in Messner's (2011) work from the Northeastern U.S. Since this plant was not in the MPERF reference collection, I acquired and grew bulbs of *Sagittaria latifolia* over the summer of 2021 and collected the tubers in August (**Figure 5.14**). I was then able to confirm these starches matched the ones from my samples. It is very likely that the starches were produced by *Sagittaria latifolia*, but because of the limited knowledge on the diagnostic level of starches produced by each *Sagittaria* species, I preferred to limit my identification to *Sagittaria* sp. *Sagittaria latifolia* has been identified in 10 contemporary Mexican states: Campeche, Durango, Jalisco, Michoacán, México, Nayarit, Puebla, Tabasco, Tamaulipas, and Veracruz (Miranda Arce 2014:46).

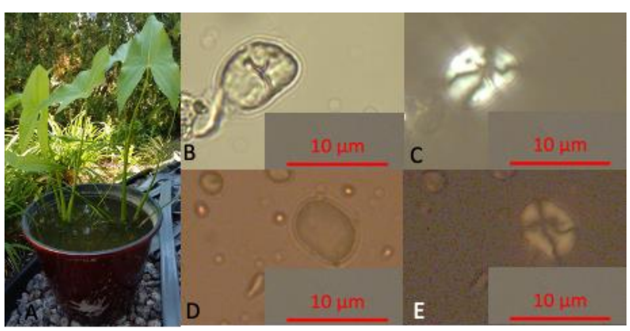


Figure 5.14: Sagittaria latifolia. A) live specimen; B-C) archaeological sample starch grains (ME-4, Grave 1994-69); D-E) reference samples starch grains

Other types of remains

Insect scales or wings

I was able to identify some remains as coming from insects thanks to a photo in Leroi-Gourhan's 1975 article (Figure 2). I was not able to identify those scales or wings to any specific order or family, making those remains difficult to interpret. Were those insects attracted by flowers as described in Leroi-Gourhan's article? Or were those insects attracted by organic elements decomposing in the studied vessels? The presence of preserved insect remains at Monte Albán might be an invitation for an entomoarchaeologist to sample some contexts in eventual archaeological excavations taking place at the site.

Diatoms

I recovered different remains of diatoms, "single-celled algae" (Wilkinson and Stevens 2008:61). Similar to phytoliths, diatoms are made of silica (Wilkinson and Stevens 2008:62). Diatoms need sunlight to survive and are therefore found in bodies of water with depths not exceeding 200 m (Wilkinson and Stevens 2008:62). This means that those diatoms could have been brought to Monte Albán unintentionally in water collected from the nearby Atoyac river or from any other source of water.

Fungus and Pollen

These two types of remains, recovered in this study, can be identified and inform us about vegetation changes through time or highlight the presence of certain plants in sealed contexts (Loughlin et al. 2021; Wilkinson and Stevens 2008:83–100). As demonstrated by a few case studies in **Chapter 2** (e.g., Bui Thi Mai and Girard 2003; Corbineau 2016; Girard 1987), pollen samples have been examined in mortuary contexts and have informed us about the presence of different botanical elements such as flowers or honey. Pollen analysis at Monte Albán could complement the data from this study and inform us about the presence of other plants not identified through phytoliths and starch grains. Houston collected numerous sediment samples for potential pollen analysis that are still waiting to be examined at the INAH laboratory in Cuilapam de Guerrero. Their analysis would provide valuable data in ancient plant practices at the site and could inform us about the environment changes happening throughout the occupation of the city.

Spherulites

Spherulites are "spherical bodies occurring in glassy rocks […] and thought to have formed as a consequence of rapid mineral growth" (*Encyclopaedia Britannica*). In some instances, animals can produce calcium carbonate spherulites through digestion, thus offering a way to identify the presence of animal dung in archaeological sediment samples (Durant et al. 2018). I was unable to identify the nature of the 41 spherulites that I recovered in this study.

Connecting Dead, Living, and Supernatural Through Plants

As expected, the plants identified in this study combined wild and domesticated species, highlighting the botanical elements available at the time. Maize is present in most of the archaeological contexts examined here, highlighting its important role. In previous chapters, I developed expectations regarding the role of plants in mortuary practices and relatively public rituals at Monte Albán (**Chapter 1**) and examined previous paleoethnobotanical studies in similar contexts around the world (**Chapter 2**). I also synthesized understandings of Monte Albán's history, based on previous archaeological excavations (**Chapter 3**). In the following three chapters, I compare these prior expectations with the actual botanical findings, to illuminate ancient practices and beliefs at the Zapotec capital.

6. Mortuary Traditions and Social Status at Monte Albán

In this first discussion chapter, I focus on a subset of samples to pursue my first objective to investigate connections between mortuary botanical offerings and the social status of the individuals interred. This pursuit allows me to determine if differences in status translated into a differential access to plants used as offerings. Here, I focus on the social and political *conjonctures* that marked the history of Monte Albán. While Monte Albán might have initially been founded through collective governance, where elite and non-nobles shared responsibilities and power, the following periods were marked by increases in social inequalities. Before analyzing the samples, my expectation was that the social status of the buried individuals greatly impacted the botanical offerings they received. I expected to identify plants of a higher value/level of rarity (such as manioc and sweet potato) and/or a higher overall richness of taxa in tombs. I focused my analysis on the social status of the deceased individuals, as determined by type of burial **(Chapter 3)** which strongly corresponds with artifact assemblage and architectural layouts (Martínez López et al. 1995, 2014).

To examine the impact of social status on the plants interred with individuals in funerary settings, I compared the botanical elements recovered in a) formal tombs, believed to have been occupied by household leaders, to the elements retrieved from b) simple graves, where people of a lesser status were placed for their final rest (Martínez López et al. 1995, 2014). Throughout this chapter, "graves" is used to define interments consisting of holes dug in the ground and then filled with dirt (labelled as *entierros* in Monte Albán reports). In some cases, slabs were used to delimit the contour of the graves (such as Grave 1993-25), and in others the graves are not associated with any architectural features (like Grave 1993-26) (**Figure 6.1**). I made this distinction following the fact that tombs could be revisited, something that was not possible for simple graves, as there was no ready access (Feinman et al. 2010:1093–1098; Joyce 2010:111–112; Lind and Urcid 2010:189–207; Markens and Martínez López in press; Martínez López et al. 1995, 2014). This distinction is also supported by the technical differences between the elaborate construction of a formal tomb (**Figure 6.2**) and the simple architectural layout of a grave, and by the difference in the quantity and quality of offerings between these two types of interments (Martínez López et al. 1995, 2014).

I focus on five of the seven simple graves examined in this study and on the eight sampled tombs (**Figure 6.3**). All of these burials come from elite contexts. Therefore, the comparison between simple graves and formal tombs allows to highlight the use of plants in relation to the social standing of the deceased in the household. I disregard Grave 1993-43 for this analysis because it is believed to relate to an important event involving multiple participants (Martínez López et al. 1995:151–175). Since my objective was to examine how the social status of the deceased influenced household mortuary practices in a private setting, Grave 1993-43 fell outside the scope of this chapter. I explore this example in more detail in the next chapter, alongside other contexts associated with relatively public rituals. The second grave left outside this analysis (Grave 1993-56) contained no mortuary offerings. I examined a lithic artifact recovered from this second grave that was ultimately categorized as associated material rather than as a mortuary offering (Martínez López et al. 1995:191–198). As this artifact did not provide information on mortuary practices, I do not examine it here, but the full results can be found in **Appendix A.**

In this chapter, I examine a total of 63 microbotanical samples. While more samples would be needed to develop robust interpretations, I offer preliminary suggestions and testable hypothesis that might be strengthened or challenged by future datasets. In paleoethnobotanical studies, these 63 samples represent a relatively large sample of funerary contexts. During the PEMA project, archaeologists collected numerous samples for future paleoethnobotanical studies, and there are still botanical assemblages available for analysis.

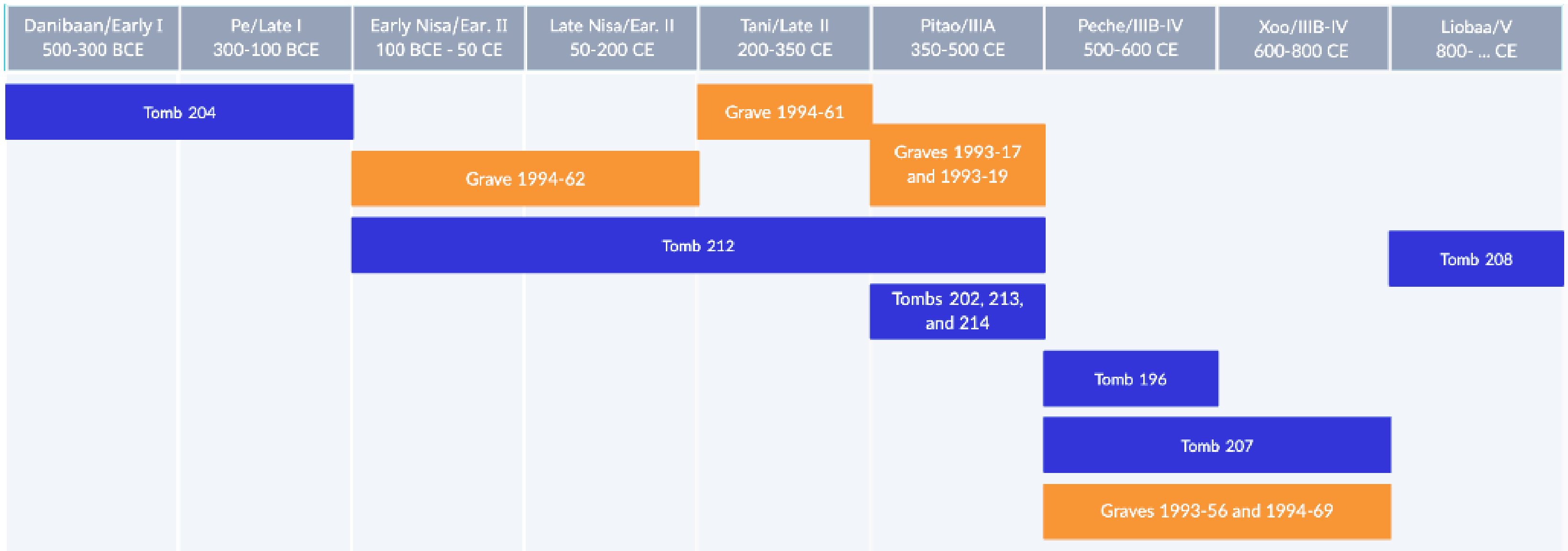


Figure 6.1: Timeline of the Studied Mortuary Contexts
Chronology established from Martínez López et al. 1995 (Roman numerals), 2014 (Zapotec nomenclature)

Plants and Graves at Monte Albán

In this section, I briefly introduce the five graves examined in this chapter (**Figure 6.4)**. I examined 25 samples recovered from those graves, covering three time periods: Nisa, Tani-Pitao, and Peche-Xoo (see **Figure 6.3**). I employed ubiquity analysis to compare the samples.

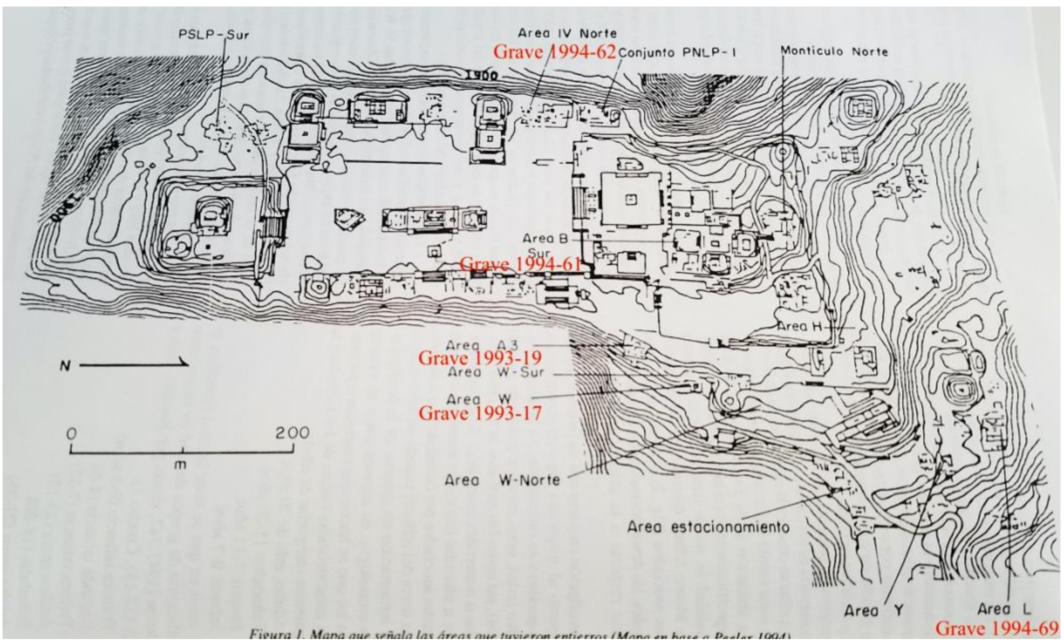


Figure 6.2: Map Highlighting the Graves Locations Based on Winter (1995, Fig. 1)

Ubiquity analysis is obtained by dividing the "total number of loci of particular taxa as present/absent across the site" by the total number of loci where they were recoverable (Morell-Hart 2019:234). I calculated these levels of ubiquity for the botanical remains recovered from Monte Albán's graves (**Table 6.1**). I examined the percentage of graves in which a taxon occurred to better understand their distribution throughout the site (labelled as *Taxon Presence: Graves* or TPG). A taxon present in all of the five graves would get a score of 100%, while a taxon found only in one of these mortuary contexts would get a score of 20%.

Table 6.1: Ubiquity analysis, graves. TPG = Taxon Presence: Graves. cf. results were considered as identified remains in the ubiquity level analysis. Note difference in numbers of samples (N) analyzed per grave context.

////////////	Grave 1994-62 (N=6)	Grave 1994-61 (N=5)	Grave 1993-17 (N=3)	Grave 1993-19 (N=1)	Grave 1994-69 (N=5)	TPG (N=5)
Arecaceae spp. Palms	2				1	40%
Asteraceae spp.					1	20%
Boraginaceae spp.	(1)				(1)	40%
Capsicum sp. Chile pepper		(1)			1	40%
Cucurbita sp. Squash		1				20%
Cyperaceae spp.		(1)				20%
Ipomoea batatas Sweet potato					1 (2)	20%
Marantaceae spp.	(1)	(1)			(1)	60%
Phaseolus sp. Common beans			1			20%
Piperaceae spp.		(1)				20%
Sagittaria sp. Arrowhead					2	20%
Zea mays Maize	(2)	3 (1)	1		2 (1)	80%
Unknown phytoliths, starches, and tissues		2	1		5	60%

As expected, maize dominated the botanical assemblages recovered from simple graves. I was however surprised that there were no other taxa commonly found in most of the graves, such as squash or beans. A great variety of plants were found in these five graves, including sweet potato, a plant I expected to encounter mostly in tombs as it had to be imported from elsewhere, making this product more highly valued.

Grave 1994-62

Grave 1994-62 (Martínez López et al. 1995:206–212) is the oldest of this study and dates to the Nisa phase. The grave was found on the West sector of the Main Plaza. Archaeologists encountered the remains of an adult laying in an extended position. The adult was a male between 20 and 25 years old. Funerary participants placed offerings alongside the deceased including four ceramic vessels, and a shell necklace (Object 4) atop the ribs, vertebrae, and clavicles of the individual. I examined residues extracted from three of the four vessels and five sediment samples: two recovered from extracted vessels, one collected under the shell necklace, one above the grave, and one under it. The conical bowl (Object 1) was found over the skull of the deceased, the composite silhouette bowl (Object 2) next to his left femur, and the asymmetric bottle (Object 3) was found in an unknown location. **Table 6.2** summarizes the key taxa identified in each of those samples (for the complete list, please see **Appendix A**).

Table 6.2: Samples Examined from Grave 1994-62
cf.: potential; dam. st.: damaged starch grain (same code utilized throughout this chapter)

Origin of Sample	Study Sample Number	Grave Sample Number	Taxa Recovered	Common Names
Conical bowl, crema ware	ME-10	Objeto 1	Poaceae spp., dam. st.	Grass
Composite silhouette bowl, gray ware	ME-11	Objeto 2	cf. *Zea mays*, Poaceae spp., dam. st.	cf. maize kernel (starch), grass
Collected in Object 2 (bowl)	S-37	Objeto 2	cf. Marantaceae spp., Poaceae spp.	cf. arrowroot family, grass
Asymmetric bottle, gray ware	ME-12	Objeto 3	Poaceae spp., dam. st.	Grass
Collected in Object 3 (Asymmetric bottle)	S-9	Objeto 3	Poaceae spp.	Grass
Collected under shell necklace	S-6	Objeto 4	cf. *Zea mays*, Arecaceae spp., Poaceae spp.	cf. maize leaves (phytolith), palms, grass
Collected above grave	S-7	N/A	Arecaceae spp., Poaceae spp.	Palms, grass
Collected under grave	S-8	N/A	cf. Boraginaceae spp., Arecaceae spp., Poaceae spp.	cf. borage family, palms, grass

The results obtained from the three artifacts were similar: I was able to identify grass (Poaceae spp.) microbotanical remains in all of them, with the addition of a few starch grains, too damaged to be identified. The results obtained from the microbotanical extractions of the composite silhouette bowl (Object 2) and the asymmetric bottle (Object 3) were consistent with the sediment samples recovered from the same artifacts. Grass phytoliths dominated the assemblage, with the presence of the Panicoideae spp. (maize grass subfamily) confirmed in all examined samples. The combination of a potential maize starch grain (cf. *Zea mays*, obtained from the extraction sample, (**Figure 6.5**) and of a phytolith potentially coming from the lerén and arrowroot family (Marantaceae spp., obtained from the sediment sample) in the composite silhouette vessel (Object 2) may indicate this vessel contained a meal or a drink placed in the grave as an offering or different uses of this vessel over time.

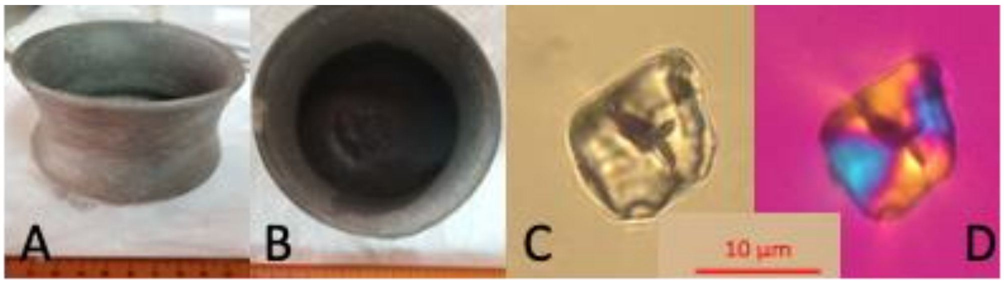


Figure 6.3: Grave 1994-62. A-B) Composite silhouette bowl (Obj. 2); C-D) cf. Zea mays starch grain

I was able to identify potential maize cross-body phytoliths (cf. *Zea mays*) in both the AB and the S fractions obtained near the shell necklace. Those results would suggest that maize leaves might have been placed in vicinity of the shell necklace and of the body. They could have contained food inside, serving as wrappers, similar to *tamales*. Phytoliths from palm trees (Arecaceae spp.) were found both above and under the grave, possibly hinting towards the presence of a cushion or a bed made of palm tree leaves.

Overall, we find evidence of grass and palms, and potentially elements of the borage (cf. Boraginaceae spp.) and arrowroot (cf. Marantaceae spp.) families, as well as remains tentatively identified as maize (cf. *Zea mays*), plants that could be found locally, likely placed as food offerings. However, it is also possible that funerary participants interred vessels with the deceased that had been used prior to death. This individual, found in a grave associated with a lesser social status than those interred in tombs, was interred with multiple vessels/culinary equipment.

Grave 1994-61

The second grave, 1994-61 (Martínez López et al. 1995:204–208), is the only mortuary context dating to the Tani phase examined in this study. Archaeologists recovered the remains of an infant (3-months old) (Martínez López et al. 1995:204). The deceased was accompanied by eight ceramic vessels and two green stone beads (Martínez López et al. 1995:204). This grave was found on the North Platform, near the VG complex, one of the most restricted areas of the entire site. Considering the location of the burial, the fact that infant burials are relatively rare at Monte Albán, and the high number of ceramic vessels placed as offerings, it is possible to argue that this infant was of a high lineage, though buried in a simple grave. I examined residues extracted from five vessels and a sediment sample (**Table 6.3**). Four of these vessels were found near the feet of the infant and the small bottle (Object 2) was found next to the skull (Martínez López et al. 1995:204).

Table 6.3: Samples Examined from Grave 1994-61
cf.: potential; dam. St.: damaged starch grain

Origin of Sample	**Study Sample Number**	**Grave Sample Number**	**Summary of Taxa**	**Common Names**
Asymmetrical cylindric vessel, crema ware	ME-14	Objeto 1	*Zea mays*, cf. Cyperaceae spp., Poaceae spp., dam. St.	Maize kernel (starch), cf. sedge, grass
Small bottle, crema ware	ME-16	Objeto 2	*Zea mays*, cf. *Capsicum* sp., Poaceae spp., dam. St.	Maize kernel (starch), cf. chile, grass
Cylindric vessel, crema ware	ME-15	Objeto 4	*Zea mays*, Poaceae spp., dam. St.	Maize kernel (starch), grass
Hemispherical plate, crema ware with black/café slip	ME-13	Objeto 6	Unknown starch grain	

Origin of Sample	**Study Sample Number**	**Grave Sample Number**	**Summary of Taxa**	**Common Names**
Cylindric vessel, crema ware	ME-17	Objeto 7	No botanical remains	
Collected in Object 7 (Cylindrical vessel)	S-28	Objeto 7	cf. *Zea mays*, *Cucurbita* spp., Poaceae spp., cf. Marantaceae spp., cf. Piperaceae spp.	Cf. maize leaves (phytolith), squash, grass, cf. arrowroot family, cf. pepperleaf family

Maize starches, produced by the kernels, were found in three of the vessels (Objects 1, 2, and 4). The cylindric vessel (Object 7), contained a squash (*Cucurbita* spp.) phytolith, 18 potential maize phytoliths (cf. *Zea mays*), and potential phytoliths from the Marantaceae spp. (arrowroot, lerén) and Piperaceae spp. (pepperleaf, hierba santa) families. Since all the botanical remains associated with Object 7 came from the sediment sample, it is likely that this vessel contained a recipe mixing multiple ingredients, or a series of deposits. It is also possible that these remains come from the sediments used to fill the grave, thus contaminating the sample. Additional sediment samples from this grave would be needed to better understand the nature of this deposit. The presence of maize starch grains, produced by kernels, and of a starch grain potentially produced by chile peppers (cf. *Capsicum* sp.) in three vessels (Objects 1, 2, 4) hints towards the presence of other edible items placed as offerings to the deceased infant (**Figure 6.6**). Considering the young age of the deceased, the presence of remains of maize kernels from three vessels could perhaps hint towards the presence of *atole*, a weaning food that could be consumed by a young infant.

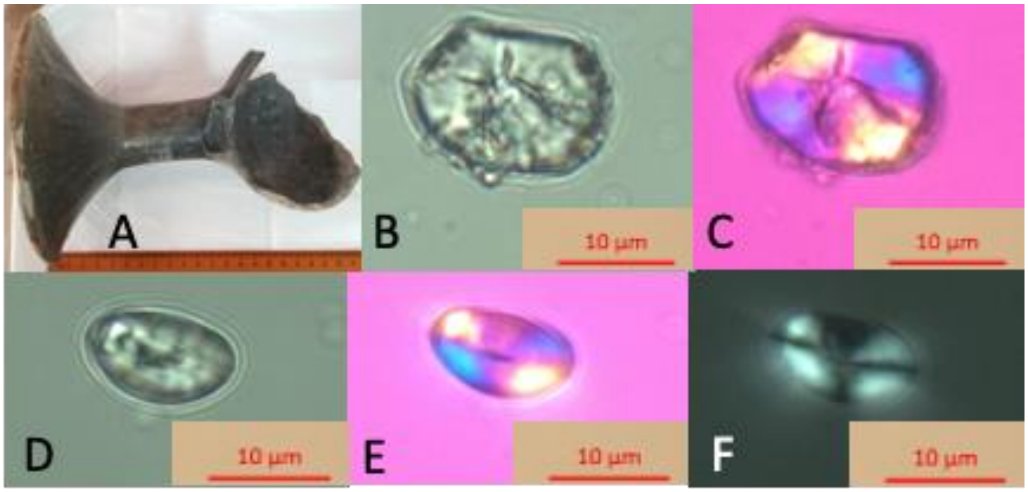


Figure 6.4: Grave 1994-61. A) Small bottle (Obj. 2); B-C) Zea mays starch grain; D-F) cf. Capsicum sp. (damaged)

Overall, we find evidence of maize, grass, and squash, with remains potentially coming from chile pepper, sedge, the arrowroot family (cf. Marantaceae spp.), and the pepperleaf family (Piperaceae spp.). These plants could all be found near Monte Albán and were likely placed as food offerings. However, as is the case when examining microbotanical extractions, it is also possible that funerary participants interred vessels with the deceased that had been used prior to death. This individual, placed in a grave associated with people of a lesser status than tombs, was interred with multiple vessels/culinary equipment. The number of offerings (eight vessels and two green stone beads) is a remarkable offering for an infant buried in a burial, once again suggesting that this individual was perhaps of a royal lineage.

Grave 1993-17

This grave, 1993-17 (Martínez López et al. 1995:109–113) dates to the Pitao period. It is located just south of the North Platform, at the core of the Main Plaza. It contained the remains of a child aged 8–9 years old (Martínez López et al. 1995:109). The deceased was accompanied by four ceramic vessels and a shell ornament (Martínez López et al. 1995:109). I examined the residues extracted from three of the four ceramics (**Table 6.4**). The small hemispherical bowl (Object 2) was found near the head of the child and the conical bowl (Object 1) was placed right over their skull. The incense burner (Object 3) was found next to the knees of the individual.

Table 6.4: Samples Examined from Grave 1993-17
dam. st: damaged starch grain

Origin of Sample	Study Sample Number	Grave Sample Number	Summary of Taxa	Common Names
Small hemispherical bowl, café ware	ME-1	Objeto 2	*Phaseolus* sp., Poaceae spp., dam. st.	Beans, grass
Hemispherical incense burner	ME-2	Objeto 3	Poaceae spp., pollen/spores	Grass
Tripod conical bowl, gray ware	ME-3	Objeto 1	*Zea mays*, Poaceae spp., dam. st.	Maize kernel (starch), grass

The presence of starch grains produced by beans (*Phaseolus* sp., **Figure 6.7**) in the sonicated wash of the small hemispherical bowl (Object 2) might indicate this vessel contained a meal or a stew (Figure 6.4). The presence of maize starches in both the wet (2) and sonicated (1) washes of the conical bowl (Object 1) could support the idea that a drink or a meal was offered as well. Although no remains from the Burseraceae family were identified in the burner, it is possible that copal or mulato (*Bursera* spp.), a genus known in Mesoamerica for its resin, often used as incense (De Ávila 2010:99, 126; Dussol et al. 2016:65-66; Folan et al. 1995:320; Morehart et al. 2005:265), was burnt in this artifact.

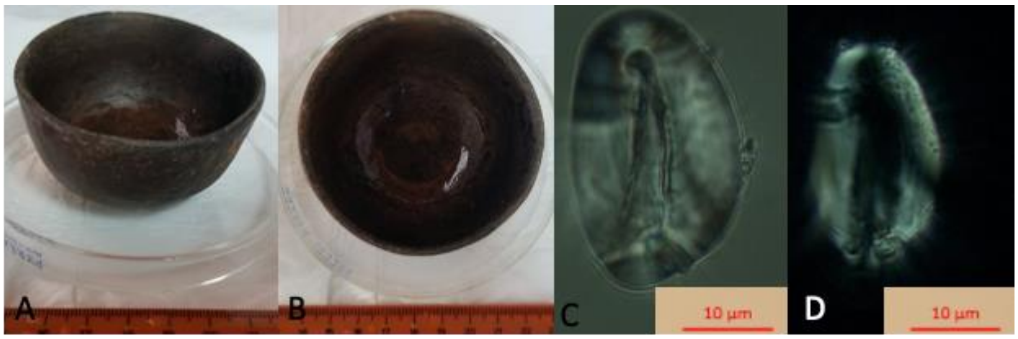


Figure 6.5: Grave 1993-17. A-B) Small hemispherical bowl (Obj. 2); C-D) damaged Phaseolus sp. starch grain

Overall, we find evidence of beans, maize kernels, and grass. These plants, all found locally, were likely placed as offerings. However, it is also possible that funerary participants interred vessels with the deceased that had been used prior to death. This individual, placed in a grave associated with people of a lesser status than tombs, was interred with multiple vessels/culinary equipment.

Grave 1993-19

The grave 1993-19 (Martínez López et al. 1995:115–116) is the second in this study dating to the Pitao phase. It is located just East of the North Platform. It contained the remains of an adult woman, accompanied by a single ceramic vessel. Even though this artifact is labelled as Object 2, the Object 1 (fragment of a figurine) was later reclassified as an "associated material" not part of the mortuary offering (Martínez López et al. 1995:115). I examined remains extracted from the vessel, which was placed at the side of the body (**Table 6.5**). I identified the presence of grass (Poaceae spp.) phytoliths in the vessel, which might inform us about the environment in the vicinity of the vessel rather than its content, or perhaps grass previously used to scour the bowl. The bowl might have been initially empty or could have contained non-botanical elements like meat or fish. The absence of additional botanical elements could also be explained by taphonomy issues.

Table 6.5: Samples Examined from Grave 1993-19

Origin of Sample	Study Sample Number	Grave Sample Number	Summary of Taxa	Common Names
Conical bowl, gray ware	ME-43	Object 2	Poaceae spp.	Grass

Grave 1994-69

The grave 1994-69 (Martínez López et al. 1995:223–227) dates to Peche-Xoo and might have stretched up to the Liobaa phase. It comes from the residence of Tomb 7 (see Caso 1970). Archaeologists recovered the remains of an adult woman missing her skull (Martínez López et al. 1995:223). The removal of bones from mortuary contexts, including cranial bones, has been reported elsewhere in Oaxaca (see Feinman et al. 2010; Lind and Urcid 2010; Markens and Martínez López in press; McCafferty and McCafferty 2015; Rivera Gúzman 2014; Urcid 2005). These archaeologists have argued that these bones sometimes served as amulets and often played an important role in veneration of ancestors. Considering this practice has been documented at numerous sites in Oaxaca, it is likely that the skull from the deceased placed in Grave 1994-69 served similar purposes.

The mortuary offering consisted of six ceramic vessels, five of them studied here (**Table 6.6**). Object 3 was recovered next to the right femur. Object 4 was retrieved over the right tibia and contained Object 5. Object 6 was placed next to the left tibia of the deceased. Finally, Object 2 was found upside down over the left femur and contained finger bones. McCauley (2019) has examined ancient Maya finger caches and was able to demonstrate that this was a relatively common practice. McCauley identified 60 sites dating between the Late Preclassic and the Late Postclassic where finger bones were placed as offerings. McCauley (2019:72) was able to separate these offerings into two categories: voluntary (e.g., mourning mothers leaving one of their fingers in the grave of their children, or bloodletting rituals where fingers were cut), and involuntary (e.g., warriors cutting fingers from enemies as a trophy or sacrifices). It is difficult to identify the exact nature of this offering in Grave 1994-69.

Table 6.6: Samples Examined from Grave 1994-69
cf.: potemtial, dam. st.: damaged starch grain

Origin of Sample	**Study Sample Number**	**Grave Sample Number**	**Summary of Taxa**	**Common Names**
Conical bowl, gray ware	ME-4	Objeto 2	*Sagittaria* sp., Poaceae spp., dam. st.	Arrowhead, grass
Fragmented small tripod conical bowl, gray ware	ME-7	Objeto 3	*Sagittaria* sp., cf. *Ipomoea batatas*, Poaceae spp.	Arrowhead, cf. sweet potato, grass
Collected inside Object 3	S-10	Objeto 3	Arecaceae spp., cf. Marantaceae spp., cf. *Zea mays*, Poaceae spp.	Palms, cf. arrowroot family, cf. maize leaves (phytolith), grass

Origin of Sample	Study Sample Number	Grave Sample Number	Summary of Taxa	Common Names
Low and incomplete hemispherical bowl, gray ware	ME-5	Objeto 4	*Capsicum* sp., *Zea mays*, cf. *Ipomoea batatas*, Poaceae spp.	Chile pepper, maize kernel (starch), cf. sweet potato, grass
Small tripod conical bowl, gray ware	ME-6	Objeto 5	Poaceae spp.	Grass
Tripod conical bowl, gray ware	ME-8	Objeto 6	*Ipomoea batatas*, *Zea mays*, Poaceae spp.	Sweet potato, maize kernel (starch), grass
Collected inside Object 6	S-11	Objeto 6	Asteraceae spp., cf. Boraginaceae spp., cf. *Zea mays*	Sunflower family, cf. borage family, cf. maize leaves (phytolith)

These vessels contained an array of edible plants, including maize, chile pepper, sweet potato, the edible tuber of arrowhead (*Sagittaria* sp.), as well as plants from the Asteraceae spp. family (ajenjo, anis, epazotillo), and potential elements from the Marantaceae (arrowroot, lerén) and Boraginaceae (cordia) families (**Figure 6.8**). These plants were mixed together in different ways, perhaps hinting towards the presence of different dishes placed as offerings. of This grave is the only one containing sweet potato and arrowhead, potentially highlighting highly elaborate mortuary practices, or more diverse cuisines from previous uses of the artifacts.

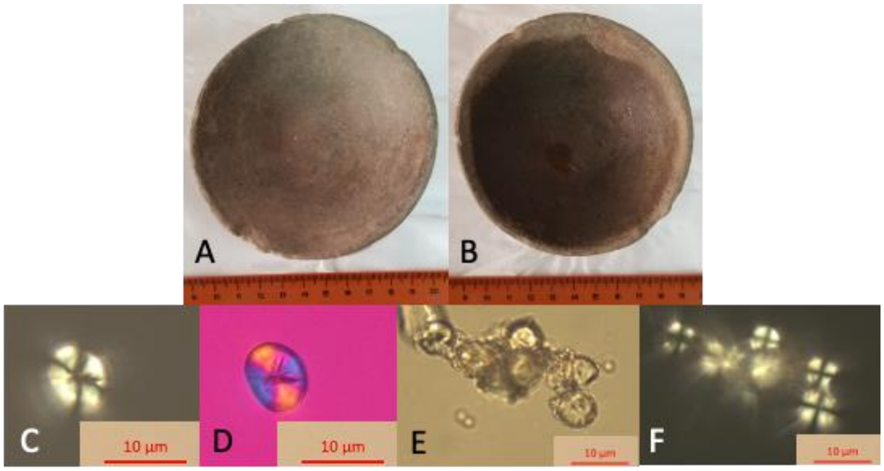


Figure 6.6: Grave 1994-69. A-B) Small tripod bowl (Obj. 3); C-D) Sagittaria sp. starch grain; E-F) cf. Ipomoea batatas starch grains

Overall, we find evidence of maize, chile pepper, grass, palms, elements of the sunflower family (Asteraceae spp.) and potential remains coming from the borage family (cf. Boraginaceae spp.), all plants that could be found locally. Arrowhead, however, needed to be imported from somewhere else as it could not grow immediately around the site, while sweet potato is a lowlands-preferring plant. However, it is also possible that funerary participants interred vessels with the deceased that had been used prior to death. This individual, placed in a grave associated with people of a lesser status than tombs, was interred with multiple vessels/culinary equipment. Interestingly, it is the only grave featuring in this study that contains potentially imported botanical remains.

Plants and Tombs at Monte Albán

In this study, I examined 45 samples retrieved from eight different tombs, ranging from the Danibaan to Liobaa phases (**Figure 6.9**). In this section, as with the five graves, I briefly introduce each of the tombs, then describe the results of each analysis.

Figure 6.7: Map Highlighting the Tombs Locations Based on Martínez López et al. (2014, Fig. 1)

I followed the same approach for the ubiquity analysis and the taxonomic richness of botanical samples collected from tombs (**Table 6.7**). To examine the spread of each taxon across the eight tombs, I determined the percentage of graves in which a taxon occurred (*Taxon Presence: Tombs* [TPT]).

Table 6.7: Ubiquity analysis, tombs. TPT= Taxon Presence: Tombs. cf. results were considered as identified remains in the ubiquity level analysis. Note difference in numbers of samples (N) analyzed per tomb context.

////////////	T204 N=13	T212 N=2	T202 N=1	T213 N=6	T214 N=9	T196 N=1	T207 N=4	T208 N=7	TPT N=8
Arecaceae spp. Palms	2 (1)	1		1			1		50%
Asteraceae spp.	1								13%
Asteraceae/ Cucurbitaceae spp.	1				2				25%
Boraginaceae spp.	(2)	(1)		(1)			2		50%

///////////	T204 N=13	T212 N=2	T202 N=1	T213 N=6	T214 N=9	T196 N=1	T207 N=4	T208 N=7	TPT N=8
Calathea sp. Lerén				1					13%
Capsicum sp. Chile							1		13%
Cucurbita sp. Squash		1							13%
Cyperaceae spp.				2			(1)	1	38%
Cyperus sp. Sedge				(1)					13%
Fabaceae spp.	2			1	(1)		(2)		50%
Ipomoea batatas Sweet potato			1					2	25%
Manihot sp. Manioc genus	1								13%
Maranta sp. Arrowroot				(1)					13%
Marantaceae spp.	2 (1)	(1)			(1)		(1)		50%
Sagittaria sp. Arrowhead								(1)	13%
Zea mays Maize	4 (1)	1		1 (1)	1 (3)		4	2 (1)	75%
Fermentation	1 (1)				2				25%
Unknown phytoliths, starches, and tissues	2	1		2	1			1	63%

Maize is once again the dominant taxon found in formal tombs. As it was the case for simple graves, there are no other taxa common throughout the assemblages. A great variety of plants was found throughout the tombs, including traces of fermentation in two tombs, a type of food preparation that was not observed from simple grave samples.

Tomb 204

This tomb, dating to Danibaan and Pe, is located in the A3 Area, East of the North Platform. There, archaeologists encountered the incomplete remains of an individual placed in four different bone concentrations (Martínez López et al. 2014:125–150). The mortuary offering consisted of ten ceramic vessels placed in the tomb's chamber and seven others disposed in the antechamber. I examined 16 samples collected from this tomb and discuss 15 of them here (**Table 6.8**). The sample ME-37 is not mentioned in this chapter, as it provided information about an artifact associated with the tomb, rather than a mortuary offering (obsidian blade, associated object 9). Objects 1, 8, 9, 10, 11, 13, and 16 were found in the antechamber. Object 7 was recovered in a concentration of bones (concentration 3: lumbar vertebrae, right humerus, left shoulder blade, first ribs).

Table 6.8: Samples Examined from Tomb 204
cf.: potential; dam. st.: damaged starch grain

Origin of Sample	Study Sample Number	Tomb Sample Number	Summary of Taxa	Common Names
Hemispherical bowl, gray ware	ME-38	Objeto 1	cf. fermentation, Poaceae spp., dam. st.	Grass
Trimmed base of a conical bowl, gray ware	ME-36	Objeto 7	*Zea mays*, *Fabaceae* spp., Poaceae spp., dam. st.	Maize kernel (starch) and leaves (phytolith), beans family, grass

Origin of Sample	**Study Sample Number**	**Tomb Sample Number**	**Summary of Taxa**	**Common Names**
Collected inside Object 7	S-29	Objeto 7	*Zea mays*, Fabaceae spp., Arecaceae spp., Poaceae spp., dam. st.	Maize leaves and cobs (phytoliths), beans family, palms, grass
Incomplete hemispherical bowl, gray ware	ME-39	Objeto 8	Fabaceae spp., *Manihot* sp., cf. Boraginaceae spp., Poaceae spp.	Beans family, manioc genus, cf. borage family, grass
Incomplete and fragmented hemispherical bowl, gray ware	ME-34	Objeto 9	cf. *Zea mays*, dam. st.	cf. maize kernel (starch)
Fragmented large conical bowl, gray ware	ME-42	Objeto 10	Poaceae spp.	Grass
Incomplete and fragmented conical bowl, gray ware	ME-41	Objeto 11	Poaceae spp., dam. st.	Grass
Incomplete and fragmented tube, gray ware	ME-35	Objeto 13	Poaceae spp.	Grass
Conical bowl, gray ware	ME-40	Objeto 16	Fermentation, Poaceae spp., *Asteraceae/Cucurbitaceae* spp., dam. st.	Grass, potential squash family
Collected inside Object 16	S-30	Objeto 16	*Zea mays*, Poaceae spp.	Maize leaves and cobs (phytoliths), grass
Obsidian blade	ME-37	Objeto asociado 9	N/A	N/A
Collected close to the skull	S-12	NA	*Zea mays*, Marantaceae spp., Poaceae spp.	Maize cobs and leaves (phytoloths), arrowroot family, grass

Origin of Sample	**Study Sample Number**	**Tomb Sample Number**	**Summary of Taxa**	**Common Names**
Collected over the tomb floor (central part)	S-15	NA	cf. Arecaceae spp., cf. Boraginaceae spp., Poaceae spp.	cf. palms, cf. borage family, grass
Collected over the painted tomb floor	S-16	NA	*Zea mays*, Poaceae spp.	Maize leaves, cobs (phytoliths) and kernel (starch), grass
Collected near bones with paint	S-13	NA	Asteraceae spp., Marantaceae spp., Poaceae spp.	Sunflower family, arrowroot family, grass
Collected in the SW corner of the tomb	S-14	NA	Arecaceae spp., cf. Marantaceae spp., Poaceae spp.	Palms, cf. arrowroot family, grass

The botanical remains identified in the vessels are diverse: maize, beans family (Fabaceae spp.), manioc genus (*Manihot* sp.), potentially squash (*cf.* Cucurbitaceae spp.), and cf. Boraginaceae spp. Object 7 (conical bowl) contained remains of maize and species in the beans family in both the extraction from the artifacts and the sediment sample taken inside the vessel. This finding could support that the remains recovered from the extracted vessels did indeed correspond to its last use. The presence of maize remains near the skull and the painted floor could indicate that maize cobs were placed in the tomb as offerings. I identified one fermented starch grain in Object 16 and one other potentially fermented starch grain in Object 1, indicating that these two bowls likely contained alcoholic beverages or fermented *in situ*. These were identified based on damages identified during the experimental experiment realized by Wang et al. (2017). I was able to identify another starch grain from the conical bowl (Object 16) as coming from maize (**Figure 6.10)**, possibly hinting towards a fermented maize beverage or an alcoholic drink involving maize as one of its ingredients and potentially squash as another (Cucurbitaceae spp.).

Figure 6.8: Tomb 204. A-B) Conical bowl (Obj. 16); C) cf. Zea mays leaf phytolith; D) fermented starch grain

Overall, we find evidence of numerous plants available locally: maize, elements of the bean family (Fabaceae spp.), palms, remains from the manioc genus (*Manihot* sp.), grasses, plants from the borage family (Boraginaceae spp.), potentially squash (Cucurbitaceae spp.), as well as remains from the arrowroot (Marantaceae spp.) and sunflower (Asteraceae spp.) families. These plants were likely placed as food offerings, including fermented elements (Object 16 and perhaps Object 1). However, it is also possible that funerary participants interred vessels with the deceased that had been used prior to death. Regardless, this individual was placed in a tomb, associated with household leaders, with multiple vessels/culinary equipment.

Tomb 212

This tomb was used from the Nisa phase to Pitao (Martínez López et al. 2014:252–260). It is located in the W Area, East of the North Platform. In this tomb, archaeologists encountered concentrations of bones from at least three individuals: a woman 35–40 years old, a man 30–35 years old, and another adult. The mortuary offering consisted of a bone needle, four shell ornaments, and a lithic artifact of an unknown function (Martínez López et al. 2014:252). I focused my attention on sediment samples recovered from this tomb (**Table 6.9**).

Table 6.9: Samples Examined from Tomb 212
cf.: potential

Origin of Sample	Study Sample Number	Tomb Sample Number	Summary of Taxa	Common Names
Collected over tomb stucco	S-17	NA	*Zea mays*, *Cucurbita* sp., Arecaceae spp., Poaceae spp.	Maize leaves and cobs (phytoliths), squash, sunflower family, grass
Collected over Tomb Level 2	S-18	NA	cf. Marantaceae spp., cf. Boraginaceae spp., Poaceae spp.	cf. arrowroot family, cf. borage family, grass

The results obtained demonstrate that different botanical remains were placed in the tomb and that some of them were likely placed directly on its floor. Those plants include maize, squash (**Figure 6.11**), and palms, along with unknown remains from the Marantaceae and Boraginaceae families.

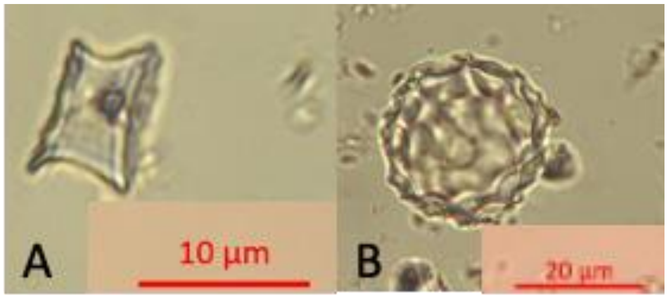


Figure 6.9: Samples recovered over stucco of Tomb 212. A) Zea mays cob phytolith; B) Cucurbita sp. phytolith

Overall, we find evidence of maize, squash, grass, remains from the sunflower family (Asteraceae spp.) and potential plants from the arrowroot (Marantaceae spp.) and borage (Boraginaceae spp.) families, plants that could be found locally. These plants, recovered from sediment samples, likely served as food offerings. These three individuals, likely household leaders since they were placed in a tomb, were accompanied with multiple vessels/culinary equipment.

Tomb 202

This tomb (Martínez López et al. 2014:112–117) is the first of three tombs dating to the Pitao phase examined in this study. It is located in the A3 sector, in close proximity to Tomb 204. In the chamber, archaeologists found the remains of an adult 40–45 years old. The mortuary offering consisted of three ceramic vessels, an obsidian blade, two bone artifacts, and a shell ornament (Martínez López et al. 2014:112–117). I examined one sample extracted from a ceramic vessel (**Table 6.10**). This vessel was found on the west wall of the tomb and contained two starch grains of sweet potato (**Figure 6.12**).

Table 6.10: Sample Examined from Tomb 202
dam. st.: damaged starch grain

Origin of Sample	Study Sample Number	Tomb Sample Number	Summary of Taxa	Common Names
Incomplete hemispherical bowl, grey ware	ME-19	Object 12	*Ipomoea batatas*, Poaceae spp., dam. st.	Sweet potato, grass

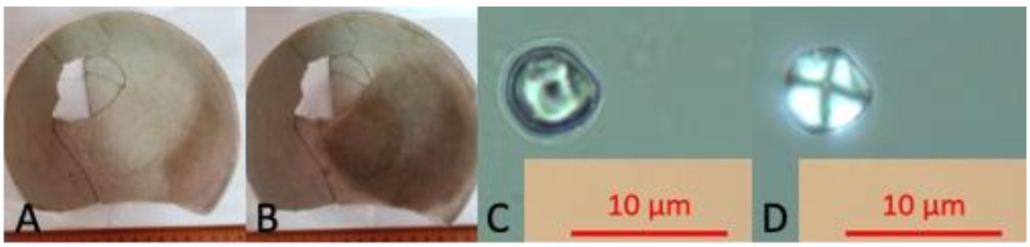


Figure 6.10: Tomb 202. A-B) Hemispherical bowl (Obj. 12); C-D) Ipomoea batatas starch grain

Overall, we find evidence of sweet potato, a plant that is not native of Oaxaca. The presence of sweet potato in this tomb likely suggests the presence of a food offering. However, it is also possible that funerary participants interred vessels with the deceased that had been used prior to death. Regardless, this individual, believed to be a leading household member, was buried with multiple vessels/culinary equipment.

Tomb 213

Tomb 213 (Martínez López et al. 2014:261–277) also dates to Pitao. It is located in the IV-North Sector, on the West side of the Main Plaza. It contained the remains of four incomplete individuals accompanied by an offering consisting of five ceramic vessels (**Table 6.11**). Object 1 was recovered in the NW corner of the tomb's chamber. Object 3 was found in the South niche of the tomb alongside Objects 4 and 5.

Table 6.11: Samples Examined from Tomb 213
cf.: potential; dam. st.: damaged starch grain

Origin of Sample	**Study Sample Number**	**Tomb Sample Number**	**Summary of Taxa**	**Common Names**
Conical bowl, gray ware	ME-28	Objeto 1	cf. *Zea mays*, cf. *Maranta* sp., Poaceae spp.	cf. maize leaves (phytoliths), cf. arrowroot, grass
Hemispherical bowl, gray ware	ME-29	Objeto 3	cf. *Cyperus* sp., Poaceae spp., dam. st.	cf. sedge, grass
Tripod conical bowl, gray ware	ME-31	Objeto 4	cf. Fabaceae spp., Poaceae spp., dam. st.	cf. beans family, grass
Conical bowl, gray ware	ME-30	Objeto 5	*Zea mays*, Poaceae spp., dam. st.	Maize kernel (starch), grass
Collected in the tomb's access	S-33	NA	Arecaceae app., *Calathea* sp., Cyperaceae spp., Poaceae spp.	Palms, lerén, sedge family, grass
Collected in the niche	S-34	NA	Cyperaceae spp., cf. Boraginaceae spp., Poaceae spp.	Sedge family, cf. borage family, grass

The vessels found in this tomb contained different edible plants: maize, arrowroot or another tuber (cf. *Maranta* sp.), potentially sedge (cf. *Cyperus* sp.), palms, elements of the borage family (Boraginaceae spp.), and remains potentially from the bean family (cf. *Fabaceae* spp.) (**Figure 6.13**). The presence of lerén (*Calathea* sp.) in the tomb's access might indicate that botanical offerings were placed near the entry. More samples collected in tomb entry areas would be needed to better understand this practice at Monte Albán.

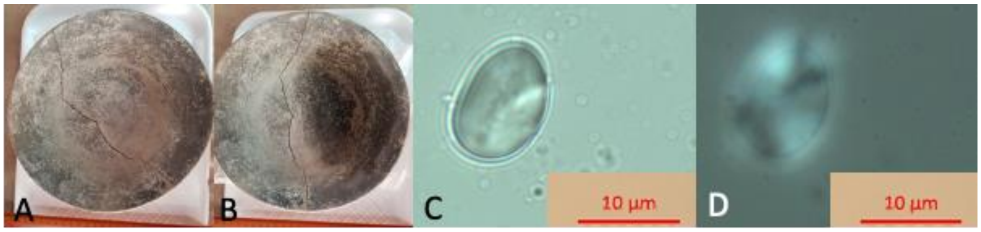


Figure 6.11: Tomb 213. A-B) Tripod bowl (Obj. 4); C-D) cf. Fabaceae spp. starch grain

Overall, we find evidence of maize and lerén and potential remains of arrowroot, sedge, and the bean family. Lerén is an imported plant, while the others could be found locally. The presence of these plants likely come from food offerings. However, it is also possible that funerary participants interred vessels with the deceased that had been used prior to death. These four individuals, likely household leaders, were buried with multiple vessels/culinary equipment.

Tomb 214

Tomb 214 (Martínez López et al. 2014:278–300) is the final interment dating to the Pitao phase featuring in this study. It is located North-East of the North Platform. It is a multiple interment that contained incomplete remains of at least 12 adults spread on four different levels (**Table 6.12**). The mortuary offering consisted of 23 ceramic vessels. Fragments of Objects 4, 21, and 23 were found in three different levels and I was unable to determine the exact provenience of the sherds I examined. Objects 8 and 10 were found at the centre of the tomb and Object 9 was placed near the door. Object 16 was recovered along the south wall.

Table 6.12: Samples Examined from Tomb 214
cf.: potential; dam. st.: damaged starch grain

Origin of Sample	**Study Sample Number**	**Tomb Sample Number**	**Level**	**Summary of Taxa**	**Common Names**
Half of a conical bowl, gray ware	ME-27	Objeto 4	1–3	Fermentation, Poaceae spp., dam. st.	Grass
Conical bowl, gray ware	ME-24	Objeto 8	3	*Zea mays*, dam. st.	Maize kernel (starch)
Incomplete and fragmented conical bowl, café ware	ME-23	Objeto 9	2	*Asteraceae/Cucurbitaceae* spp., Poaceae spp., dam. st.	Potential squash family, grass
Fragmented pot, gray ware	ME-20	Objeto 15	3	Fermentation, Poaceae spp., dam. st.	Grass
Incomplete and fragmented hemispherical bowl, gray ware	ME-25	Objeto 16	3	cf. *Zea mays*, Poaceae spp., dam. st.	cf. maize leaves (phytoliths), grass
Fragmented tripod conical bowl, gray ware	ME-22	Objeto 21	2–3	*Asteraceae/Cucurbitaceae* spp., cf. *Zea mays*, Poaceae spp., dam. st.	Potential squash family, cf. maize leaves (phytoliths), grass
Incomplete and fragmented hemispherical bowl, crema ware	ME-26	Objeto 23	2–3	No remains	
Fragmented conical bowl, gray ware	ME-21	Objeto 27	Filling	Dam. st.	
Collected under the bones, near bedrock	S-19	NA	4	cf. *Zea mays*, cf. Fabaceae spp., cf. Marantaceae spp., Poaceae spp.	cf. maize leaves (phytoliths), cf. beans family, cf. arrowroot family, grass

I identified the potential presence of maize, plants from the bean family (cf. *Fabaceae* spp.) and of the arrowroot family (*Marantaceae* spp.) under the bones, which might indicate that botanical remains were placed under the deceased. I was able to identify the presence of maize or potential remains from this plant in three vessels and remains that might have been produced by squash (cf. Cucurbitaceae spp.). The majority (7/8) vessels contained damaged starches, potentially indicating they contained botanical elements. I was unable to find any remains from Object 23 and only recovered damaged starch grains from Object 27. Objects 4 (conical bowl) and 15 (pot) contained fermented starches, potentially informing us of the presence of alcoholic beverages in this tomb or other fermented foods (**Figure 6.14**). Unfortunately, it is not possible to determine the fermented ingredients. Based on the low recovery of botanical remains, it is possible that some of these vessels (Objects 23 and 27) might have contained other products such as meat or fish, with plants being either absent or in small quantity. It is also possible that these vessels contained botanical elements that were washed away in the laboratory before this analysis.

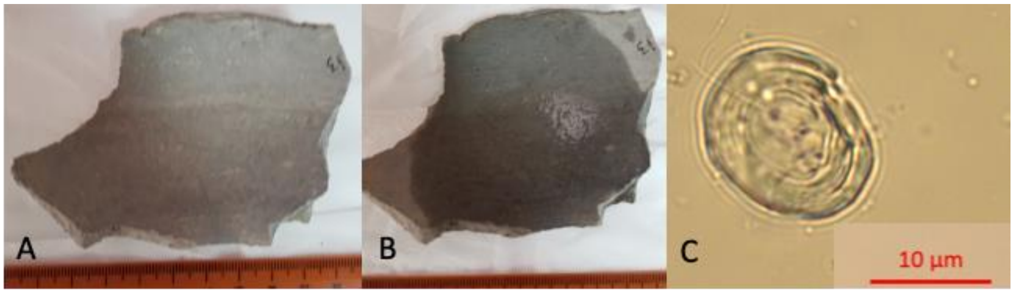


Figure 6.12: Tomb 214. A-B) Pot (Obj. 15); C) fermented starch grain

Overall, we find evidence of maize, grass, elements of the arrowroot family (Marantaceae spp.), and potential remains from the squash family (*Cucurbitaceae* spp.), plants that could be found locally. These plants were likely placed as food offerings and the presence of fermented starch grains in two vessels (Objects 4 and 15) might suggest alcohol was also used as an offering. However, it is also possible that funerary participants interred vessels with the deceased that had been used prior to death. Regardless, the numerous individuals placed in this tomb and believed to have been household leaders were accompanied by multiple vessels/culinary equipment.

Tomb 196

Tomb 196 dates to the Peche phase (Martínez López et al. 2014:38–53). It is located in the W sector, near Tomb 212. Archaeologists recovered the remains of five adults and two offerings in this multiple interment: an incomplete obsidian ornament and a fragmented worked bone. The lithic ornament (**Figure 6.15**) was found near the roof of the tomb (**Table 6.13**). The remains recovered from the microbotanical extraction highlighted the presence of grass and damaged starch grains, indicating that this ornament might also have been used as a tool to process grass and potentially other plants. I argue that this change of function might have happened after the ornament was broken. While it might not have been used anymore as an ornament due to aesthetic reasons, it still offered a sharp edge ideal for food preparation. The data obtained from this tomb does not inform us directly about the botanical offerings that might have been placed to accompany the deceased.

Table 6.13: Sample Examined from Tomb 196
dam. st.: damaged starch grain

Origin of Sample	Study Sample Number	Tomb Sample Number	Summary of Taxa	Common Names
Small obsidian ornament	ME-18	Object 1	Poaceae spp., dam. st.	Grass

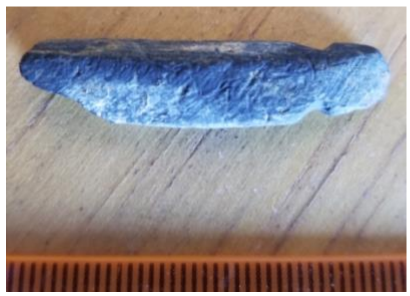


Figure 6.13: Lithic ornament, Tomb 196

Tomb 207

Tomb 207 was used during both the Peche and the Xoo phases (Martínez López et al. 2014:172–188). It is located on the Southern section of the Main Plaza. It contained the remains of four adults. The mortuary offering was split in two different concentrations of objects: one that starts in the tomb's access and continues in the chamber's entry (one effigy vessel, five ceramic vessels, worked bones and shells) and a second one found in the NW niche of the tomb (12 ceramic vessels). The two artifacts examined from this tomb came from the first group of objects and the two sediment samples were collected in the niche (**Table 6.14**). Object 1 was found in the access to the tomb and is an effigy vessel representing two individuals holding corn cobs (**Figures 6.16, 6.17**). The second vessel, a reddish sandstone shallow carved bowl, was found in the tomb's chamber.

Table 6.14: Samples Examined from Tomb 207
cf.: potential; dam. st.: damaged starch grain

Origin of Sample	Study Sample Number	Tomb Sample Number	Summary of Taxa	Common Names
Effigy vessel	ME-33	Objeto 1	*Zea mays*, Poaceae spp., dam. st.	Maize leaves, cobs (phytoliths) and kernel (starch), grass
Reddish sandstone shallow carved bowl	ME-32	Objeto 14	*Zea mays*, *Capsicum* sp., cf. Fabaceae spp., cf. Marantaceae spp., Poaceae spp.	Maize kernel (starch), chile pepper, cf. beans family, cf. arrowroot family, grass
Collected inside Object 1 (Bowl)	S-32	Objeto 1 (Niche)	*Zea mays*, Boragniaceae spp., cf. Marantaceae spp., Poaceae spp.	Maize leaves and cobs (phytoliths), borage family, cf. arrowroot family, grass
Collected inside Object 2 (Incense burner)	S-31	Objeto 2 (Niche)	*Zea mays*, Arecaceae spp., Boraginaceae spp., cf. Fabaceae spp., Poaceae spp., dam. st.	Maize leaves and cobs (phytoliths), palms, borage family, cf. beans family, grass

Figure 6.14: Tomb 207. A-B) Effigy vessel (Obj. 1); C) drawings (Martínez López et al. 2014, Figure 105.1)

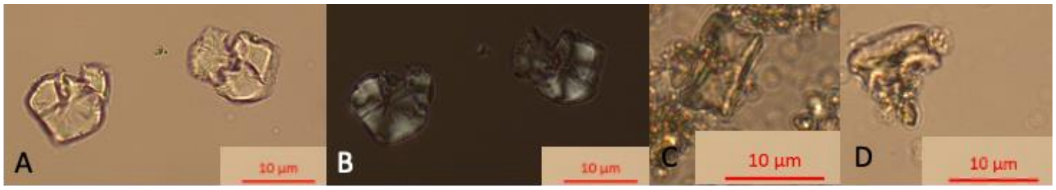


Figure 6.15: Microbotanical remains from the effigy vessel A-B) Zea mays starches; C) Zea mays cob phytoliths

The incense burner in the niche seems to have been used to burn a mixture composed of maize, palms, potentially beans (cf. *Fabaceae* spp.) and possibly cordia (*Boraginaceae* spp.). The shallow carved bowl seems to have been used to prepare different foods, including maize, chile pepper, potentially beans (cf. *Fabaceae* spp.) and possibly lerén or arrowroot (cf. *Marantaceae* spp.). It is possible that this lithic artifact, having processed some of the plants placed in funerary vessels, was placed alongside them as a mortuary offering.

Overall, we find evidence of maize, chile pepper, grass, palms, remains from the borage family (Boraginaceae spp.), and potential elements coming from the bean family (cf. Fabaceae spp.) and the arrowroot family (cf. Asteraceae spp.). These plants could all be found locally and were likely placed as food offerings. However, it is also possible that funerary participants interred vessels with the deceased that had been used prior to death. Regardless these four individuals, likely household leaders, were accompanied by multiple vessels/culinary equipment.

Tomb 208

The last multiple tomb was used during the Pitao phase and reused during Liobaa (Martínez López et al. 2014:189–218). It is located on the West sector of the Main Plaza, close to Tomb 213, in the PNLP Sector. All the artifacts analyzed in this study date from the Liobaa phase. Archaeologists encountered the remains of eight adults and one sub-adult (15–20 years old). The mortuary offering consists of multiple artifacts (ceramic vessels [50], lithic [9], and shell [27]) (**Table 6.15**). Object 5 was found near steps in the tomb's access. All the other objects were recovered from the tomb's chamber, but their exact location is unknown.

Table 6.15: Samples Examined from Tomb 208
cf.: potential; dam. st.: damaged starch grain

Origin of Sample	Study Sample Number	Tomb Sample Number	Summary of Taxa	Common Names
Miniature hemispherical bowl, café ware	ME-44	Objeto 5	Dam. st.	
Miniature hemispherical bowl, café ware	ME-47	Objeto 23	*Zea mays*, dam. st.	Maize kernel (starch)
Miniature pot, café ware	ME-45	Objeto 26	*Ipomoea batatas*, cf. *Zea mays*, cf. *Sagittaria* sp., dam. st.	Sweet potato, cf. maize leaves (phytoliths), cf. arrowhead
Ceramic tray, gray ware	ME-48	Objeto 31	Poaceae spp., dam. st.	Grass
Miniature pot, café ware	ME-46	Objeto 32	Poaceae spp.	Grass
Hemispherical bowl, gray ware	ME-49	Objeto 36	Cyperaceae spp., Poaceae spp., dam. st.	Sedge family, grass
Composite silhouette bowl	ME-50	Objeto 38	*Ipomoea batatas*, *Zea mays*, dam. st.	Sweet potato, maize kernel (starch)

Starches of sweet potato were recovered in two vessels, alongside maize (**Figure 6.18**) and potentially arrowhead (cf. *Sagittaria* sp.), the aquatic plant producing an edible tuber. Damaged starch grains were recovered in six of the seven vessels, supporting the idea that they contained plants.

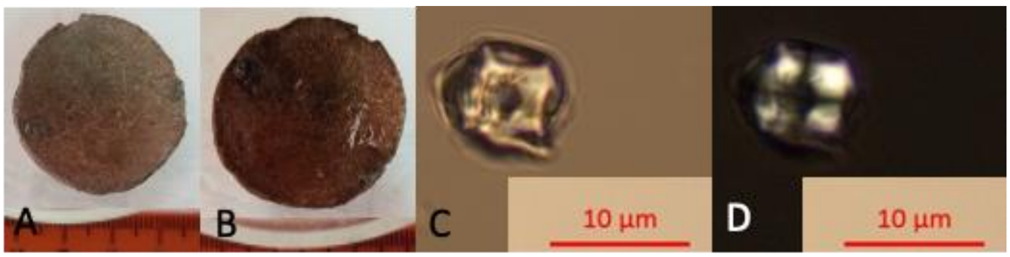


Figure 6.16: Tomb 208. A-B) Miniature bowl (Obj. 23); C-D) Zea mays starch

Overall, we find evidence of maize and a plant from the sedge family, plants that could be found locally. In addition to these, I identified sweet potato in two vessels and a potential starch produced by arrowhead, plants that could not grow in the immediate vicinity of Monte Albán. Arrowhead has been identified in one other context, Grave 1994-69, and this plant was accompanied there as well by sweet potato, possibly informing us about ancient ingredient combinations in mortuary offerings. However, it is also possible that funerary participants interred vessels with the deceased that had been used prior to death. Regardless, the numerous individuals were placed in this tomb with multiple vessels and implements.

Plant Offerings in Relation to Social Status

As discussed in **Chapter 3**, at Monte Albán a key social and political *conjoncture* was the emergence and deepening of social inequalities, beginning during the Nisa period and continuing throughout the occupation of the site. Archaeologically, this trajectory is seen through the increasingly complex architecture of rulers' houses as well as the increasing presence of exotic and elaborate artifacts in their domestic areas. Through numerous mechanisms, such as the appropriation of the Main Plaza by its rulers, nobles were able to create a distinction between themselves and non-nobles. However, less information exists regarding the social distinctions that existed within these noble households.

To address such distinctions, I compared the use of plants as private mortuary offerings in formal tombs and simple graves found on the Main Plaza. To make this comparison effective, I used two exploratory statistical tools: ubiquity analysis (Dickau et al. 2012; Morell-Hart 2019) and taxonomic richness (see Lennstrom and Hastorf 1992; Morell-Hart 2019). Ubiquity analysis allows us to identify the level of rarity or commonness of each taxon, based on its frequency across an assemblage. I used the ubiquity analysis to determine common and unusual plants in the botanical assemblages. Rarer plants are often considered has having a high economic value, thus explaining why a limited amount of people could afford them. I expected to find common plants shared in both mortuary settings (like maize) and the presence of rarer botanical elements in tombs (such as manioc) (see **Chapter 5** for more details). Taxonomic richness allows paleoethnobotanists to determine how the number of taxa found per sample varies from an averaged number of taxa. I expected to encounter higher taxonomic richness in tombs (see **Chapter 5** for more details).

Since the same plant can produce multiple phytoliths and starch grains, I focused on the presence and absence of the taxa from each sample instead of the raw number of remains recovered for each taxon. I also combined results where two samples were extracted from the same artifact (e.g., one microbotanical extraction sonicated from a ceramic vessel and a sediment sample taken inside of it). I added "fermentation" in the list of taxa, although it is a plant processing technique rather than a botanical species. This allowed me to examine the use of this rare processing technique at Monte Albán (only seen in two formal tombs). Since my objective was to examine plants voluntarily placed as offerings, I decided to set aside the grass phytoliths (Poaceae spp.) in measures of the ubiquity and taxonomic richness. I made this decision because of their widespread presence in samples. While these plants might have been used as mortuary offerings, such as clothes, wrapping, or mortuary mats (*petates*), it is also possible the presence of these species is due to ambient local vegetation. Without macrobotanical data or other lines of evidence, it is unfortunately impossible to determine the exact nature of the grass phytoliths found in this study.

Ubiquity Analysis and Taxonomic Richness in Simple Graves

As expected, maize is the most prevalent plant: it was found in four of the five graves and in 50% of all the samples examined. Maize was absent from Grave 1993-19, but this absence could be explained by the fact that I examined only one ceramic vessel from this context. It is therefore likely, based on the strong presence of maize in the other contexts, that maize might have been placed as an offering in this grave as well. At the very least, maize was fairly common across the site, whether associated specifically with food offerings or uselives of vessels. This demonstrates the importance of maize in the Zapotec mortuary tradition, over the *longue durée*. While new plants made their way into daily practices of Monte Albán's inhabitants, as a result of intersecting *conjonctures*, maize remained imbued with an important role in daily subsistence, and in rituals such as mortuary offerings.

Maize seems to be the only taxon regularly recovered from mortuary offerings in simple graves. Remains from the arrowroot family (*Marantaceae* spp.) might have been recovered from three different graves, but they are difficult to consider common, since all the remains were tentatively identified (cf.). While frequently identified in Mesoamerica and Oaxaca (see **Chapter 5**), chile pepper, squash, sweet potato, and beans were found in a very limited quantity. These results might indicate that botanical mortuary offerings placed in tombs generally consisted of maize, accompanied by other elements without following a clear pattern.

This hypothesis is also supported by the taxonomic richness obtained from graves (**Table 6.16**). Taxonomic richness consists of measuring the number of taxa present in each context. It is worth nothing once again that the vessels examined were washed before the microbotanical extraction. It is possible that those vessels did initially contain more botanical remains that were unfortunately removed when washed in the laboratory.

Table 6.16: Taxonomic richness from graves. Note differences in number of samples (N) obtained from each context.

Grave	Taxonomic richness
Grave 1994-62 (N=6)	4
Grave 1994-61 (N=5)	7
Grave 1993-17 (N=3)	3
Grave1993-19 (N=1)	0
Grave 1994-69 (N=5)	9
Average Grave Taxonomic Richness (N=20)	4.6

Grave 1994-69 and Grave 1994-61 show a higher level of taxonomic richness (9 taxa and 7 taxa, respectively) than the average, and higher than the other graves (0–4 taxa). While it is difficult to determine what might explain this difference, Grave 1994-69, dates to the Peche-Xoo period (see **Chapter 8**), and is the only grave examined where the skull of the individual was missing. The removal of bones from mortuary contexts, including cranial bones, has been reported elsewhere in Oaxaca (see Feinman et al. 2010; Lind and Urcid 2010; Markens and Martínez López in press; McCafferty and McCafferty 2015; Rivera Gúzman 2014; Urcid 2005). The elevated plant taxonomic richness, combined with the removal of the skull of the deceased individual, might indicate a different mortuary tradition that could have been accompanied by more botanical elements.

Grave 1994-61, also exhibiting higher taxonomic richness, contained the remains of a 3-months old infant (Martínez López et al. 1995:204–208). I suggest that infants and perhaps children might have been buried with more plants to accompany them, perhaps to feed them as they would not have been able to gather food on their own at that age. This interpretation is somewhat similar to one by Gumerman IV (1994:409–410) who suggested that the Moche placed primarily domesticated species in mortuary assemblages as these plants might not have existed in the afterlife (see **Chapter 2**). This hypothesis would need to be confirmed by the study of botanical remains from other infant burials, a context that has been recovered rarely at Monte Albán (see Martínez López et al. 1995).

Ubiquity Analysis and Taxonomic Richness in Tombs

In tombs, maize is once again a common taxon (44% of all samples). These results demonstrate that maize played an important role in mortuary rituals, regardless of the social status of the deceased. However, maize was absent from two of the eight tombs: T196 and T202. As was the case for Grave 1993-19, only one sample was examined from each of these interments. While this study did not demonstrate the presence of maize in these contexts, it is likely, based on the frequency of this plant overall, that maize was also present in these two tombs, but is underrepresented in the single sample for each location. Remains of plants from the palm family (Arecaceae spp.), borage family (Boraginaceae spp.), bean family (Fabaceae spp.), and arrowroot family (Marantaceae spp.) were identified in at least half of these tombs, making these taxa more common than other food plants such as chile peppers, squash, sweet potato, and manioc.

On average, I identified 5 taxa per tomb context (**Table 6.17**). Three of the eight tombs showed a higher taxonomic richness than the average: T204, T213, and T207 (9 taxa, 9 taxa, and 7 taxa, respectively). Here as well, the higher richness might be explained by the period of use of these tombs, something discussed in **Chapter 8**. T204 dates to Danibaan-Pe, T213 to Pitao, and T207 to Peche-Xoo.

Table 6.17: Taxonomic richness in formal tombs. Note differences in numbers of samples (N) obtained from each context.

Tomb	Taxonomic Richness
T204 (N=13)	8
T212 (N=2)	6
T202 (N=1)	1
T213 (N=6)	9
T214 (N=9)	4
T196 (N=1)	0
T207 (N=4)	7
T208 (N=7)	5
Average Taxonomic Richness in Tombs (N=43)	5

Comparing Tombs and Graves

A total of 12 different taxa were identified in simple graves and a total of 15 different taxa were found in tombs (*Asteraceae/Cucurbitaceae* spp. and fermentation not included here). This difference might be due to the different sample sizes (20 from burials vs. 43 from tombs), or it might indicate that the botanical assemblages placed in tombs were drawn from a wider array of options. The average number of taxa recovered from each type of interment is almost identical: 4.6 on average for grave contexts vs. 5 on average for tomb contexts.

Monte Albán's history was marked by increased inequalities between commoners and rulers in the political and social realms. The results obtained here suggest that in purely elite contexts, these *conjonctures* might not have affected the practices surrounding the use of plants in mortuary practices, as a marker of difference between heads of households and other members of elite families.

I expected to encounter the opposite results, with a higher degree of richness in tombs based on the higher social status of the deceased within the household. Instead, similarities in the taxonomic richness might demonstrate that the use of plants was relatively similar between simple graves and formal tombs, with only a few taxa unique to each mortuary context. This may indicate that botanical practices in mortuary contexts on the Main Plaza might not have served to highlight the social status of the deceased, or that social difference was instead more marked between elites and non-elites instead of between members of households. The living might have perceived all ancestors as important entities that could influence political and social *conjonctures*, thus warranting similar numbers of plants offered to all the deceased.

The ubiquity levels of particular taxa, however, did vary between graves and tombs (**Table 6.18**). In graves, I encountered chile peppers and squash at a higher frequency. Beans and remains of the pepperleaf family (Piperaceae spp.) were only recovered from simple graves. In formal tombs, I identified numerous plants absent from graves: lerén, sedge, manioc genus (*Manihot* sp.), and fermented starch grains. Were these differences based on differential access to plants? It is difficult to assess since none of these plants are very common. For graves, only a few plants other than maize were present in up to 15% of the samples, with similar patterns for some taxa in 14% of the tombs. Because there is no recurrent pattern of plant uses in these mortuary contexts, I suggest that differences in plant taxa offered in funerary settings may be attributed to personal preferences of the deceased and the ones taking part in the mortuary rituals. The deceased placed in Tomb 204 might have craved manioc (*Manihot* sp.), while the people burying the infant found in Grave 1994-61 might have thought that maize kernels and squash were perhaps better suited for an infant. It is also possible these findings relate to the availability of preferred plants at the time of the death of the interred individuals, or the reuse of utilized vessels in mortuary contexts.

Table 6.18: Combined ubiquity analysis for graves and tombs. Note differences in number of contexts analyzed for each grave type (N).

////////////	Taxon ubiquity across graves (N=5)	Taxon ubiquity across tombs (N=8)
Arecaceae spp. Palms	40%	50%
Asteraceae spp.	20%	13%
Asteraceae/ Cucurbitaceae spp.		25%
Boraginaceae spp.	40%	50%
Calathea sp. Lerén		13%
Capsicum sp. Chile	40%	13%
Cucurbita sp. Squash	20%	13%
Cyperaceae spp.	20%	38%
Cyperus sp. Sedge		13%
Fabaceae spp.		50%
Ipomoea batatas Sweet potato	20%	25%

////////////	Taxon ubiquity across graves (N=5)	Taxon ubiquity across tombs (N=8)
Manihot sp. Manioc genus		13%
Maranta sp. Arrowroot		13%
Marantaceae spp.	60%	50%
Phaeolus sp. Beans	20%	
Piperaceae spp.	20%	
Sagittaria sp. Arrowhead	20%	13%
Zea mays Maize	80%	75%
Fermentation		25%
Unknown phytoliths, starches, and tissues	60%	63%

Botanical Offerings and Social Status: Final Observations

The results obtained in this study allowed me to make certain key observations. First, maize seems to have been the most important plant used as mortuary offering. It was highly ubiquitous, found in most of the tombs and burials, and its absence from a few burials could be due to the limited number of samples coming from them. The repetitive use of maize in burials right from the start of Monte Albán's history (Danibaan-Pe) seems to have followed an established tradition that still persists today (see Rojas 2016). The symbolic value attributed to maize might have put some pressure on grieving members of the households, who felt a mortuary offering would not be complete without maize, which left residues from cobs, leaves, and/or kernels. The repetition of this tradition in each mortuary ceremony slightly strengthened this practice, a practice that continued up to the abandonment of Monte Albán. This demonstrates that certain elements of ritual practices remained important over the *longue durée*, throughout the history of the city, regardless of the medium-term phenomena that unfolded.

Second, there do not seem to be recurrent patterns regarding the use of plants (except for maize). Throughout the site, people used numerous plants as mortuary offerings: maize, beans, squash, sweet potato, and potentially other plants such as manioc (*Manihot* sp.), and arrowroot (cf. *Maranta* sp.). I identified remains of arrowhead (*Sagittaria* sp.) from two mortuary contexts (Grave 1994-69 and potentially Tomb 208), a plant I had not initially expected to encounter, as it is an aquatic plant and not found in the immediate environs of Monte Albán. In each tomb or grave, the deceased were accompanied by various plants, with no strong patterns apart from those of maize. For example, chile pepper was found in 40% of the graves and 13% of the tombs, while squash remains were identified in 20% of the graves and 13% of the tombs. I suggest that the mortuary offering diversity might be explained by personal preferences and/or the availability of certain preferred foods at the time of death. The grieving members of the household might have thought that the best way to create a bridge with the newly deceased ancestor would be to offer them their favourite foods. As it was the case for maize, it is possible that cooking the deceased's favourite meals might have become a tradition, thus explaining the absence of clear differences between tombs and burials. It is also possible that results are muddied by the reuse of vessels in mortuary contexts.

In **Chapter 8**, I examine how uses of plants might have changed through time, following the arrival of new foods through creation of new trade networks with neighbouring regions.

Third, the presence of fermentation from two tombs (204 and 214) and its absence from simple graves could indicate that this food preparation technique might have been reserved for special ancestors only. In Tomb 204, one of the vessels containing fermented starches also contained maize and perhaps squash (cf. *Cucurbitaceae* spp.). While these results are limited and might be challenged by future analyses, I still suggest that alcoholic beverages could have been a rare mortuary offering at Monte Albán. Fermented beverages might have been reserved exclusively for people buried in tombs or by the people taking part in the mortuary ritual, thus perpetuating differences in social status in the afterlife through plants.

I argue here that plants placed as mortuary offerings might not have served to replicate the social status of the deceased, differentiating between the highest level of elites and lesser elites. It is possible that plants might have served to establish a bridge with the deceased, through the selection of their favourite foods, as is documented in contemporary *Día de los Muertos* ceremonies. Whether simple or elaborate dishes, it may be that these offerings allowed one last opportunity to share a meal with the dead; one last time to socialize with loved ones or powerful members of the household through food. What better way to create this new alliance with the ancestors than providing them with the foods they enjoyed the most?

Other elements of the burials, such as the architecture and other mortuary offerings (greenstone, shells, ceramic vessels, etc.) might have allowed celebrants to replicate social standings in the afterlife. It would be interesting to examine the place of meat in these offerings, considering data obtained by González Licón (2003) that showed that the people placed in formal tombs ate more meat than those placed in simple graves (see **Chapter 3**). In this study, however, apart from the potential alcoholic beverages, I was not able to identify plants solely associated with a specific type of burial.

At Monte Albán, elite residents were buried in simple graves and in formal tombs (e.g., Joyce 2004; Markens and Martínez López in press; Martínez López et al. 1995, 2014; Winter 1974), already highlighting social differences. Formal tombs could be revisited (Feinman et al. 2010; Joyce 2010; Lind and Urcid 2010; Markens and Martínez López in press) and they generally contained more offerings (González Licón 2003), suggesting that they were reserved for household leaders. González Licón (2003) has identified a continuous increase in social differences between those buried in simple graves and in formal tombs that started during the Nisa and continued until the Xoo phase. Those placed in formal tombs ate an increasing amount of meat, while those buried in simple graves ate increasingly less through time. In his study, we see how the foods consumed played a role in reinforcing status differences in the living world, in relation to larger phenomena taking place at Monte Albán. However, I found no marked differences between plant assemblages in formal tombs and simple graves, indicating that social distinction in funerary practices was not expressed through offerings of plants over the short-term or the long-term. This indicates that mid-term phenomena such as economic, social, and political shifts had no great effect on plant practices in elite funerary contexts.

Having examined the use of plants in private mortuary contexts, I next compare these botanical assemblages to those associated with relatively public rituals. This comparison is the focus of the next chapter, allowing me to highlight the connection between private and relatively public rituals at Monte Albán. In the final discussion chapter, I address in detail how the selection of botanical remains in different contexts can be connected to larger *conjonctures* taking place at Monte Albán (**Chapter 8**).

7. Private and Relatively Public Rituals at Monte Albán

In the previous chapter, I examined the plants used in private mortuary rituals, comparing simple graves and formal tombs. In this chapter, I focus on my third objective: comparing plants recovered from contexts associated with relatively public rituals to those recovered from private mortuary rituals. I examine similarities and distinctions between ceremonies for the ancestors and ceremonies targeting a larger audience composed of spirits, deities, and other entities. This chapter will focus mainly on Grave 1993-43, highlighting the impact of the Teotihuacan cultural influence that took place during the Tani-Pitao phase.

In private mortuary rituals, maize was the only common taxon to be identified across formal tombs and simple graves. The combinations of plants recovered in private mortuary rituals varied greatly between interments, without a clear pattern. I suggested that the absence of homogenous mortuary botanical assemblages might be due to personal preferences of the deceased and/or the people taking part in mortuary practices, as well as the availability of plants at the time of the death of the interred individuals. In contrast, before analyzing samples from relatively public rituals, I expected to identify a fair level of homogeneity between botanical assemblages, highlighting a perpetuation of traditions and perhaps the continuation of a shared identity supported by the spiritual realm (see **Chapter 1**). These expectations were set up by studies demonstrating the increasing role of elite members as ritual specialists, as they used the spiritual realm to cement their political position at the local and regional levels (Joyce 2020b:339; Marcus and Flannery 1996:14). Elite members of Monte Albán might have attempted to connect these private rituals with powerful deceased ancestors as well, by continuing past traditions in public rituals. By replicating the rituals that existed during the Nisa phase, a period marked by the rise to power of the elite, the rulers of the following periods might have increasingly needed to legitimize their authority, an authority that became increasingly challenged over time.

I examined 20 sediment samples potentially informing us about the use of plants in relatively public rituals. I was not able to gain access to artifacts recovered from these same contexts as they were not available during my fieldwork, therefore I could not examine microbotanical extractions from culinary implements and vessels. This limited some of the plants that could be identified, as some plants (such as sweet potato) a) produce diagnostic starch grains that are mainly absent from the sediment samples examined, and b) do not produce diagnostic phytoliths, the main type of remains identified in the sediment samples.

Five of these sediment samples came from Grave 1993-43, a grave likely associated with a relatively public ritual. As I did not consider this grave to be a private mortuary setting, like other mortuary contexts explored in **Chapter 6,** it is examined for the first time in this chapter. An additional six sediment samples came from relatively public offerings placed in the South Platform of Monte Albán’s Main Plaza. I also examined nine sediment samples retrieved from floors and other architectural features from Mound III (South Platform), the Sacred Axis (between the South Platform and East Patio), the Altar (East Patio), the W1 Area (North Platform), the VG Patio (North Platform), and the North Mound (North Platform) that could have been associated with relatively public rituals. These samples were likely associated with relatively public rituals, as they were categorized as "Temples and Non-Residential Structures" by the late Margaret Houston in the samples catalogue that she completed during the PEMA. However, I was not able to tie the results from these nine samples to relatively public rituals for various reasons listed later in this chapter, such as mislabeled items and the complicated nature of these samples.

Two types of contexts offered concrete paleoethnobotanical evidence related to relatively public rituals: Grave 1993-43 (five samples) and three public offering boxes (seven samples). **Table 7.1** lists the taxa present within each of the contexts examined here. I examined the percentage of offering boxes in which a taxon occurred to better understand their distribution throughout the site (labelled as *Taxon Presence: Offering Boxes* or TPOB). As with private funerary contexts, maize dominated the relatively public ritual assemblages. As was the case with private burials, no other plant was present across the different contexts, thus challenging my initial hypotheses that numerous plants would be featured in relatively public rituals. This chapter also highlights the unique nature of mass Grave 1993-43 and demonstrates how it differed from the private mortuary contexts examined in the previous chapter.

Table 7.1: Ubiquity analysis, relatively public rituals.
TPOB = Taxon Presence: Offering Boxes.cf. results were considered as identified remains in the ubiquity level analysis.

Taxon	Grave 1993-43 (N=5)	Offering Box Element 2 (N=1)	Offering Box Element 4 (N=4)	Offering Box Element 5 (N=2)	TPOB (N=7)
Acrocomia sp. Coyol	(1)				
Arecaceae spp.	3				
Capsicum sp. Chile pepper	(1)	(1)			33%
Cucurbita sp. Squash	1				
Cyperaceae spp.				1	33%
Cyperus sp. Sedge	1				
Fabaceae spp.	1 (1)				
Marantaceae spp.			(3)		33%
Zea mays Maize	5	1	(1)		67%
Unknown phytoliths and starches	4		1		33%

Grave 1993-43

Grave 1993-43 dates to the Pitao phase (Martínez López et al. 1995:151–175), a time period marked by the strong influence of the Teotihuacan culture on the religious and economic spheres. This burial is located on the North Mound, at the core of the North Platform (Martínez López et al. 1995:151). This was likely a restricted area that could not be accessed by commoners, though would have allowed access for a greater number of individuals than a simple grave or a formal tomb. In this multiple burial, archaeologists found the skulls of 18 children and some adult bones, including humeri, femurs, tibias, clavicles, and fibulae (Martínez López et al. 1995:151). The skulls "are probably Zapotec" but this interment differs from the traditional graves found at Monte Albán (formal tombs or simple graves) (Winter 1998:167). The critical differences of note are the rarity of children burials at Monte Albán and the absence of any other burial containing multiple children's skulls (Winter 2015:165). The human remains were accompanied by a large ceramic vessel and "fragments of a Teotihuacan-style mosaic object" (Winter 2002:77).

It is important to note that mosaic fragments of this type are quite uncommon at Monte Albán (Winter 1998:167). Winter (1998, 2002) and Martínez López et al. (1995) make the connection between this grave and another at the Central Mexican site of Teotihuacan, where the remains of 18 children, believed to have potentially been sacrificed, were found under an altar (Jarquín Pacheco and Martínez Vargas 1991; López Austin et al. 1991). Jarquín Pacheco and Martínez Vargas (1991) explain the presence of the remains of 18 children in the Teotihuacan burial as related to the 18-month calendar, with one potentially sacrificed child representing each month. Jarquín Pacheco and Martínez Vargas (1991) have suggested that the children buried and potentially sacrificed at Teotihuacan served as an offering to the rain deity. Perhaps the Zapotec grave at Monte Albán also served as a dedication offering to a deity, given that the total number of skulls also numbered 18.

Martínez López et al. (1995:162) suggest that the 18 skulls recovered in Grave 1993-43 might come from a second depository context, that is, the skulls would have been unearthed and reburied in this mass grave context. The skulls were recovered from three arbitrary levels: level 1 (skulls 1,2, 4, and ceramic vessel), level 2 (skulls 3, 5–15), and level 3 (skulls 16–18) (Martínez López et al. 1995:151; **Figure 5.1**). The burying of these skulls was likely a relatively public ritual rather than a private mortuary ritual, given the unique nature of this grave at Monte Albán, the high number of skulls buried during the same event, and the clear ties to Teotihuacan practices. Therefore, it likely involved more participants than a private mortuary context, as it took place outside of an individual household setting. I argue that this event was at the same time limited to a certain audience, as it took place on the North Platform and near the VG complex, an area likely reserved for the elite (see Joyce 2009:38). It is therefore possible to think that only nobles were allowed to participate in this event.

While it is difficult to interpret the motivation of the inhabitants of Monte Albán who buried those skulls, the connection with the 18-month calendar, the potential association with a special dedication ceremony, and the removal and burial of skulls from 18 individuals likely involved the participation of numerous people. I examined sediment remains recovered near five of these skulls found on levels 2 and 3 (**Table 7.2**). Although these samples were processed with chemicals that usually destroy starch grains (see **Chapter 4**), I was able to recover some starch grains from these samples that likely survived the chemical digestion and heating process (similarly to Wyatt et al. 2012).

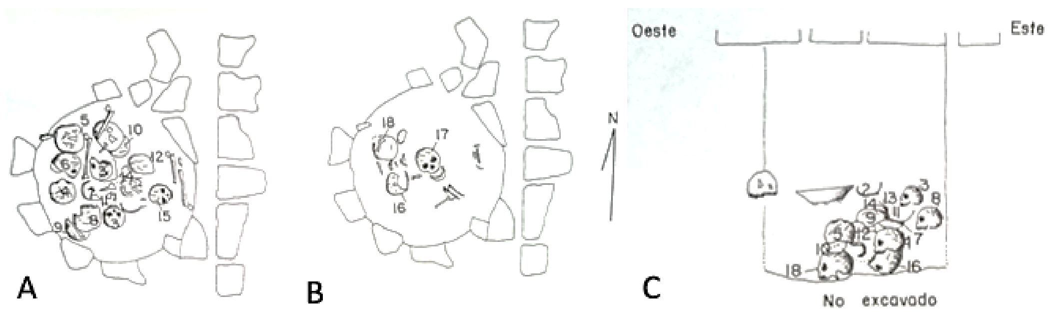


Figure 7.1: Drawings of Grave 1993-43. A) Level 2; B) Level 3; C) Profile (Martínez López et al. figures 54 b-d)

Table 7.2: Samples Examined from Grave 1993-43
cf.: potential; dam. St.: damaged starch grain

Origin of Sample	Study Sample Number	Description of individual	Summary of Taxa	Common Names
Skull 12	S-1	15 y.o., F	*Zea mays*, cf. *Acrocomia* sp., cf. *Capsicum* sp., *Cyperus* sp., Poaceae spp., dam. St.	Maize leaves and cobs (phytoliths), cf. coyol, cf. chile pepper, sedge, grass, dam. St.
Skull 14	S-2	Infant	*Zea mays*, cf. Fabaceae spp., Poaceae spp., dam. St.	Maize leaves and cobs (phytoliths), cf. beans family, grass, dam. St.
Skull 16	S-3	10–15 y.o., M	*Zea mays*, Arecaceae spp., Fabaceae spp., Poaceae spp.	Maize leaves and cobs (phytoliths), palms, beans family, grass
Skull 17	S-4	15 y.o., M	*Zea mays*, Arecaceae spp., Poaceae spp.	Maize leaves and cobs (phytoliths), palms, grass
Skull 18	S-5	10–15 y.o., M	*Zea mays*, *Cucurbita* sp., Arecaceae spp., Poaceae spp.	Maize leaves and cobs (phytoliths), squash, palms, grass

I was able to identify a wide array of plants from this grave: remains of maize leaves and cobs (**Figure 7.2**), squash (**Figure 7.2**), palms, and sedge; potential remains from coyol and chile; and remains from the bean family (Fabaceae spp.) and the grass family (Poaceae spp.). It is difficult to assess the nature of the botanical assemblage recovered from Grave 1993-43. It is possible that the remains identified in this study inform us about the plants placed alongside the skulls of the deceased, serving as additional offerings along with the large ceramic vessel. However, it is possible that the plants found here came from the sediment fill or from the sediment collected from the previous graves when the skulls were reburied (Martínez López et al. 1995:162).

These 18 skulls, placed in a grave with a ceramic vessel, were part of an important ritual that took place at Monte Albán, and likely indicate Teotihuacan influence during the Pitao phase in the Oaxacan city (Winter 1998, 2002). The botanical assemblage, if deliberately placed, and not made up of secondary or tertiary deposits, was there to accompany the deceased children. It is essentially composed of plants that could be found locally, perhaps hinting towards a practice mixing Teotihuacan and local influences.

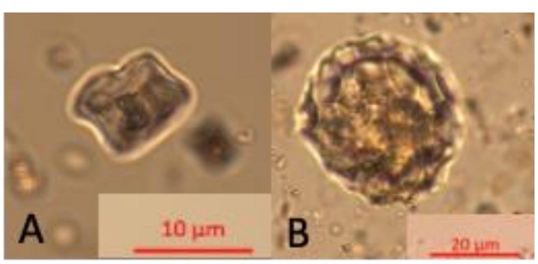


Figure 7.2: Grave 1993-43. A) Zea mays cob phytolith (sediment recovered near Skull 16); B) Cucurbita sp. phytolith (sediment recovered near Skull 18)

South Platform and East Patio

In this section, I present the results obtained from eleven sediment samples collected on the Main Plaza's South Platform and East Patio. Two samples come from Mound III (the pyramid on the South Platform, at the top of **Figure 7.3**). One sample came from the Altar on the East Patio (illustrated between the central and East rows of the Main Plaza on **Figure 7.3**) and eight samples were collected from the Sacred Axis, located between the Altar and Mound III.

Some missing elements on the labels of two samples from the South Plaza (S-20 and S-35) made it impossible for me to tie them to a known archaeological context. The results can be found in **Appendix A** but they are not discussed here.

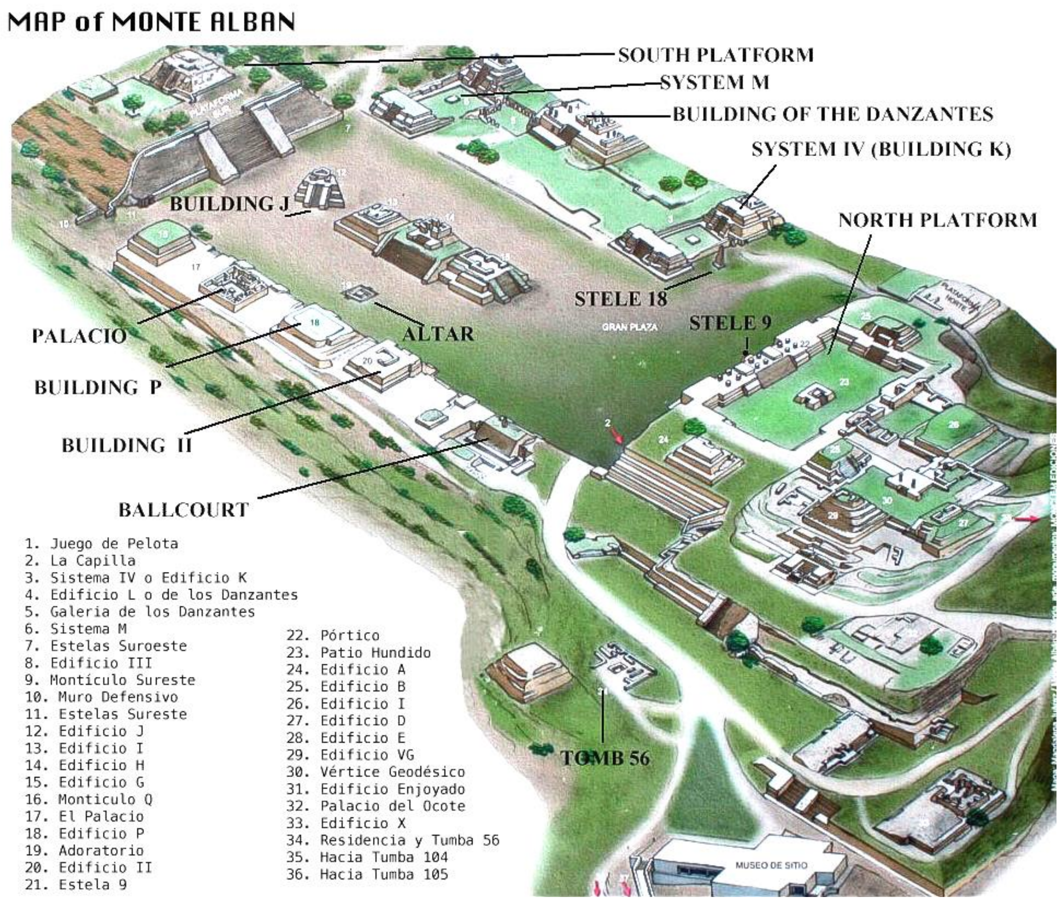


Figure 7.3: Map of the Main Plaza (Map by Mary Ann Sullivan, 2009)

Mound III

Mound III is the biggest structure of the Main Plaza's South Platform (Winter et al. 1999a:5). It consists of a pyramid with a rectangular temple located on its summit. The construction of Mound III started during the Nisa phase (potentially during the Early Nisa phase) and this structure was remodeled up to the Xoo phase (Winter et al. 1999a:6). It was built in a period marked by the increase in social inequality that was accompanied by a reconfiguration of the layout of the Main Plaza (Levine et al. 2021). This Mound was then remodeled in the following time periods where the elite's authority was challenged by the creation of rival centres, until the city was finally abandoned. I examined two sediment samples from this structure: one collected over the Floor 19 and one coming from the steps of the pyramid (**Table 7.3**). It was impossible to determine which steps were sampled, which would have helped to date the context more precisely. Floor 19 is associated to the “fourth construction stage” of the mound that dates to the Xoo Period (possibly Early Xoo) (Winter et al. 1999a:13). The sample collected in the steps could not be dated as it likely consists of a mixed context regrouping numerous construction stages.

Mound III is an important building located on the Main Plaza, the *axis mundi* allowing the elite intermediaries to connect the Zapotec visitors to sky entities and the underworld (Joyce 2009:33; Joyce and Barber 2015:830; Robles García 2011:60). I identified numerous grass phytoliths, a phytolith produced by a maize cob (**Figure 7.4**) collected near the initial steps of the pyramid, and a potential maize leaf phytolith on Floor 19 (**Figure 7.4**). I had initially selected these two samples to potentially recover botanical remains used in relatively public rituals that would have been trapped on the floor or near the initial steps of the pyramid. The grass phytoliths likely come from the local vegetation. The two maize phytoliths might bear witness of a ritual but they might come from sediments used as a fill. The two samples examined here do not provide enough information to highlight plants that might have been used in relatively public rituals taking place on and around Mound III.

Table 7.3: Samples Examined from Mound III
cf.: potential

Origin of Sample	Study Sample Number	Taxa Recovered	Common Names
Floor 19	S-48	cf. *Zea mays*, Poaceae spp.	Cf. maize leaf (phytolith), grass
Initial Steps	S-49	*Zea mays*, Poaceae spp.	Maize cob (phytolith), grass

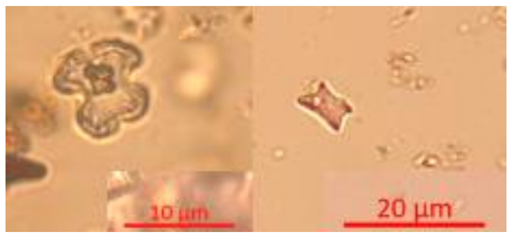


Figure 7.4: Mound III. A) cf. Zea mays leaf phytolith (Floor 19); B) Zea mays cob phytolith (initial steps)

Sacred Axis

The Sacred Axis is located between Mound III (located on the South Platform) and the Altar (found on the East Patio) (Gámez Goytia 2002; Winter 1999a:151) (**Figure 7.3)**. The Sacred Axis consists of a linear series of offering boxes that contained numerous artifacts, including ceramic vessels, jade, greenstones, obsidian, shells, and bones (Gámez Goytia 2002). Fähmel Beyer (2005) argues that some of these offering boxes might not have been visible to the visitors of the Main Plaza as they might have been covered after their use. Therefore, the invisible line of offering boxes might only have been known by the ritual specialists (Fähmel Beyer 2005). Gámez Goytia (2002:271) argues that the first offering boxes of the Sacred Axis were created during the Nisa phase. The researcher (Gámez Goytia 2002:271) believes that there was an interruption during the Tani-Pitao phase in the use of these boxes. Then, during the Xoo phase, Gámez

Goytia (2002:271, personal translation) identifies a “resurgence” as these offering boxes start to be used once again. This argument is likely based on the ceramics recovered from these boxes that allowed researchers to date them (see Winter 1999a). The Sacred Axis was an essential component that might have served to animate the building of the Main Plaza, maintaining this *axis mundi* as alive and vibrant (see Joyce 2020a). I examined eight sediment samples collected from the Sacred Axis.

Six of these samples come from three boxes used to deposit offerings (named offering boxes or *cajas de ofrendas*) (Winter et al. 1999a:157-202) (**Table 7.4**). The first offering box in this study, Element 2 (**Figures 7.5, 7.6)**, is rectangular (Winter et al. 1999a:157-170). It measured 60 cm X 53 cm and reached a depth of 70 cm. It contained 37 objects deposited in seven different levels. Unfortunately, it is not possible to establish the date of the sample, since the level where it was taken was not written on the sample bag. One sample (S-21) was examined from Element 2.

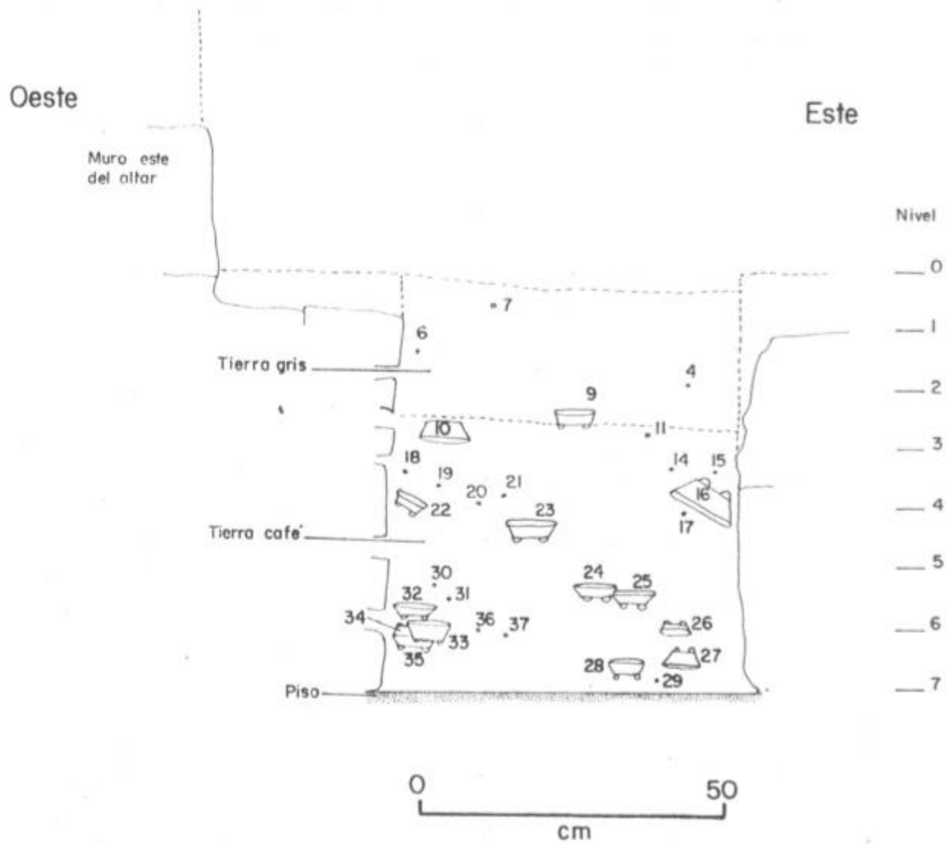


Figure 7.5: Drawing of Element 2, (Winter et al. 1999a Fig. 5.4)

Figure 7.6: Photograph of Element 2 (Winter et al. 1999a, Fig. 5.3)

Three samples come from Element 4, a circular hole containing an offering (Winter et al. 1999a:175-189). 111 objects were recovered from this element, which was filled with three different types of sediments. The architectural structure was divided into 22 levels by archaeologists (Winter et al. 1999a:175-189). Sediment sample 27 was collected between the levels 16–22. There, excavators recovered sherds dating to the Nisa phase, 81 cylinders of uncooked clay, and 26 lids (the lids were not counted as distinct objects) (Winter et al. 1999a:178). This sediment sample (S-27) was separated in two bags, one labelled as "normal soil" and the other as "green soil", without additional explanations regarding the nature of the green soil. When I opened the bags to process these two samples, I was not able to see any visible difference between both sets of sediment. The sediment sample 36 was collected between levels 7–16 and dates to the Xoo phase (potentially Early

Xoo) (Winter et al. 1999a:175), a time marked by the revival of Zapotec traditions and by the loss of authority by Monte Albán's leaders. Excavators found 27 objects associated with this deposit. Finally, sediment sample 22 was collected between levels 4–6. Those layers date to the Xoo phase and contained eroded ceramic sherds (Winter et al. 1999a:175).

Two sediment samples come from Element 5, a squared-shape offering box (Winter et al. 1999a:190-202). This box contained 23 objects and was filled with six different layers of sediment. These layers were divided in 19 arbitrary layers by the excavators (Winter et al. 1999a:190). Sediment sample 23 was collected on level 5, dating to the Nisa phase (Winter et al. 1999a:190). Sediment sample 24 was collected on levels 9–10 near an agglomeration of charcoals and ash. Those layers were potentially dated to the Nisa phase (Winter et al. 1999a:194).

The last two sediment samples come from Element 8 (Winter et al. 1999a:209-210). This rectangular stone feature is believed to be the remains of a bench that would have opened onto a plaza (Winter et al. 1999a:210). This element dates to the Nisa phase or later (Winter et al. 1999a:210). S-25 was collected on the floor and S-26 was recovered next to the bench.

Table 7.4: Samples Examined from the Sacred Axis

Origin of Sample	**Study Sample Number**	**Taxa Recovered**	**Common Names**
Element 2 (rectangle)	S-21	*Zea mays*, cf. *Capsicum* sp., Poaceae spp.	Maize cobs (phytoliths), cf. chile, grass
Element 4 (circle) Layers 16–22	S-27 (1)	cf. Marantaceae spp., Poaceae spp.	Cf. arrowroot family, grass

Origin of Sample	Study Sample Number	Taxa Recovered	Common Names
Element 4 (circle) Layers 16–22	S-27 (2)	Poaceae spp.	Grass
Element 4 (circle) Layers 7–16	S-36	cf. *Zea mays*, Marantaceae spp., Poaceae spp., dam. St.	cf. maize leaves (phytoliths), arrowroot family, grass
Element 4 (circle) Layers 4–6	S-22	cf. Marantaceae spp., Poaceae spp., dam. St.	cf. arrowroot family, grass
Element 5 (square) Level 5	S-23	Cyperaceae spp., Poaceae spp.	Sedge family, grass
Element 5 (square) Levels 9–10	S-24	Poaceae spp.	Grass
Element 8 (bench) Floor	S-25	Poaceae spp., dam. St.	Grass
Element 8 (bench) Next to	S-26	cf. *Cyperus* sp., Poaceae spp., dam. St.	cf. sedge, grass

The results obtained vary greatly between the different features. From the rectangle offering box (Element 2), I found maize cob phytoliths as well as a starch grain potentially produced by chile pepper (**Figure 7.7**), suggesting these two plants might have been placed there as an offering for supernatural entities or deities. From the circular offering hole, I identified remains from the arrowroot family (Marantaceae spp.) and potential maize leaves. In the square offering box (Element 5), I found phytoliths produced by a plant from the sedge family (Cyperaceae spp.). Near element 8, I found remains of grass and potentially from sedge.

All the plants identified from these contexts could be found locally. The presence of grass phytoliths probably informs us about the local vegetation, and the presence of sedge (or potentially sedge) near the bench (Element 8) might suggest that sedge could also have been growing near Monte Albán or that these plants were brought to the site and utilized in some unknown way. The elements found in the rectangular offering box (Element 2) might be the most informative about the botanical remains placed in relatively public offerings, with the presence of maize and potentially chile pepper. Ceramic vessels were placed in each of these elements, and it is possible that food remains accompanied them, though I was unable to carry out extractions of the vessels for this study. The results presented here provide useful information about the botanical content of these offering boxes, something that had not previously been examined.

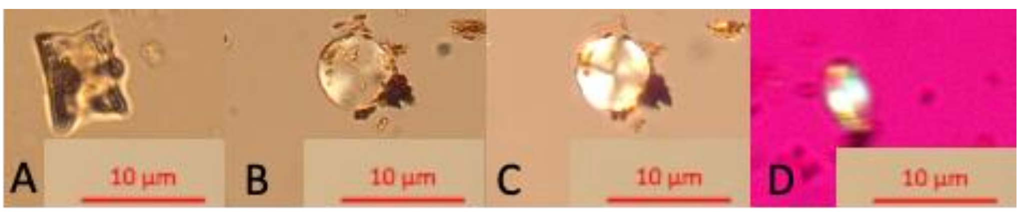


Figure 7.7: Microbotanical remains from Element 2. A) Zea mays cob phytolith; B-D) cf. Capsicum sp. starch

Altar, East Patio

The altar (named *Adoratorio* and *Altar* in Spanish) is located at the centre of the East Patio and marks the end of the Sacred Axis (Winter et al. 1999a:59; Figure 42). The altar was used to place offerings and might also have served for sacrifices (Winter et al. 1999a:59). I examined one sample from this structure, collected from Floor 1 (**Table 7.5**). This floor is located right under the initial construction phase of the altar (Winter et al. 1999a:64). It was not possible to date the floor due to its poor level of preservation and because ceramic sherds covering from the Danibaan phase up to the Postclassic period were found in the superior levels (Winter et al. 1999a:64).

My objective was to examine if certain botanical offerings might have been placed in the sediments used to level the floor before constructing the altar. However, the botanical remains from this sample might have been cross-contamination coming from the sediment used for levelling. My hope was to find numerous botanical elements that might hint towards a dedication offering prior to the construction of the altar. I identified four palm phytoliths, one from the sedge family (Cyperaceae spp.), and more than 150 grass phytoliths. The limited number of taxa identified makes it difficult to identify them as remains of a dedication offering. Grasses and palm leaves could have been used to hold food or be part of roof thatch, cord remains, or matting. Their presence could also inform us about the local environment, which could have consisted of certain areas filled with patches of grass and palm trees.

Table 7.5: Sample Examined from the Altar (East Patio)

Origin of Sample	**Study Sample Number**	**Taxa Recovered**	**Common Names**
Floor 1	S-42	Arecaceae spp., Cyperaceae spp., Poaceae spp.	Palms, sedge family, grass

<u>North Platform</u>

I examined eleven samples from the North Platform. They came from three different areas. Four samples came from the W1 Area (located just East of the North Platform, next to Tomb 56 in **Figure 7.3**), three were collected from the VG Patio (next to the VG Building in **Figure 7.3**), and four samples were collected from the North Mound, where there is a superposition of temples (Winter et al. 1994:15; Figure 42). Unfortunately, the information on the sediment sample labels did not reveal the exact location where these North Mound samples were collected. The results of these four unknown contexts can be found in **Appendix A,** but I do not detail them here.

W1 Area

The W1 Area is located South of Building W (Winter et al. 1999b:17) (the pyramid next to Tomb 56 in **Figure 7.3**). The four samples examined in this study were collected from three buildings (**Table 7.6**): Structures W1-A, W1-B, and W1-C. The selection of these four samples, coming from a residence near the Main Plaza, is due to a mistake on my part. I confused Building W (the pyramid with a temple at its top) with Structure W1, the residence examined here. Nevertheless, those four samples allowed me to examine the types of plants that made their way into ancient Zapotec elite residences.

Structure W1-A is the oldest of the W1 Area and dates to the Pitao phase and was modified up to the Xoo phase (Winter et al. 1999b:11). Pitao was marked by Teotihuacan cultural influences, followed by the revival of Zapotec traditional practices in Peche-Xoo. In Pitao, Monte Albán’s authority in the regional sphere started to be challenged by new rival centres, a trend that continued up to the abandonment of the city, at the end of Xoo. There, I studied one sample coming from the patio floor of the Pitao residence. Structure W1-B, built over Structure W1-A, dates to the Xoo phase (Winter et al. 1999b:37). I examined two samples coming from this structure: one collected from the patio floor, and another collected under Element W1-12. This element is an effigy urn with a "human figure […] seated with his legs crossed and his hands on his knees [and] is wearing a snake mask" (Winter et al. 1999b:39, personal translation). Building W1-C, built over Building W1-B, also dates to the Xoo phase (Winter et al. 1999b:49). There, I examined a sample collected from a stucco floor in the West section of the building.

Table 7.6: Samples Examined from the W1 Area

Origin of Sample	**Study Sample Number**	**Taxa Recovered**	**Common Names**
W1-A Patio floor	S-40	*Zea mays*, Poaceae spp.	Maize leaves and cobs (phytoliths), grass
W1-B Patio floor	S-41	cf. *Zea mays*, Poaceae spp.	Cf. maize leaves (phytoliths), grass
W1-B Effigy vessel	S-38	cf. Marantaceae spp., Poaceae spp.	Cf. arrowroot family, grass
W1-C Stuco floor	S-39	cf. *Zea mays*, cf. Bursearaceae spp., cf. Cyperaceae spp., cf. Marantaceae spp., Poaceae spp.	Cf. maize leaves (phytoliths), cf. copal family, cf. sedge family, cf. arrowroot family, grass

I identified maize, grass, and potential arrowroot family (Marantaceae spp.) phytoliths from the samples coming from Buildings W1-A and W1-B. I identified numerous plant remains from the W1-C stucco floor, including phytoliths potentially coming from the copal family (Burseraceae spp.) (**Figure 7.8**), but it is difficult to interpret these remains with the limited amount of information available from this context. Could these plants have been used for domestic rituals? Or were these plants consumed by the inhabitants of this residence? Examining other samples collected from domestic contexts would help us to better understand these four samples.

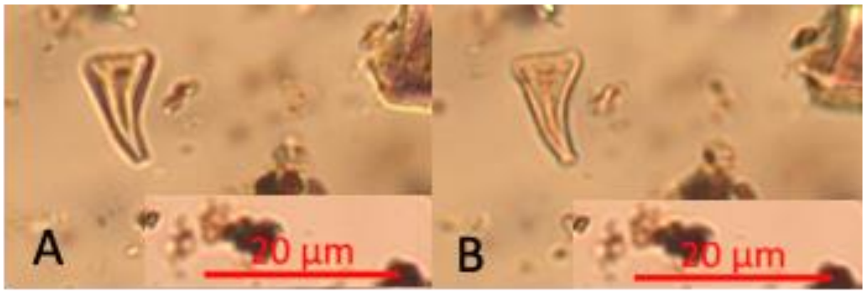


Figure 7.8: cf. Burseraceae spp. Phytolith (stucco floor) Structure W1-C

Patio VG

I examined two samples collected from Patio VG (located next to Building VG, **Figure 7.3**) (**Table 7.7**). Patio VG is one of the principal patios of the North Platform and is located close to the larger Sunken Patio (*Patio Hundido*) (Winter et al. 1994:13). Patio VG dates to the Xoo phase. One of these samples was collected near the bedrock and served as a control sample, while the other was collected from the patio's drain. There were two separate bags in this sediment sample, collected from two different sections of the drain. I selected those samples based on my earlier training in paleoethnobotany at historical sites in Québec, where I often examined botanical remains from drains during my time as a laboratory technician. My goal was to identify remains that might have been used in rites performed on this patio and then discarded.

Table 7.7: Samples Examined from the Patio VG

Origin of Sample	Study Sample Number	Taxa Recovered	Common Names
Bedrock	S-44	Poaceae spp.	Grass
Drain	S-50 (1)	cf. *Zea mays*, Cyperaceae spp., Poaceae spp.	Cf. maize leaves (phytoliths), sedge family, grass
Drain	S-50 (2)	*Zea mays*, Poaceae spp.	Maize leaves and cobs (phytoliths), grass

I identified remains of maize (**Figure 7.9**) and plants of the sedge family, elements that have been identified in other contexts in this study. These plants could all be found locally. While the presence of these plants in a drain does not necessarily tie them to relatively public rituals, we can associate them with activities in the Main Plaza and on a patio. Maize in particular could have been eaten, stored there temporarily, or played a role in the ritual practices taking place on the North Platform of the Main Plaza.

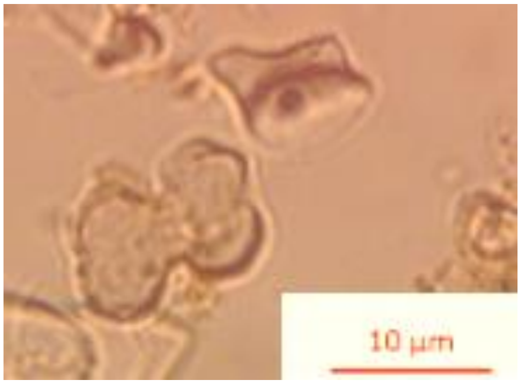


Figure 7.9: Patio VG. Zea mays cob phytotlith (upper right) next to a cf. Zea mays leaf phytolith (bottom left) from the drain

Comparing Relatively Public Rituals and Private Mortuary Practices Using Botanical Residues

Two of the examined contexts provided results likely associated with relatively public rituals: Grave 1993-43 and the offering boxes located in the Sacred Axis. The other samples, collected from floors, drains, and near architectural features, did not provide results clearly tied with relatively public rituals. When I selected these samples, I looked for samples initially labelled as coming from "temples" and "burials", but the interpretations made of these contexts following the archaeological excavation made the connection with relatively public rituals more difficult to establish than I had initially thought.

The plants found in the W1 residences could have come from relatively public rituals, or be the remains of domestic activity, household food consumption, or private rituals. The same observation can be made from the remaining samples. The plants identified there might come from relatively public rituals, but they might also represent the local vegetation or plants used in other practices. I was not able to identify plants tied to ritual practices from these contexts, demonstrating the need to focus on "sealed [and] secure" contexts when examining ritual uses of plants (Morehart and Morell-Hart 2015:492). Since I was able to determine with a good level of confidence that Grave 1993-43 and the offering boxes found in the Sacred Axis were associated with relatively public rituals, here I focus solely on the samples recovered from these contexts.

As in the earlier chapter, I used ubiquity analysis (Dickau et al. 2012; Morell-Hart 2019) and measures of taxonomic richness (see Lennstrom and Hastorf 1992:210–212; Morell-Hart 2019:235) to better understand the use of plants in ritual practices. Because a single plant can produce multiple phytoliths and starch grains, I examined the presence and absence of the taxa from each sample instead of the raw number of remains recovered for each taxon, the same procedure followed in the previous chapter. I also set aside grass family (Poaceae spp.) phytoliths from the ubiquity analysis and the taxonomic richness to be consistent with my earlier calculations. That decision was made due to their widespread presence in the samples (present in all the sediment samples examined here) and because the residues might provide information about the local vegetation instead of use of plants in ritual practices. As mentioned earlier, these grasses could also have been used for roof thatch, cord remains, or matting, but those uses cannot be clearly identified solely based on the presence of phytoliths in sediment samples.

As it was the case with the private graves examined in **Chapter 6**, maize was the most common plant found in Grave 1993-43 (present in all five samples examined). Interestingly, remains from the arrowroot family (Marantaceae spp.) were absent from Grave 1993-43, even though this plant had been tentatively identified in 60% of the simple graves and in 50% of the formal tombs (see **Chapter 6**). This indicates that the participants in the relatively public burial ceremony did not place arrowroot family plants alongside the children's skulls—a distinction from the other two funerary settings. Remains of palms (Arecaceae spp.)

were identified in three of the five samples coming from Grave 1993-43, possibly indicating that its presence was important in this context. Perhaps the leaves were used to wrap food, which would have served as an offering. The presence of palm leaves phytoliths could also perhaps suggest the presence of small mats (*petates*) that served to hold the heads while they were buried. Remains of squash and of phytoliths produced by the bean family (Fabaceae spp.), alongside potential remains of coyol and chile pepper, could support the idea that food was placed alongside the skulls in Grave 1993-43. However, because those skulls were likely unearthed from elsewhere and reburied there (Martínez López et al. 1995:162), we must also be aware that those botanical remains might inform us about earlier botanical offerings with the primary interments rather than plants placed alongside the offering of 18 skulls during the Pitao phase.

Table 7.8: Taxonomic richness in relatively public ritual contexts

Context	**Taxonomic richness**
Grave 1993-43 (N=5)	8
Element 2 (N=1)	2
Element 4 (N=4)	3
Element 5 (N=2)	1
Offering boxes (N=7)	5
Average taxonomic richness in relatively public ritual contexts	3.5

From relatively public ritual contexts, I recovered an average of 3.5 different taxa per context, which is lower than the average obtained from simple graves (4.6) and formal tombs (5) (**Table 7.8**). However, Grave 1993-43 has one of the highest taxonomic richness of all the mortuary assemblages examined (8 different taxa recovered), superseded only by Grave 1994-69, a burial containing the remains of a woman missing her skull (see **Chapter 6;** 9 different taxa recovered).

It is important to note that these two contexts have an important component in common: the removal of the skull from the body. In Grave 1994-69, archaeologists found the remains of an adult woman missing her skull. In Grave 1993-43, the excavating team found the skulls of 18 children, buried together in what appears to be a single episode of deposition. As with Grave 1994-69, the removal of cranial bones has been reported elsewhere in Oaxaca, where such bones could serve as amulets (see Markens and Martínez López in press). As for Grave 1993-43, archaeologists believe that this multiple burial was likely influenced by Teotihuacan rites (Martínez López et al. 1995; Winter 1998, 2002). In both cases, the inhabitants of Monte Albán might have placed more types of botanical elements in these graves than what has been seen elsewhere at the site, possibly hinting towards important differences in the mortuary practices in relation to the removal of the deceased skulls. In the next chapter, I explain how the offerings recovered from these two burials might also have been tied to larger *conjonctures* enveloping religious practices and cultural influences.

The results from the offering boxes do not allow us to identify common plants. Remains from the arrowroot family (cf. Marantaceae spp.) were tentatively identified in three samples coming from Element 4 (circular hole). This would demonstrate this plant could be used some relatively public ceremonies and not exclusively in private mortuary settings. Only two taxa (apart from grass) could be identified with confidence from the offering boxes: maize cob phytoliths from Element 2 (rectangular box) and remains from the sedge family (Cyperaceae spp.) from Element 5 (square box). The very limited presence of botanical remains apart from maize and sedge in these boxes could indicate that plants were not the main component used as offerings.

The taxonomic richness from the offering boxes (**Table 7.8**) is quite low, ranging from 1–3 taxa in total per offering box. Perhaps the ancient inhabitants of Monte Albán did not place botanical elements there, rather focusing on durable artifacts (numerous ceramics were recovered) and potentially faunal remains (undetected in this study). The extraction of microbotanical residues from some of the vessels recovered from those three contexts could perhaps offer a better understanding of the choices made by the Zapotecs when placing objects in those offering boxes. Perhaps the artifacts contained food or beverages, materials that would be more visible through microbotanical analysis of artifact extractions.

Botanical Offerings and Relatively Public Rituals: Final Observations

Grave 1993-43 represents a unique event in Monte Albán's history. For reasons still difficult to understand, the inhabitants of Monte Albán broke away from tradition to inter 18 children's skulls, in a ceremony likely influenced by the Teotihuacan culture. The Grave 1993-43 burial seems to have contained more botanical elements than private simple graves and formal tombs, perhaps reinforcing the unique nature of this burial at the site. I suggest that the plants placed as mortuary offerings in Grave 1993-43 were carefully selected, in accordance with the unique nature of this burial.

However, numerous plants found in this mass redeposit grave were also encountered in private primary burials: maize, squash, beans family, palms, potentially chile pepper, and coyol palm. The use of these plants in Tani-Pitao phase Grave 1993-43 is consistent with previous mortuary rituals, possibly suggesting this ritual deposit was influenced by established traditions regarding mortuary ceremonies, dating to the Danibaan-Pe, and Nisa phases. However, the absence of any remains of arrowroot family species (Marantaceae spp.) and the high average taxonomic richness make this burial stand out when compared to the use of plants in the private interments.

Burial 1993-43, a unique event, did not seem to establish a new tradition or impact later mortuary practices at Monte Albán, as private mortuary offerings continued until the abandonment of the city. As demonstrated in the next chapter, the plants used in private mortuary offerings did not change following the interment of Grave 1993-43. The burying or reburying of the skulls of 18 children was an important event at Monte Albán, but this ceremony likely did not impact the established mortuary traditions already in place, and instead suggests an event quite different from a “normal” funerary ceremony. The differences seen in Grave 1993-43 might be explained by the increased number of participants in this event, by the influence of another cultural sphere (Teotihuacan), or by the separation of the skulls from the bodies, a hypothesis based on the higher taxonomic richness obtained from Grave 1994-69.

The samples collected from offering boxes offer a basis for future paleoethnobotanical analyses specifically targeting these contexts. Having more data on relatively public offerings would allow us to examine continuities and changes through time, thus permitting us to determine if these events followed a rigid tradition or if they varied greatly throughout the long history of Monte Albán. To better understand botanical elements placed in relatively public offerings, I would recommend targeting both sediment samples and artifact residues to cover both phytoliths and starch grains.

The information presented in this chapter allowed me to better understand the plants placed in Grave 1993-43 and to study the contents of the offering boxes found in the Sacred Axis of the Main Plaza. It also allowed me to identify the contexts worthy of targeting in future studies that would further examine the use of plants in ritual practices at Monte Albán. In **Chapter 6**, I examined the plants used in private mortuary practices at Monte Albán by examining the residues placed in simple graves and in formal tombs. This allowed me to examine the connection between the plants placed as offerings in elite contexts and the relative social status of the deceased within households. When these results are combined, it becomes possible to examine the use of plants in private and relatively public mortuary rituals that took place in and around the Main Plaza throughout the occupation of the site. In the subsequent chapter, I combine this evidence to consider changes and continuities in the use of botanical elements in various practices in relation to larger *conjonctures* unfolding at Monte Albán, during the four main periods described in **Chapter 3**.

8. Broader Social Processes Affecting Mortuary Tradition and Relatively Public Rituals at Monte Albán

In this dissertation, I have examined plant remains to shed light on the traditions and beliefs associated with mortuary contexts and rituals at the ancient Zapotec capital of Monte Albán. Botanical offerings played a great role in the meaningful ceremonial activities that connected living members to their deceased ancestors, gods, deities, and supernatural spirits. The Main Plaza also played a large role in relatively public rituals, making it a critical place to examine the use of botanical elements in both private and relatively public ceremonies.

This research contributes to an understanding of activities at Monte Albán in several key ways. First, at a methodological level, I have demonstrated throughout this dissertation the potential for paleoethnobotanical studies targeting mortuary contexts and relatively public rituals to provide novel information regarding ancient lifeways and beliefs. This is the first paleoethnobotanical study to examine ritualized practices at Monte Albán. This was also the first study to focus on microbotanical remains at the site, and only the second study focusing on ancient plant remains, Houston (1983) being the first scholar to examine plant residues, at the macrobotanical scale. The results have allowed me to identify plants likely used as mortuary offerings at Monte Albán and confirm that vessels contained plant foods and potentially fermented drinks, a previous assertion that had awaited confirmation (Winter 1995). The most important plant over the *longue durée*, based on its presence in the highest number samples, was maize. Offerings of this plant were almost always accompanied by numerous other botanical foodstuffs and non-edible plants that may pertain to matting, thatching, or cordage.

Second, this dissertation illuminates certain aspects of funerary rites (**Chapter 6**), demonstrating key similarities across funerary contexts that in other respects (architecture, artifacts, burial style) are quite distinct. I compared botanical elements recovered in simple graves and formal tombs to examine if the use of plants in mortuary contexts varied depending on the relative social status of elite individuals. The results obtained seem to demonstrate that there were no clear differences in plants found in mortuary contexts based on this criterion. This follows the same logic in the study by Ponce de León et al. (2020), who argued that there was "some degree of equality" between men and women based on the absence of clear differences in the mortuary practices. In addition to this absence of clear differences, I was not able to observe a pattern in the botanical dataset. This means that I was not able to identify recurrent uses for the same plants, except for maize. Plant combinations changed in each burial, and the plants selected differed greatly from one assemblage to another. Based on these observations, I suggest that plants placed in burials might have been selected mainly based on personal preferences and/or the availability of plants at the time of the death of the interred individuals. In this chapter, I will examine how certain key *conjonctures*, such as the creation of new trade routes that led to the arrival of new plants, might have had a role to play in the plants selected as mortuary offerings.

Third, in **Chapter 7** I addressed distinctions between relatively public rituals, in the form of offering boxes and a private burial (Grave 1993-43), and private rituals, in the form of the mortuary rites examined in **Chapter 6**. I compared the plants recovered from private mortuary contexts to those used in contexts associated with relatively public rituals. The results obtained from the offering boxes in the Sacred Axis and multiple Grave 1993-43 (18 children's skulls buried together) also highlighted the important role of maize, whether in private or relatively public rituals.

The high taxonomic richness of the samples recovered from the multiple Grave 1993-43 confirmed the unique nature of this grave at Monte Albán, likely influenced by Teotihuacan culture. These results suggest that Grave 1993-43 had different functions and meanings from private funerary ceremonies. However, other similarities between the plants placed as offerings in this grave and those recovered from private mortuary contexts might have allowed ritual participants to balance local Zapotec and Teotihuacan cultural elements, continuing some Zapotec traditions while incorporating novel practices identical to those at Teotihuacan. These skulls were reburied during Tani-Pitao, a phase marked by new polities challenging Monte Albán's authority. I suggest that this unique event might perhaps have been accomplished in an attempt to establish a connection with influential deities that could have helped the rulers cement their power. The presence of 18 skulls, a possible reference to the 18-months calendar (Martínez López et al. 1995) might perhaps have been intended to represent a cyclical symbolism, ensuring that this offering would have lasting repercussions. This interment could also have been done to affirm political and economic ties through a powerful ally, Teotihuacan, through a joint ceremony. This could have served to reemphasize the strong position of Monte Albán in broad economic markets.

In **Chapter 2**, I highlighted the role played by paleoethnobotanical studies in mortuary offerings. In numerous cultures around the world and in Mesoamerica (e.g., Belmar et al. 2020; McNeil 2010; Nelson 2003), offerings allowed participants to create a bridge between the living and the dead as they became ancestors. This is also true for the ancient Zapotec at Monte Albán (e.g., Joyce 2020a; Lind and Urcid 1983). Powerful ancestors could protect their descendants, and plants played a key role in ensuring the establishment and the maintenance of this essential connection. Plants placed as in mortuary offerings around the world often carried important symbolic meanings (e.g., Bui Thi Mai and Girard 2010; Corbineau 2018; Corbineau and Bui Thi Mai 2014; Girard and Maley 1987). Such was the case at Monte Albán, where maize was the most common edible species found in this study, across contexts and time periods. As demonstrated in **Chapter 5**, this plant played and still plays today an important role in rituals in Oaxaca (Monaghan 1996; Rojas 2016; Sellen 2011), and is the lone plant of consistent importance over the *longue durée* at the ancient city of Monte Albán.

At Huitzilapa, in Jalisco, plants used as clothing seem to have reinforced social differences in mortuary practices (Benz et al. 2006). In The Mixteca Alta, during the Formative Period, Ponce de León et al. (2020) examined social differences based on differences in funerary treatments. Their results suggested that there were no strong differences related to sex. However, they argued that infants and adults were treated differently (cremation vs. burial), thus hinting towards social status differences within a single household. At Monte Albán, the results seem to suggest that plants did not serve to reinforce social status differences between elites interred in simple graves and those placed in formal tombs. The plants might have been selected to ensure the safe transition to ancestor status, similar to Tupinambá practices observed by Beauclair et al. (2009), where bark, a plant material considered as having transformative properties, was used to transform the deceased into ancestors. Regardless, at Monte Albán relative social status of elite household members does not appear to have been reflected in the plants offered to the deceased, unlike other elements of material culture.

The use of plants in private mortuary and relatively public ceremonies can be connected with larger political, economic, and religious *conjonctures* taking place at the site. I began this interpretive process with two possible results in mind: 1) mortuary practices remained similar through time, as observed by Rue et al. (1989) for Maya communities; and 2) plant uses differed at various points in time, such as during the Tani-Pitao phase, where there was strong influence from the Teotihuacan culture. Paleoethnobotanists have encountered varying results when examining mortuary practices in similar contexts elsewhere in the world (e.g., Belmar et al. 2020; Kreuz 2000; Reddy 2009; Rottoli and Castiglioni 2011).

I presented the long history of Monte Albán, separated into four different phases by previous researchers. These phases also align with the nexus of economic, social, and political *conjonctures* taking place in the city and in the Valley of Oaxaca (**Chapter 3**). In this current chapter, my goal is to understand the connection between mortuary contexts and relatively public rituals (generally considered distinct from quotidian lifeways) to larger phenomena affecting the daily lives of the Zapotec inhabitants of the city. To do so, I examined changes and continuities over time in the botanical elements identified in this study, deposited in various events. I here relate these events to the medium-term political, economic, and social phenomena (*conjonctures*) taking place at Monte Albán. I also address the construction, maintenance, and transformation of social memory at Monte Albán through the plants selected in these contexts—how they conformed or did not conform to other ongoing traditions.

Relationships between Botanical Practices, Ritualized Events, and Broader *Conjonctures*

Here, I consider the occupation of Monte Albán from its founding to its abandonment (500 BCE — 800 CE) as the *longue durée* in a Braudelian sense (similarly to the study by Santeramo et al. [2019] at the abandoned village of Zalaba in the Basque Country investigation). Economic, social, and political medium-term phenomena, or *conjonctures*, are generally coalesced into four phases: Danibann-Peche, Nisa, Tani-Pitao, and Peche-Xoo. I am interested here in examining how individual events (the use of plants in mortuary contexts and relatively public rituals) influenced and were influenced by these broader *conjonctures*.

However, the relationship between events and *conjonctures* is one of co-creation; both scales influenced each other in varying degrees at different points in time. This approach is much closer to the approach developed by Ricoeur (1984, 2004) than Braudel's conceptualization of the dynamics regarding these different scales (1966 [1990:429]). At Monte Albán, offerings were not simply a reflection of broader political and economic processes. Offerings also had the potential to transform the lives of the living, as they allowed ritual participants to establish and maintain connection with ancestors, spirits, and deities. In these mortuary and relatively public offerings, particular plants could please or anger the dead, thus impacting living people for better or for worse. Plants used in offerings could be influenced by *conjonctures*, such as the economic expansion of Monte Albán, allowing for new plants such as sweet potato to arrive in the Zapotec capital. Plant uses could also be dictated to a certain extent by past religious events that coalesced into a particular tradition, such as the use of maize. Botanical practices could be affected by personal preferences, such as the favorite foods of the deceased, or the availability of preferred plants at the time of the death of the interred individuals. Regardless, each event, leading to the deposition of botanical residues, had the potential to strengthen or challenge previous norms and expectations, either reinforcing traditions or leading to the creation of new practices.

The new botanical data from Monte Albán offers the opportunity to examine the connection between events and *conjonctures*, specifically between the use of plants in private and relatively public rituals in relation to larger phenomena unfolding at the site. Here, I summarize the results from all 100 microbotanical samples, obtained from the extraction of residues from 50 artifacts and 50 sediment samples (**Figure 8.1).** The results obtained allowed me to identify plants likely used as mortuary offerings in six simple graves, eight formal tombs, and one mortuary context likely associated with relatively public rituals (E1993-43) (**Figure 8.1**). I also collected sediment samples from contexts associated with relatively public rituals to examine the content of three offering boxes used to animate buildings of the Main Plaza (Joyce 2020b). These microbotanical samples cover the whole occupation of the site, from its founding around 500 BCE up to its abandonment around 800 CE. The samples collected from Tomb 208 also cover the Liobaa phase, a period of sporadic reoccupation of the site following its abandonment by its large population. The full set of results are examined here in relation to the four larger phases identified earlier in this dissertation (**Table 8.1**), and the conjonctures unfolding during each of these phases.

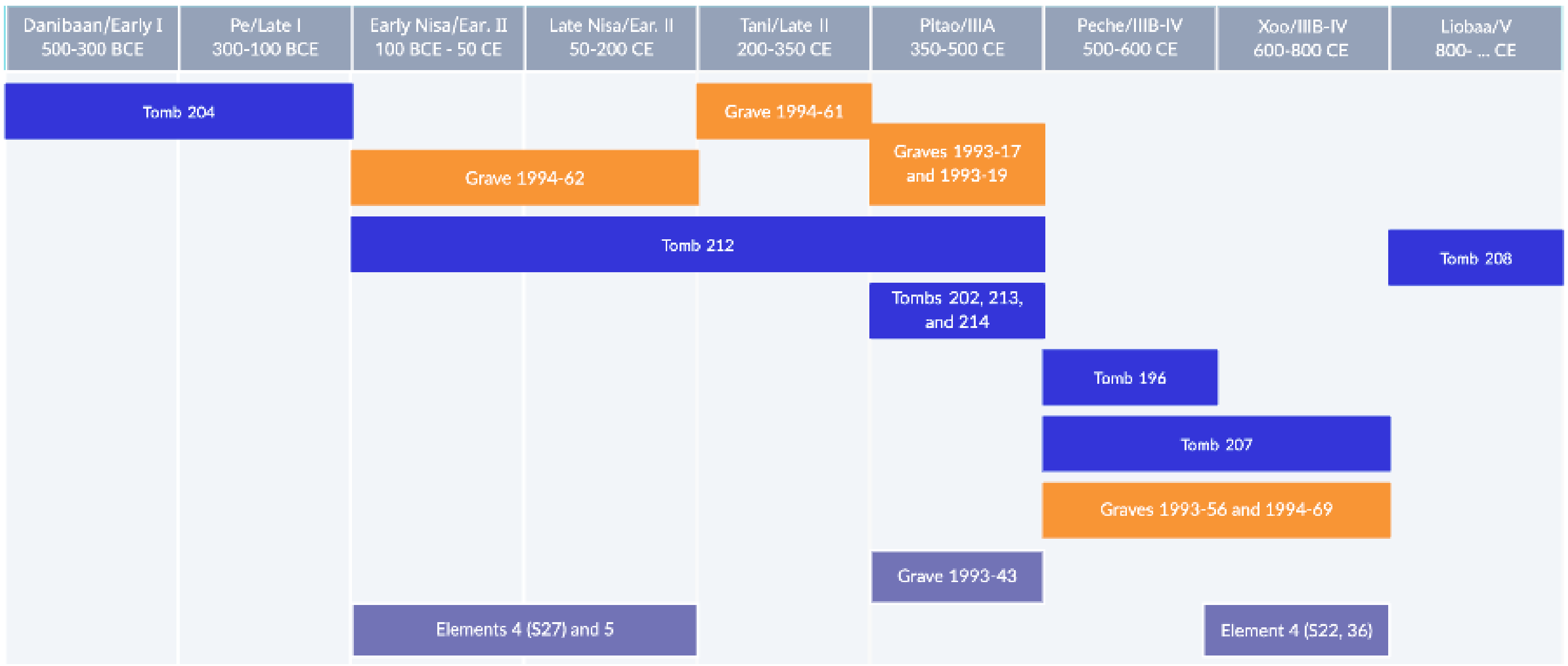


Figure 8.1: Contexts examined in this study

Table 8.1: Presence/Absence of taxa from private mortuary contexts
cf. identifications are in parenthesis. G: graves; T: tombs

//////////	Danibaan-Pe	Nisa	Tani-Pitao	Peche-Xoo	Liobaa
Acrocomia sp. Coyol					
Arecaceae spp.	T204	G62, T212	T212, T213	G69, T207	
Asteraceae spp.	T204			G69	
Asteraceae/ Cucurbitaceae spp.	T204		T214		
Boraginaceae spp.	(T204)	(G62), (T212)	(T212), (T213)	(G69), T207	
Calathea sp. Lerén			T213		
Capsicum sp. Chile pepper			(G61)	G69, T207	
Cucurbita sp. Squash		T212	G61, T212		
Cyperaceae spp.			(G61), T213	(T207)	T208
Cyperus sp. Sedge			(T213)		
Fabaceae spp.	T204		T213, (T214)	(T207)	
Ipomoea batatas Sweet potato			T202	G69	T208
Manihot sp. Manioc genus	T204				
Maranta sp. Arrowroot			(T213)		
Marantaceae spp.	T204	(G62), (T212)	(G61), (T212), (T214)	(G69), (T207)	
Phaeolus sp. Beans			G17		
Piperaceae spp.			(G61)		
Sagittaria sp. Arrowhead				G69	(T208)
Zea mays Maize	T204	(G62), T212	G17, G61, T212, T213, T214	G69, T207	T208
Fermentation	T204		T214		

//////////	Danibaan-Pe	Nisa	Tani-Pitao	Peche-Xoo	Liobaa
Unknown phytoliths and starches	T204	T212	G17, G61, T212, T213, T214	G69	T208

Danibaan-Pe

The Danibaan-Pe phase begins with the foundation of Monte Albán. Following the creation of this city, archaeological evidence hints towards collective governance, where elites and commoners shared powers (Joyce 2020; Urcid 2011; Urcid and Joyce 2014). This cooperation was key in the creation of the monumental Main Plaza. Throughout this period, rulers slowly solidified their power through the gathering and trade of resources (Joyce 2010:144), transforming political *conjonctures* following the founding of the city. This solidification of power also impacted economic medium-term phenomena during the Pe phase, when the population of Monte Albán reached the point where food produced locally could not suffice to feed all inhabitants (Joyce 2010:148).

In **Chapter 3**, I argued that, during the initial founding of Monte Albán (Danibaan-Pe), elite members likely focused on the use of plants in relatively public rituals rather than using them in more private mortuary contexts. his would have strengthened the power in the public sphere of families that were to become the ruling class in the following periods. While ancestors played an important role at Monte Albán, the polity was still at its growing stage, and the deceased of these new lineages might not yet have reached the prestige that was to come in the next generations. I anticipated that the ancestors of these lineages thus potentially warranted fewer offerings, including botanical ones. Based on this hypothesis, I expected to encounter low taxonomic richness from samples dating to this period, in relatively homogenous assemblages with a few recurrent species. This would have served as an example of a situation where unfolding *conjonctures* (political and social) could shape key practices (mortuary offerings).

I examined 16 samples collected from one Tomb (204) dating to this period. It contained the incomplete remains of an adult (Martínez López et al. 2014:125–150). The results obtained (**see Chapter 6**) show the opposite of what I initially expected. This tomb contained a very diverse array of botanical elements, including remains from the bean family and from the manioc genus, in addition to maize and fermented starch grains, potentially indicating the presence of an alcoholic beverage such as *pulque* or *chicha* placed in this tomb.

These findings may corroborate the importance of ancestors right from the start of the founding of Monte Albán. Ancestor veneration was already well established in Oaxaca prior to the founding of the city (Flannery and Marcus 2015), but I had anticipated that the relationship between the descendants and their ancestors might have been a bit weaker at the initial stages of Monte Albán. The results demonstrate, on the contrary, that Zapotec inhabitants of Monte Albán established strong relationships with their powerful ancestors right from the beginning, through different means, including botanical offerings in mortuary contexts.

The first burials at Monte Albán began to establish norms and expectations for future interments. Tomb 204 contained plants that were found in later contexts, including maize. Early events might have influenced the symbolic nature of botanical elements, leading to the creation of religious traditions that would be difficult to change through time.

Nisa

The Nisa phase corresponds to a dramatic change in Monte Albán's social and political *conjonctures*, with increased hierarchical inequalities (see **Chapter 3**). The transformation of the Main Plaza to better control access, and the presence of numerous projectile points near one of these entries, demonstrate the tensions following these important changes (Joyce 2010:159; Martínez López and Markens 2004). During that time, Monte Albán's influence extended to new polities (Elson and Sherman 2007; Spencer et al. 2008:321). This also impacted Monte Albán's economic *conjonctures*, with the creation of new trade routes and the arrival of new resources.

I expected **(see Chapter 3)** that, during the Nisa phase, exotic goods would make their appearance in mortuary offerings and in relatively public rituals following the establishment of new trade routes with neighbouring and distant communities, including Chiapas, Veracruz, and Puebla (González Licón 2011:67). The plants used in relatively public rituals could allow the elite members to showcase their prestige, while the plants used in mortuary rituals allowed them to connect with their powerful and revered ancestors. Therefore, I expected to encounter diversified assemblages that included foreign plants (like manioc) and a higher taxonomic richness compared to Danibaan-Pe. In addition to these new plants, I still expected to see the kinds of plants found in the earlier Tomb 204 to be present in later tombs (Tomb 212 and E1994-62), as a way to reproduce practices and maintain social memory.

I examined eight samples recovered from E1994-62, a simple grave dating to the Nisa phase, as well as remains from two offering boxes from the same period (four samples). I also identified microbotanical remains from two samples collected from Tomb 212, a tomb initially used during the Nisa phase that remained in use until the end of the Pitao phase. Those results are difficult to interpret, as they span over two main phases (over 600 years) in the long history of Monte Albán. Tomb 212 results are considered from both phases in the following pages, as it was impossible to tighten its relatively wide temporal range.

The simple grave E1994-62 (Martínez López et al. 1995:206–212) contained the remains of a male aged 20–25 years old. From this grave, I was able to detect the presence of numerous plants, including maize, palms, and potential remains from the borage and arrowroot families. Two samples collected from Element 4, the circular offering hole (Winter et al. 1999a:175-189) date to the Nisa phase, while another sample from the same structure dates to the Xoo phase (discussed later here). The samples collected from the Nisa layers contained grass phytoliths and potential phytoliths from the arrowroot family. Element 5, the square offering box, contained remains from the sedge and grass families. Tomb 212 (Martínez López et al. 2014:252–260) contained the remains of at least three adults: a woman aged 35–40 years old, a younger male (30–35 years old) and another adult, too fragmented to be assigned a sex and an age. The two samples contained remains of maize leaves and cobs (phytoliths), squash, grass, and potential remains from the sunflower, arrowroot, and borage families.

Here again, the results do not match what I had initially expected. Fewer taxa were identified from this period compared to the earlier Tomb 204 and only one new plant made an appearance: squash. This plant, with a long history of cultivation in the region, does not reflect the inclusion of new exotic plants in the mortuary record. It appears that, even if the inhabitants of Monte Albán had access to new plants, following the establishment of new trade routes with foreign regions, they did not use these exotic botanical elements in their mortuary practices (a phenomenon noted elsewhere, e.g., Bouby and Marinval 2004; Reddy 2009). By perpetuating the same mortuary traditions and focusing on local plants rather than foreign botanical resources, the inhabitants of Monte Albán might have been creating and strengthening a form of local social memory, thus connecting their practices with the founders of the Zapotec capital. New plants made their way into daily life, but might not have had the same ritual power as the plants that had featured in Zapotec traditions from previous centuries. If this is indeed the case, it would demonstrate how events can sometimes be limited by *conjonctures* already unfolding (in this case religious beliefs and practices established through time).

Tani-Pitao

Following the Nisa phase, the Tani-Pitao period was marked by the influence of Teotihuacan at Monte Albán, which impacted the trajectory of religious *conjonctures* (through new mortuary practices such as seated burials and Grave 1993-43), economic *conjonctures* (through the introduction of foreign goods including Teotihuacan pottery [Blanton et al. 1981:89; Caso et al. 1967:311–362; Winter 2002:76]), and political *conjonctures* (with Monte Albán's authority being challenged by new rival centres).

Considering this influence in other domains, I expected to find profound changes in the plants used in mortuary offerings from this period, as well, particularly in Grave 1993-43 where a Teotihuacan vessel was recovered. I expected to encounter new plants in these assemblages and see plants previously present disappear. I expected that some important plants, like maize, would persist in use, but that there would be visible changes in the selection and the use of plants in these contexts. However, I had also considered the possibility that the inhabitants of Monte Albán might have maintained certain plant practices even if new cultural elements made their way into the polity. This would follow a pattern I had seen at the Mixtec site of Achiutla, in the transition from the Late Postclassic to Early Colonial periods (Bérubé 2017; Bérubé and Forde in press).

In addition to Tomb 212, used from the Nisa phase up to the end of the Pitao phase, I examined samples collected from three simple graves dating to this period (E1993-17, E1993-19, and E1994-61), three tombs (T202, T213, and T214), and

E1993-43, the burial containing the skulls of 18 children. I examined three samples from E1993-17, a simple grave containing the remains of a child (8–9 years old) (Martínez López et al. 1995:109–113). I identified remains of maize kernels (starch grains), beans, and grasses. From E1993-19, the grave of an adult woman (Martínez López et al. 1995:115–116), I examined one sample that only included remains from the grass family. E1994-61 contained the remains of an infant only three months old (Martínez López et al. 1995:204–208). I examined six samples where I encountered remains of numerous plants including maize kernels (starch grains), squashes (phytoliths), and potentially remains from chile pepper (starches).

Tomb 202 contained the body of an adult, aged 40–45 years old (Martínez López et al. 2014:112–117). I examined one sample from this tomb that contained sweet potato starch grains. I examined six samples from Tomb 213, where excavators encountered the incomplete remains of four individuals (Martínez López et al. 2014:261–277). I encountered numerous plants there, including maize starch grains (kernels) and lerén. Tomb 214 contained remains of at least 12 adults (Martínez López et al. 2014:278–300). I examined nine samples collected from this context, where I found remains of maize kernels (starch grains) and potential remains from the squash and beans families among many different plants. Two samples contained fermented starch grains.

Finally, I examined five sediment samples collected near the skulls of children recovered from E1993-43 (Martínez López et al. 1995:151–175). Among the plants I was able to identify, I found numerous remains of maize cobs and leaves (phytoliths), as well as remains from the squash and bean families, and potential remains produced by chile peppers.

As expected, based on previous botanical studies in the area (e.g., Bérubé and Forde in press; García Ríos and Robles García in press; Feinman and Nicholas in press; King and Morell-Hart in press; Marcus and Flannery 1996; Markens and Martínez López in press; Morell-Hart and Bérubé in press; see **Chapter 5**), new plants became visible in the record: lerén, potentially chile pepper, possible remains of sedge (and the sedge family), sweet potato, beans, potentially arrowroot, and potential remains of plants in the pepperleaf family. Many of these plants have been recovered from nearby regions dating to earlier time periods, and some, such as sedges, bean family species, and pepperleaf species, are autochthonous to Oaxaca.

The appearance of numerous additional plants in the archaeological assemblages could indeed confirm new traditions making their way into mortuary rituals, parallel with the Teotihuacan cultural influences affecting the daily life of Monte Albán's inhabitants, through the potential addition of new food practices in tombs and graves. I suggest these new traditions were slowly constructed through recurrent events including novel botanical elements. Through time, it became more and more common to see plants such as squash, chile pepper, and arrowhead featuring in ritual contexts, slowly strengthening their role in the ritual sphere. While the earlier Zapotec inhabitants during the Nisa phase might have refrained from using new plants as mortuary offerings, it seems that the following generations during the Tani-Pitao phase did not hesitate to engage in novel plant practices when creating elaborate offerings. This demonstrates how economic *conjonctures* (the establishment of new trade routes) may have impacted religious *conjonctures* (plants imbued with spiritual values and included in ritual practices).

Peche-Xoo

The Peche and Xoo periods saw the disappearance of the Teotihuacan influence and a revival of ancient Zapotec traditions (Winter 2002:81–82). This is visible archaeologically through different observations, including the construction of new temples after such activities had stopped in the Tani-Pitao phase. Based on the idea that the Zapotec religious *conjonctures* were marked by a period of resurgence in the Peche-Xoo, I expected to see the new plant practices that had made their way into earlier Zapotec rites, potentially related to Teotihuacan influence, to be rejected in the Peche-Xoo phase. I expected to see a return to ancient practices, to re-establish the social memory that might have been threatened by Teotihuacan influence in the Tani-Pitao phase. I expected that the taxonomic richness of this phase, however, might have been lower than the much earlier Nisa phase, since the economic position of Monte Albán's elite members was threatened by the new neighbouring centers and not as strong as it was during the earlier phase.

Samples from one simple grave (1994-69) and two tombs (196 and 207) date to this phase, along with one offering box. Grave E1994-69 contained the remains of an adult woman missing her skull (Martínez López et al. 1995:223–227). I examined seven samples from this context and identified numerous plants, including remains from maize, chile pepper, arrowhead plant, and sweet potato. I examined one sample from Tomb 196 (Martínez López et al. 2014:38–53), a tomb that contained the remains of five adults. The sample extracted from a small obsidian ornament only contained grass phytoliths, which might indicate the presence of a thread of herbs used to wear it. Tomb 207 contained the bodies of four adults (Martínez López et al. 2014:172–188). From the four samples analyzed, I encountered remains of maize kernels (starch grains), maize leaves and maize cobs (phytoliths), chile pepper (starch grains), as well as several other plants. I also examined two samples from Element 4 (a circular offering box) dating to this period. This box contained remains of grasses, plants from the arrowroot family, and potentially from maize leaves (phytoliths).

The Peche-Xoo results are close to results from the earlier periods, with the inclusion of one new plant: arrowhead (*Acuitlalpalli, Cacatezli, papas de agua, flor de agua, hierba de papa, pulla, guí;* Hellmuth 2020). This plant, potentially also placed as a mortuary offering in Tomb 208 (in the later Liobaa phase), could have been used to tie mortuary contexts with broader Zapotec religious traditions. As this aquatic plant needed to be in water constantly to survive, I suggest the presence of arrowhead in this burial could perhaps be tied with *Cociyo*, the rain/lightning god.

As described in **Chapter 3**, *Cociyo* was an important deity for the inhabitants of Monte Albán across time periods, especially for the elite members who used the power of *Cociyo* to strengthen their authority. Offerings tied to *Cociyo*, to rain and to water, had been visible throughout the occupation of the site.

These offerings have been identified in the water cistern (Urcid 2020:459) and mortuary contexts, with the presence of shells and greenstones (Acosta 1949; Joyce 2020b:339), associated with aquatic realms. Fish, turtles, and ducks have also been identified in ritual contexts at the site (Martínez-Lira 2014:229). It is worth noting that turtles have also been identified from other sites in Oaxaca, such as Guilá Naquitz, San José Mogote, Fábrica San José and Ejutla (see Lapham et al. 2014) At Monte Albán, the most striking example of an aquatic offering is perhaps of two whale ribs transformed into music instruments, found on the North Platform of the Main Plaza (Caso et al. 1967:103-105; Joyce 2020a, 2020b), more than 100 kilometers distant from the coast. Prior to the Peche-Xoo period, I did not recover any aquatic plant remains (only plants such as sedge that survive in seasonally marshy areas). The presence of arrowhead starch grains from two vessels of Grave 1994-69 perhaps shows a new practice emerging that would have continued even after Monte Albán was mostly abandoned, since the same plant was potentially identified from the later Postclassic Tomb 208.

The resurgence of Zapotec rituals and traditions that mark the Peche-Xoo phase was accompanied by the loss of influence of Monte Albán in the regional sphere. At the time where elite members felt challenged and slowly lost their grip on power, I suggest they might have done everything in their power to strengthen their bond with *Cociyo* to compensate for this loss, to slow it, or to reverse it. In mortuary traditions, this can be seen through the creation of strong bond between the ancestors and the Rain Deity. In addition to shell and greenstones, I argue that arrowhead was added to the list of potential mortuary offerings, tying water to the deceased in an innovative way. Therefore, the use of arrowhead in mortuary contexts would have served to create new connections with deities, while strengthening the connections that already existed through other types of food offerings.

Plants and *Conjonctures*

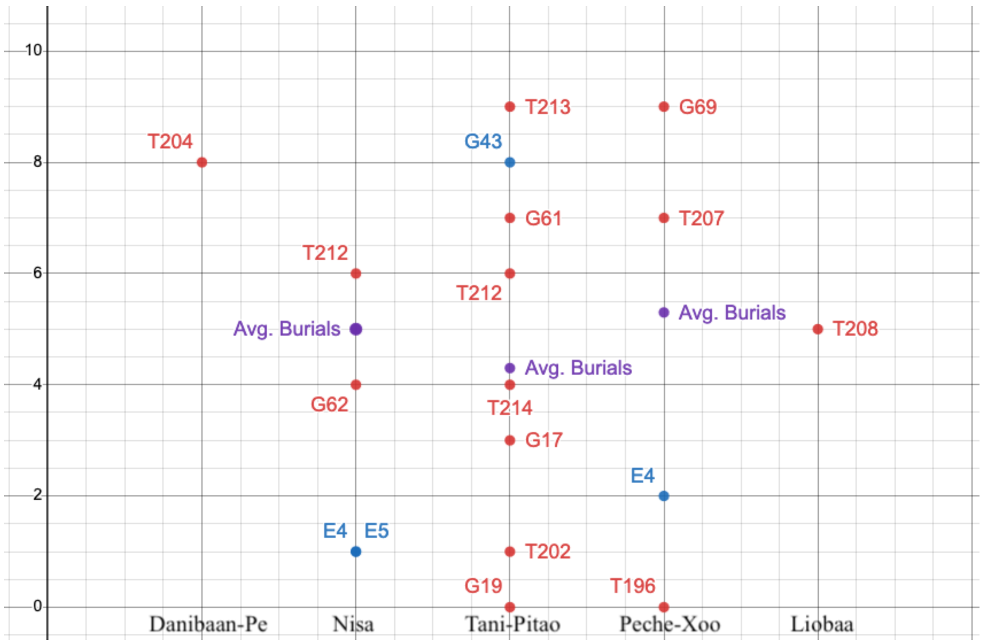
This multi-scalar temporal framework allowed me to compare botanical assemblages across the site in ritual contexts. By examining microbotanical remains in relation to larger political, social, political, and religious phenomena, I was able to better contextualize these samples and provide interpretations related to plant uses in ritual contexts. Following Ricoeur (1984, 2000, 2004), I examined both the influence of *conjonctures* on individual events (in this case private mortuary and relatively public offerings), and the collective impact of these events on medium-term phenomena, such as the creation of new trade routes, the increase in social inequalities, or the resurgence of Zapotec traditions. Every ritual offering had the potential to reinforce or transform larger mortuary traditions, to an extent. For example, the relatively public interment of 1993-43 likely had more impact on future mortuary practices than a private mortuary offering, as it involved more participants. However, we do not see novel mortuary practices evident in this event replicated in later time periods, as Grave 1993-43 remains the only burial containing multiple children's skulls at the site.

The approach taken in this dissertation offered a route to examine plant uses in ritual contexts at Monte Albán by combining top-down (larger phenomena affecting events) and bottom-up (events impacting *conjonctures*) approaches. Top-down effects might include the creation of new trade networks impacting ritual events, by paving the new for new plants to make their way into these practices. Bottom-up effects might include the placement of an aquatic plant in a mortuary context to petition the gods to impact larger phenomena, strengthening the authority of the rulers or impacting climatic conditions by bringing rain and water.

Botanical Practices, Investments in Mortuary Rituals, and Average Taxonomic Richness

The average taxonomic richness per context showed no enormous variation, but did slightly increase through time (**Figure 8.2**). Average taxonomic richness remained just under 4.3 taxa/context (grass family phytoliths excluded), until the Peche-Xoo period, where it reached 5.3 taxa/context. Average taxonomic richness must be considered with caution (Morell-Hart 2019:237). The taxa in this study were only identified through microbotanical remains, thus leaving out certain plants like cacao that do not produce diagnostic phytoliths or starch grains. The ratio could therefore change with additional paleoethnobotanical data including macrobotanical and chemical residues.

Table 8.2: Taxonomic Richness
E : Element ; G : Grave ; T: Tomb



The average taxonomic richness is also affected by the number of samples examined per context. For example, I examined only one context from Danibaan-Pe (Tomb 204 composed of 16 samples). The use of plants in Tomb 204 could perhaps differ greatly from the norm at the time. More samples from additional contexts dating to this phase would be needed to establish baselines and norms.

Even with these caveats, the average taxonomic richness per context nonetheless seems to highlight a tendency at the site. Through all phases of occupation of the site, the average taxonomic richness in private mortuary contexts seems to remain stable, moving only slightly from 5 taxa/context during the Nisa phase up to 5.3 taxa/context during the Tani-Pitao, indicating that the number of plants placed as private mortuary offerings might have remained similar through this succession of time periods. This is a clear contrast with the multiple burial

Grave 1993-43 that had more than 8 taxa represented, indicating a later rupture with previous mortuary practices. During the Peche/Xoo phase, the taxa/context remained 5.3, equivalent to what had been previously seen at the site. Even though Monte Albán's economic power had decreased considerably during that later time (Joyce 2010:200–201; Winter 2002:78–79), funerary offerings contained equivalent numbers of types of plants, indicating the continued importance of investing in mortuary offerings even during challenging times for the elite.

The results obtained differed from what I initially expected. As demonstrated in this study, multiple plant species were used as mortuary offerings at Monte Albán right from its foundation (Danibaan-Pe) and up to its abandonment in Peche-Xoo. This demonstrates that celebrating the deceased and venerating ancestors was perennially important for inhabitants, even if the lineage of elite members might have been less established in the first centuries of the city's long history. Early ancestors might have been considered key players in the creation of the city and in its economic and political influence in the region. Through time, more plants made their way into mortuary practices, especially in the Tani-Pitao phase. I argue that these new plants, such as sweet potato, may have been available at the site earlier, but that it took time to include them in ritual contexts. This demonstrates that *conjonctures* (in this case the creation of new trade networks) can take time before having an impact on multiple practices or events (in this case the use of plants in mortuary rituals and relatively public ceremonies).

The *Longue Durée*: Recurrent Plant Practices at Monte Albán

Certain plants are present from the first burial examined in this study (Tomb 204) up to the abandonment of Monte Albán in the Xoo phase. These plants consist of palm trees (Arecaceae spp.), potentially plants from the borage family (cf. Boraginaceae spp.), remains from the arrowroot family (Marantaceae spp.) and maize (*Zea mays*). The palm trees could indicate the presence of structures (Bonomo et al. 2017:105; Rostain 2017:12), clothes made from those fibres (Scheel-Ybert and Bachelet 2020:278; see also Lentz et al. 1996:250), mortuary mats (*petates*) (Cavallaro 2013:70; Simpson and Inglis 2001) or the presence of edible fruits like coyol or cohune (Abramiuk et al. 2011:260; Morell-Hart et al. 2014:74). Since these remains were mostly recovered from sediment samples, the idea that palm trees were used for structural, clothing, or decorative purposes seems the most plausible. Macrobotanical data would be needed to offer a better understanding of the use of palm materials in mortuary contexts at Monte Albán.

I tentatively identified remains from the borage family from all four phases. This family includes herbs, trees, and shrubs, and is widespread around the world (Marie-Victorin 2002 [1935]:454). There as well, the potential presence of plants from this family could perhaps inform us on the presence of construction material (de Ávila 2010:126). I identified numerous phytoliths from the arrowroot family generally, in addition to two phytoliths diagnostic of the lerén genus (*Calathea* sp.) and one potential starch grain diagnostic of arrowroot (cf. *Maranta arundinacea*). These plants likely inform us about the presence of edible food placed as mortuary offering, rather than on construction materials. Finally, maize was found throughout the occupation of Monte Albán, as expected, demonstrating this plant played an important role in Mesoamerican and Zapotec beliefs (Bérubé 2017; Fussell 1992; León Avendaño and Vásquez Dávila 2003:62).

The presence of these plants in burials throughout the long history of Monte Albán could demonstrate the perpetuation of certain traditions in mortuary rites. While it is impossible to confirm how these plants were used (for example, were palm trees used as structures, for clothes, for mortuary mats, or as food offerings?), the recurrent use of these taxa demonstrates their important role for the Ancient Zapotec. By using the same plants time and time again, even during the Teotihuacan influence phase, the participants of these rituals not only created a bridge with their ancestors; they also maintained a connection with their past. Each event that included the use of these key plants such as maize and elements of the arrowroot family might have served to cement their use in future mortuary rituals, thus leading to the persistence of social memory through plants used in mortuary traditions.

While I was able to examine the relationship between *conjonctures* and events, more robust links between the *longue durée* and events are harder to establish. Even though 100 samples represent a relatively large set for a paleoethnobotanical study taking place in Mesoamerica, I felt more data would be needed to better examine the relationship between the long history of Monte Albán and ritual plant uses, although we certainly see the persistent use of maize across all phases, especially prominent in funerary contexts. To more robustly track long-term arcs over the *longue durée*, however, would require more samples from relatively public offerings and mortuary rituals, and many more samples from domestic contexts for comparative purposes. As argued in **Chapter 3**, the *longue durée* might be perhaps examined more easily at Monte Albán through the study of terraces that played an important role in the Zapotec capital. These agricultural terraces needed to be continually maintained (see Pérez Rodríguez et al. 2011) or they became at risk of collapsing and crushing other terraces below, something seen in other areas of Monte Albán (González Licón 2011). Additional samples from domestic contexts and agricultural terraces would allow us to better understand very long-term and persistent plant practices at Monte Albán, in relation to ritual deposition events. I therefore encourage future archaeological projects taking place at Monte Albán to include a paleoethnobotanical component in their research.

Concluding Thoughts

There are four key takeaways from this study. First, plants were used in simple graves and in formal tombs in a similar fashion, even though the elite individuals interred did not have the same social standing. The types of plants identified from those contexts were similar and the average taxonomic measures per sample were very similar, with simple graves having slightly more taxa/sample. The implication here is that the plants used as mortuary offerings might not have been used to reinforce the social status of “greater” and “lesser” elites in noble households. As the political and social *conjonctures* of Monte Albán were marked by increasing inequalities, it would be critical to investigate commoner households to better understand the impact these medium-term phenomena might have had on the inhabitants of the city.

Second, this study has shown which plants were persistently placed as mortuary offerings, and highlighted what offering boxes might have contained at Monte Albán. Up to now, researchers suggested the vessels placed as offerings in tombs and graves contained food and drinks without being able to confirm this assertion. This study showed that maize was the predominant plant placed as offerings, but that other important economic plants were also present in those meaningful contexts. Some of these plants were likely placed as a food offerings (maize, chile pepper, beans, squash, sweet potato, lerén, arrowroot), while others such as palms and grasses might demonstrate the presence of construction materials, clothes, or *petates* upon which bodies or offerings might have been placed. The presence of fermented starch grains (too damaged to be identified to a specific plant) also highlights the potential presence of alcoholic beverages placed as offerings in these contexts, consumed by descendants during the burial ceremony, or consumed during earlier uses of these vessles. These findings also demonstrate the important role of maize in ritual practices, a constant throughout the history of Monte Albán, regardless of the *conjonctures* that might have impacted other aspects of practices.

Additional data on the food elements placed in these contexts in Monte Albán and in the Valley of Oaxaca would allow us to better understand the connection between deceased ancestors and the living, and on the role of food to create and maintain a connection between these entities. To do so, it would be best to combine paleoethnobotanical data (macrobotanical and microbotanical), zooarchaeological analysis, lipid analysis, and entomoarchaeology. This would allow us to engage with Oaxacan cuisine as a whole, and with the numerous combinations that make it so unique.

Third, I have addressed the relationship between *conjonctures* and events more generally. Monte Albán has been the site of numerous studies focusing on various topics. For example, researchers have examined political aspects relating to the formation of statehood (Joyce 2010; Joyce and Barber 2015; Joyce and Winter 1996; Marcus and Flannery 1996; Urcid and Joyce 2014), and the religious role of ritual specialists on the local population and on neighbouring communities (Joyce 2020a, 2020b; Marcus 1978; Urcid 2011; Winter et al. 2007). All of these studies allowed us to develop a better understanding of the long history of Monte Albán and of the main *conjonctures* that unfolded there. This extensive knowledge allowed me to relate certain temporally limited events (private mortuary rituals and relatively public rituals) with these *conjonctures*. In mortuary rituals, plant practices served to create and maintain connections between the dead and the living, and to ensure the ancestors would help the remaining members of elite households. In relatively public rituals, botanical offerings allowed participants to animate buildings and petition different entities, including gods and spirits. The results of this study demonstrate that all deceased members of the households had a key role to play after their passing and that maintaining a meaningful connection with them was critical. In this way, individual botanical events related to ritual practices might have been used to create and maintain beneficial *conjonctures*, such as the reinforcement of ruler authority at the local and regional levels, by ensuring the help of powerful ancestors. Many traditions were especially persistent, even with Teotihuacan influences in the Tani-Pitao phase, when some events were strikingly unique yet appeared to have no great impact in later time periods.

Generally, this study demonstrates the potential for paleoethnobotanical studies focusing on mortuary contexts and relatively public rituals, at a global scale, to provide novel information regarding ancient lifeways and beliefs. This potential is amplified at well-understood archaeological sites where *conjonctures* are more clearly researched. In this study, the extensive literature surrounding the city of Monte Albán allowed me to better contextualize botanical data to offer new insights on ancient beliefs, practices, and traditions.

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Appendix A: Results

Context	Sample Nb.	Origin	Taxon	Type of remain	Count	TotItems
Grave 1993-43	Sedi 1	AB	Poaceae sp.	Phyto	37	100
Grave 1993-43	Sedi 1	AB	cf. *Zea mays*	Phyto	4	100
Grave 1993-43	Sedi 1	AB	Dam starch	Starch	1	100
Grave 1993-43	Sedi 1	AB	cf. *Acrocomia* sp.	Phyto	1	100
Grave 1993-43	Sedi 1	AB	UNK Starch 4	Starch	1	100
Grave 1993-43	Sedi 1	AB	Panicoideae sp.	Phyto	8	100
Grave 1993-43	Sedi 1	AB	Poaceae sp.	Phyto	42	100
Grave 1993-43	Sedi 1	AB	*Zea mays*	Phyto	5	100
Grave 1993-43	Sedi 1	AB	Poaceae sp.	Phyto	1	100
Grave 1993-43	Sedi 1	S	Non diagnostic	Phyto	1	100
Grave 1993-43	Sedi 1	S	Poaceae sp.	Phyto	27	100
Grave 1993-43	Sedi 1	S	cf. *Capsicum* sp.	Starch	1	100
Grave 1993-43	Sedi 1	S	*Cyperus* sp.	Phyto	1	100
Grave 1993-43	Sedi 1	S	Non diagnostic	Phyto	5	100
Grave 1993-43	Sedi 1	S	UNK Phyto 5	Phyto	1	100
Grave 1993-43	Sedi 1	S	Poaceae sp.	Phyto	1	100
Grave 1993-43	Sedi 1	S	Panicoideae sp.	Phyto	18	100
Grave 1993-43	Sedi 1	S	Poaceae sp.	Phyto	37	100
Grave 1993-43	Sedi 1	S	*Zea mays*	Phyto	2	100
Grave 1993-43	Sedi 1	S	UNK Starch 5	Starch	1	100
Grave 1993-43	Sedi 1	S	Chloridoideae sp.	Phyto	1	100
Grave 1993-43	Sedi 1	S	cf. *Zea mays*	Phyto	4	100
Grave 1993-43	Sedi 2	AB	Non diagnostic	Phyto	4	100
Grave 1993-43	Sedi 2	AB	Poaceae sp.	Phyto	19	100

Grave 1993-43	Sedi 2	AB	cf. *Zea mays*	Phyto	5	100
Grave 1993-43	Sedi 2	AB	Dam starch	Starch	1	100
Grave 1993-43	Sedi 2	AB	Poaceae sp.	Phyto	2	100
Grave 1993-43	Sedi 2	AB	*Zea mays*	Phyto	7	100
Grave 1993-43	Sedi 2	AB	Poaceae sp.	Phyto	38	100
Grave 1993-43	Sedi 2	AB	Panicoideae sp.	Phyto	22	100
Grave 1993-43	Sedi 2	AB	Chloridoideae sp.	Phyto	2	100
Grave 1993-43	Sedi 2	S	Non diagnostic	Phyto	9	100
Grave 1993-43	Sedi 2	S	Chloridoideae sp.	Phyto	8	100
Grave 1993-43	Sedi 2	S	cf. Fabaceae sp.	Phyto	1	100
Grave 1993-43	Sedi 2	S	UNK Phyto 6	Phyto	1	100
Grave 1993-43	Sedi 2	S	Poaceae sp.	Phyto	3	100
Grave 1993-43	Sedi 2	S	*Zea mays*	Phyto	7	100
Grave 1993-43	Sedi 2	S	Poaceae sp.	Phyto	32	100
Grave 1993-43	Sedi 2	S	cf. *Zea mays*	Phyto	7	100
Grave 1993-43	Sedi 2	S	Poaceae sp.	Phyto	21	100
Grave 1993-43	Sedi 2	S	Panicoideae sp.	Phyto	11	100
Grave 1993-43	Sedi 3	AB	Poaceae sp.	Phyto	57	100
Grave 1993-43	Sedi 3	AB	Fabaceae sp.	Phyto	1	100
Grave 1993-43	Sedi 3	AB	Non diagnostic	Phyto	2	100
Grave 1993-43	Sedi 3	AB	Poaceae sp.	Phyto	17	100
Grave 1993-43	Sedi 3	AB	Chloridoideae sp.	Phyto	2	100
Grave 1993-43	Sedi 3	AB	cf. *Zea mays*	Phyto	7	100
Grave 1993-43	Sedi 3	AB	*Zea mays*	Phyto	6	100
Grave 1993-43	Sedi 3	AB	Arecaceae sp.	Phyto	1	100
Grave 1993-43	Sedi 3	AB	Panicoideae sp.	Phyto	6	100
Grave 1993-43	Sedi 3	AB	Poaceae sp.	Phyto	1	100
Grave 1993-43	Sedi 3	S	Panicoideae sp.	Phyto	11	100
Grave 1993-43	Sedi 3	S	Non diagnostic	Phyto	11	100

Grave 1993-43	Sedi 3	S	Poaceae sp.	Phyto	23	100
Grave 1993-43	Sedi 3	S	Chloridoideae sp.	Phyto	1	100
Grave 1993-43	Sedi 3	S	Poaceae sp.	Phyto	8	100
Grave 1993-43	Sedi 3	S	Poaceae sp.	Phyto	42	100
Grave 1993-43	Sedi 3	S	*Zea mays*	Phyto	3	100
Grave 1993-43	Sedi 3	S	cf. *Zea mays*	Phyto	1	100
Grave 1993-43	Sedi 4	AB	Poaceae sp.	Phyto	42	100
Grave 1993-43	Sedi 4	AB	Non diagnostic	Phyto	1	100
Grave 1993-43	Sedi 4	AB	Poaceae sp.	Phyto	21	100
Grave 1993-43	Sedi 4	AB	cf. *Zea mays*	Phyto	5	100
Grave 1993-43	Sedi 4	AB	*Zea mays*	Phyto	5	100
Grave 1993-43	Sedi 4	AB	Arecaceae sp.	Phyto	2	100
Grave 1993-43	Sedi 4	AB	Panicoideae sp.	Phyto	18	100
Grave 1993-43	Sedi 4	AB	Poaceae sp.	Phyto	2	100
Grave 1993-43	Sedi 4	AB	Chloridoideae sp.	Phyto	4	100
Grave 1993-43	Sedi 4	S	Non diagnostic	Phyto	16	100
Grave 1993-43	Sedi 4	S	Poaceae sp.	Phyto	30	100
Grave 1993-43	Sedi 4	S	cf. *Zea mays*	Phyto	3	100
Grave 1993-43	Sedi 4	S	Panicoideae sp.	Phyto	6	100
Grave 1993-43	Sedi 4	S	Poaceae sp.	Phyto	3	100
Grave 1993-43	Sedi 4	S	Poaceae sp.	Phyto	42	100
Grave 1993-43	Sedi 5	AB	Poaceae sp.	Phyto	41	100
Grave 1993-43	Sedi 5	AB	Poaceae sp.	Phyto	12	100
Grave 1993-43	Sedi 5	AB	Arecaceae sp.	Phyto	2	100
Grave 1993-43	Sedi 5	AB	UNK Phyto 7	Phyto	1	100
Grave 1993-43	Sedi 5	AB	Panicoideae sp.	Phyto	29	100
Grave 1993-43	Sedi 5	AB	Poaceae sp.	Phyto	2	100
Grave 1993-43	Sedi 5	AB	*Zea mays*	Phyto	4	100
Grave 1993-43	Sedi 5	AB	cf. *Zea mays*	Phyto	8	100

Grave 1993-43	Sedi 5	AB	Chloridoideae sp.	Phyto	1	100
Grave 1993-43	Sedi 5	S	Poaceae sp.	Phyto	38	100
Grave 1993-43	Sedi 5	S	Poaceae sp.	Phyto	29	100
Grave 1993-43	Sedi 5	S	Non diagnostic	Phyto	1	100
Grave 1993-43	Sedi 5	S	Non diagnostic	Phyto	10	100
Grave 1993-43	Sedi 5	S	*Cucurbita* sp.	Phyto	1	100
Grave 1993-43	Sedi 5	S	Poaceae sp.	Phyto	9	100
Grave 1993-43	Sedi 5	S	[POLLEN]	[POLLEN]	1	100
Grave 1993-43	Sedi 5	S	Panicoideae sp.	Phyto	5	100
Grave 1993-43	Sedi 5	S	*Zea mays*	Phyto	1	100
Grave 1993-43	Sedi 5	S	cf. *Zea mays*	Phyto	2	100
Grave 1993-43	Sedi 5	S	Chloridoideae sp.	Phyto	3	100
Grave 1994-62	Sedi 6	AB	Poaceae sp.	Phyto	23	100
Grave 1994-62	Sedi 6	AB	Poaceae sp.	Phyto	19	100
Grave 1994-62	Sedi 6	AB	Non diagnostic	Phyto	2	100
Grave 1994-62	Sedi 6	AB	cf. *Zea mays*	Phyto	16	100
Grave 1994-62	Sedi 6	AB	Arecaceae sp.	Phyto	5	100
Grave 1994-62	Sedi 6	AB	Panicoideae sp.	Phyto	30	100
Grave 1994-62	Sedi 6	AB	Poaceae sp.	Phyto	2	100
Grave 1994-62	Sedi 6	AB	Bambusoideae sp.	Phyto	1	100
Grave 1994-62	Sedi 6	AB	Chloridoideae sp.	Phyto	2	100
Grave 1994-62	Sedi 6	S	Poaceae sp.	Phyto	11	100
Grave 1994-62	Sedi 6	S	Non diagnostic	Phyto	9	100
Grave 1994-62	Sedi 6	S	[POLLEN]	[POLLEN]	1	100
Grave 1994-62	Sedi 6	S	Panicoideae sp.	Phyto	24	100
Grave 1994-62	Sedi 6	S	Poaceae sp.	Phyto	33	100
Grave 1994-62	Sedi 6	S	Poaceae sp.	Phyto	18	100
Grave 1994-62	Sedi 6	S	cf. *Zea mays*	Phyto	4	100
Grave 1994-62	Sedi 7	AB	Non diagnostic	Phyto	1	100

Grave 1994-62	Sedi 7	AB	Aristidoideae sp.	Phyto	6	100
Grave 1994-62	Sedi 7	AB	Poaceae sp.	Phyto	41	100
Grave 1994-62	Sedi 7	AB	Chloridoideae sp.	Phyto	2	100
Grave 1994-62	Sedi 7	AB	Arecaceae sp.	Phyto	19	100
Grave 1994-62	Sedi 7	AB	Poaceae sp.	Phyto	31	100
Grave 1994-62	Sedi 7	S	Non diagnostic	Phyto	8	100
Grave 1994-62	Sedi 7	S	Poaceae sp.	Phyto	8	100
Grave 1994-62	Sedi 7	S	Poaceae sp.	Phyto	43	100
Grave 1994-62	Sedi 7	S	Poaceae sp.	Phyto	37	100
Grave 1994-62	Sedi 7	S	Aristidoideae sp.	Phyto	1	100
Grave 1994-62	Sedi 7	S	Chloridoideae sp.	Phyto	3	100
Grave 1994-62	Sedi 8	AB	Non diagnostic	Phyto	5	100
Grave 1994-62	Sedi 8	AB	Aristidoideae sp.	Phyto	8	100
Grave 1994-62	Sedi 8	AB	Bambusoideae sp.	Phyto	3	100
Grave 1994-62	Sedi 8	AB	Poaceae sp.	Phyto	39	100
Grave 1994-62	Sedi 8	AB	Chloridoideae sp.	Phyto	1	100
Grave 1994-62	Sedi 8	AB	Panicoideae sp.	Phyto	21	100
Grave 1994-62	Sedi 8	AB	Poaceae sp.	Phyto	22	100
Grave 1994-62	Sedi 8	AB	Poaceae sp.	Phyto	1	100
Grave 1994-62	Sedi 8	S	cf. Boraginaceae sp.	Phyto	1	100
Grave 1994-62	Sedi 8	S	Non diagnostic	Phyto	7	100
Grave 1994-62	Sedi 8	S	Poaceae sp.	Phyto	28	100
Grave 1994-62	Sedi 8	S	Chloridoideae sp.	Phyto	1	100
Grave 1994-62	Sedi 8	S	Arecaceae sp.	Phyto	1	100
Grave 1994-62	Sedi 8	S	Panicoideae sp.	Phyto	23	100
Grave 1994-62	Sedi 8	S	Poaceae sp.	Phyto	10	100
Grave 1994-62	Sedi 8	S	Poaceae sp.	Phyto	25	100
Grave 1994-62	Sedi 8	S	Aristidoideae sp.	Phyto	4	100
Grave 1994-62	Sedi 9	AB	Bambusoideae sp.	Phyto	2	100

Grave 1994-62	Sedi 9	AB	Poaceae sp.	Phyto	45	100
Grave 1994-62	Sedi 9	AB	Panicoideae sp.	Phyto	32	100
Grave 1994-62	Sedi 9	AB	Poaceae sp.	Phyto	21	100
Grave 1994-62	Sedi 9	S	Non diagnostic	Phyto	6	100
Grave 1994-62	Sedi 9	S	Panicoideae sp.	Phyto	38	100
Grave 1994-62	Sedi 9	S	Poaceae sp.	Phyto	6	100
Grave 1994-62	Sedi 9	S	Poaceae sp.	Phyto	27	100
Grave 1994-62	Sedi 9	S	Poaceae sp.	Phyto	23	100
Grave 1994-69	Sedi 10	AB	Non diagnostic	Phyto	1	100
Grave 1994-69	Sedi 10	AB	cf. Marantaceae sp.	Phyto	1	100
Grave 1994-69	Sedi 10	AB	cf. *Zea mays*	Phyto	3	100
Grave 1994-69	Sedi 10	AB	UNK Phyto 8	Phyto	1	100
Grave 1994-69	Sedi 10	AB	Panicoideae sp.	Phyto	17	100
Grave 1994-69	Sedi 10	AB	Poaceae sp.	Phyto	4	100
Grave 1994-69	Sedi 10	AB	Poaceae sp.	Phyto	47	100
Grave 1994-69	Sedi 10	AB	Poaceae sp.	Phyto	24	100
Grave 1994-69	Sedi 10	AB	Arecaceae sp.	Phyto	2	100
Grave 1994-69	Sedi 10	S	Non diagnostic	Phyto	5	100
Grave 1994-69	Sedi 10	S	Panicoideae sp.	Phyto	13	100
Grave 1994-69	Sedi 10	S	Poaceae sp.	Phyto	47	100
Grave 1994-69	Sedi 10	S	Poaceae sp.	Phyto	35	100
Grave 1994-69	Sedi 11	AB	Aristidoideae sp.	Phyto	4	100
Grave 1994-69	Sedi 11	AB	Poaceae sp.	Phyto	21	100
Grave 1994-69	Sedi 11	AB	cf. *Zea mays*	Phyto	11	100
Grave 1994-69	Sedi 11	AB	Panicoideae sp.	Phyto	15	100
Grave 1994-69	Sedi 11	AB	Poaceae sp.	Phyto	49	100
Grave 1994-69	Sedi 11	S	Non diagnostic	Phyto	6	100
Grave 1994-69	Sedi 11	S	Aristidoideae sp.	Phyto	1	100
Grave 1994-69	Sedi 11	S	Asteraceae sp.	Phyto	4	100

Grave 1994-69	Sedi 11	S	cf. Boraginaceae sp.	Phyto	1	100
Grave 1994-69	Sedi 11	S	cf. *Zea mays*	Phyto	11	100
Grave 1994-69	Sedi 11	S	Poaceae sp.	Phyto	2	100
Grave 1994-69	Sedi 11	S	Poaceae sp.	Phyto	41	100
Grave 1994-69	Sedi 11	S	Poaceae sp.	Phyto	24	100
Grave 1994-69	Sedi 11	S	Panicoideae sp.	Phyto	10	100
Tomb 204	Sedi 12	AB	Non diagnostic	Phyto	3	100
Tomb 204	Sedi 12	AB	cf. *Zea mays*	Phyto	10	100
Tomb 204	Sedi 12	AB	*Zea mays*	Phyto	2	100
Tomb 204	Sedi 12	AB	Marantaceae sp.	Phyto	5	100
Tomb 204	Sedi 12	AB	Aristidoideae sp.	Phyto	2	100
Tomb 204	Sedi 12	AB	Panicoideae sp.	Phyto	6	100
Tomb 204	Sedi 12	AB	Poaceae sp.	Phyto	5	100
Tomb 204	Sedi 12	AB	Poaceae sp.	Phyto	36	100
Tomb 204	Sedi 12	AB	Poaceae sp.	Phyto	29	100
Tomb 204	Sedi 12	AB	Chloridoideae sp.	Phyto	2	100
Tomb 204	Sedi 12	S	Non diagnostic	Phyto	2	100
Tomb 204	Sedi 12	S	Chloridoideae sp.	Phyto	1	100
Tomb 204	Sedi 12	S	cf. *Zea mays*	Phyto	12	100
Tomb 204	Sedi 12	S	*Zea mays*	Phyto	2	100
Tomb 204	Sedi 12	S	Panicoideae sp.	Phyto	10	100
Tomb 204	Sedi 12	S	Poaceae sp.	Phyto	11	100
Tomb 204	Sedi 12	S	Poaceae sp.	Phyto	29	100
Tomb 204	Sedi 12	S	Poaceae sp.	Phyto	33	100
Tomb 204	Sedi 13	AB	Non diagnostic	Phyto	2	100
Tomb 204	Sedi 13	AB	Aristidoideae sp.	Phyto	7	100
Tomb 204	Sedi 13	AB	Poaceae sp.	Phyto	29	100
Tomb 204	Sedi 13	AB	Panicoideae sp.	Phyto	17	100
Tomb 204	Sedi 13	AB	Poaceae sp.	Phyto	42	100

Tomb 204	Sedi 13	AB	Poaceae sp.	Phyto	3	100
Tomb 204	Sedi 13	S	Non diagnostic	Phyto	1	100
Tomb 204	Sedi 13	S	Asteraceae sp.	Phyto	6	100
Tomb 204	Sedi 13	S	Poaceae sp.	Phyto	27	100
Tomb 204	Sedi 13	S	Marantaceae sp.	Phyto	1	100
Tomb 204	Sedi 13	S	Panicoideae sp.	Phyto	19	100
Tomb 204	Sedi 13	S	Poaceae sp.	Phyto	4	100
Tomb 204	Sedi 13	S	Poaceae sp.	Phyto	40	100
Tomb 204	Sedi 13	S	Aristidoideae sp.	Phyto	2	100
Tomb 204	Sedi 14	AB	Non diagnostic	Phyto	1	100
Tomb 204	Sedi 14	AB	Non diagnostic	Phyto	1	100
Tomb 204	Sedi 14	AB	Bambusoideae sp.	Phyto	17	100
Tomb 204	Sedi 14	AB	Poaceae sp.	Phyto	19	100
Tomb 204	Sedi 14	AB	Panicoideae sp.	Phyto	24	100
Tomb 204	Sedi 14	AB	Poaceae sp.	Phyto	38	100
Tomb 204	Sedi 14	S	Non diagnostic	Phyto	5	100
Tomb 204	Sedi 14	S	Arecaceae sp.	Phyto	1	100
Tomb 204	Sedi 14	S	cf. Arecaceae sp.	Phyto	7	100
Tomb 204	Sedi 14	S	Bambusoideae sp.	Phyto	30	100
Tomb 204	Sedi 14	S	Poaceae sp.	Phyto	22	100
Tomb 204	Sedi 14	S	cf. Marantaceae sp.	Phyto	1	100
Tomb 204	Sedi 14	S	Poaceae sp.	Phyto	3	100
Tomb 204	Sedi 14	S	Poaceae sp.	Phyto	22	100
Tomb 204	Sedi 14	S	Panicoideae sp.	Phyto	9	100
Tomb 204	Sedi 15	AB	Poaceae sp.	Phyto	28	100
Tomb 204	Sedi 15	AB	cf. Arecaceae sp.	Phyto	2	100
Tomb 204	Sedi 15	AB	Poaceae sp.	Phyto	2	100
Tomb 204	Sedi 15	AB	Panicoideae sp.	Phyto	28	100
Tomb 204	Sedi 15	AB	Poaceae sp.	Phyto	34	100

Tomb 204	Sedi 15	AB	Bambusoideae sp.	Phyto	6	100
Tomb 204	Sedi 15	S	Non diagnostic	Phyto	1	100
Tomb 204	Sedi 15	S	Bambusoideae sp.	Phyto	10	100
Tomb 204	Sedi 15	S	cf. Boraginaceae sp.	Phyto	1	100
Tomb 204	Sedi 15	S	Non diagnostic	Phyto	1	100
Tomb 204	Sedi 15	S	Panicoideae sp.	Phyto	20	100
Tomb 204	Sedi 15	S	Poaceae sp.	Phyto	28	100
Tomb 204	Sedi 15	S	Poaceae sp.	Phyto	20	100
Tomb 204	Sedi 15	S	Poaceae sp.	Phyto	19	100
Tomb 204	Sedi 16	AB	Aristidoideae sp.	Phyto	2	100
Tomb 204	Sedi 16	AB	Bambusoideae sp.	Phyto	8	100
Tomb 204	Sedi 16	AB	Poaceae sp.	Phyto	22	100
Tomb 204	Sedi 16	AB	cf. *Zea mays*	Phyto	3	100
Tomb 204	Sedi 16	AB	*Zea mays*	Phyto	2	100
Tomb 204	Sedi 16	AB	*Zea mays*	Starch	1	100
Tomb 204	Sedi 16	AB	UNK Phyto 9	Phyto	1	100
Tomb 204	Sedi 16	AB	Panicoideae sp.	Phyto	16	100
Tomb 204	Sedi 16	AB	Poaceae sp.	Phyto	43	100
Tomb 204	Sedi 16	AB	Poaceae sp.	Phyto	2	100
Tomb 204	Sedi 16	S	Non diagnostic	Phyto	2	100
Tomb 204	Sedi 16	S	Poaceae sp.	Phyto	29	100
Tomb 204	Sedi 16	S	Panicoideae sp.	Phyto	21	100
Tomb 204	Sedi 16	S	Bambusoideae sp.	Phyto	9	100
Tomb 204	Sedi 16	S	Poaceae sp.	Phyto	37	100
Tomb 204	Sedi 16	S	cf. *Zea mays*	Phyto	2	100
Tomb 212	Sedi 17	AB	Non diagnostic	Phyto	1	100
Tomb 212	Sedi 17	AB	Non diagnostic	Phyto	2	100
Tomb 212	Sedi 17	AB	Arecaceae sp.	Phyto	1	100
Tomb 212	Sedi 17	AB	cf. *Zea mays*	Phyto	5	100

Tomb 212	Sedi 17	AB	*Zea mays*	Phyto	7	100
Tomb 212	Sedi 17	AB	Panicoideae sp.	Phyto	16	100
Tomb 212	Sedi 17	AB	Poaceae sp.	Phyto	37	100
Tomb 212	Sedi 17	AB	Poaceae sp.	Phyto	31	100
Tomb 212	Sedi 17	S	Non diagnostic	Phyto	2	100
Tomb 212	Sedi 17	S	*Cucurbita* sp.	Phyto	1	100
Tomb 212	Sedi 17	S	Poaceae sp.	Phyto	20	100
Tomb 212	Sedi 17	S	Poaceae sp.	Phyto	21	100
Tomb 212	Sedi 17	S	Poaceae sp.	Phyto	21	100
Tomb 212	Sedi 17	S	Panicoideae sp.	Phyto	25	100
Tomb 212	Sedi 17	S	*Zea mays*	Phyto	6	100
Tomb 212	Sedi 17	S	cf. *Zea mays*	Phyto	4	100
Tomb 212	Sedi 18	AB	Poaceae sp.	Phyto	32	100
Tomb 212	Sedi 18	AB	cf. Marantaceae sp.	Phyto	1	100
Tomb 212	Sedi 18	AB	Chloridoideae sp.	Phyto	6	100
Tomb 212	Sedi 18	AB	UNK Phyto 9	Phyto	1	100
Tomb 212	Sedi 18	AB	Panicoideae sp.	Phyto	27	100
Tomb 212	Sedi 18	AB	Poaceae sp.	Phyto	5	100
Tomb 212	Sedi 18	AB	Poaceae sp.	Phyto	28	100
Tomb 212	Sedi 18	S	cf. Marantaceae sp.	Phyto	1	100
Tomb 212	Sedi 18	S	[DIATOM]	[DIATOM]	1	100
Tomb 212	Sedi 18	S	cf. Boraginaceae sp.	Phyto	1	100
Tomb 212	Sedi 18	S	Non diagnostic	Phyto	1	100
Tomb 212	Sedi 18	S	Poaceae sp.	Phyto	39	100
Tomb 212	Sedi 18	S	Poaceae sp.	Phyto	44	100
Tomb 212	Sedi 18	S	Chloridoideae sp.	Phyto	6	100
Tomb 212	Sedi 18	S	Panicoideae sp.	Phyto	7	100
Tomb 214	Sedi 19	AB	Bambusoideae sp.	Phyto	14	100
Tomb 214	Sedi 19	AB	[DIATOM]	[DIATOM]	3	100

Tomb 214	Sedi 19	AB	cf. *Zea mays*	Phyto	10	100
Tomb 214	Sedi 19	AB	cf. Fabaceae sp.	Phyto	1	100
Tomb 214	Sedi 19	AB	Poaceae sp.	Phyto	36	100
Tomb 214	Sedi 19	AB	Poaceae sp.	Phyto	17	100
Tomb 214	Sedi 19	AB	Panicoideae sp.	Phyto	13	100
Tomb 214	Sedi 19	AB	cf. Marantaceae sp.	Phyto	6	100
Tomb 214	Sedi 19	S	Poaceae sp.	Phyto	31	100
Tomb 214	Sedi 19	S	Panicoideae sp.	Phyto	14	100
Tomb 214	Sedi 19	S	Poaceae sp.	Phyto	45	100
Tomb 214	Sedi 19	S	Bambusoideae sp.	Phyto	6	100
Tomb 214	Sedi 19	S	cf. *Zea mays*	Phyto	4	100
South Platform	Sedi 20	AB	Non diagnostic	Phyto	1	100
South Platform	Sedi 20	AB	Poaceae sp.	Phyto	26	100
South Platform	Sedi 20	AB	cf. Marantaceae sp.	Phyto	2	100
South Platform	Sedi 20	AB	cf. *Zea mays*	Phyto	1	100
South Platform	Sedi 20	AB	Non diagnostic	Phyto	1	100
South Platform	Sedi 20	AB	Non diagnostic	Phyto	1	100
South Platform	Sedi 20	AB	Panicoideae sp.	Phyto	9	100
South Platform	Sedi 20	AB	Poaceae sp.	Phyto	59	100
South Platform	Sedi 20	S	Non diagnostic	Phyto	2	100
South Platform	Sedi 20	S	cf. Marantaceae sp.	Phyto	1	100
South Platform	Sedi 20	S	Poaceae sp.	Phyto	53	100
South Platform	Sedi 20	S	Poaceae sp.	Phyto	44	100
Element 2	Sedi 21	AB	Non diagnostic	Phyto	2	100
Element 2	Sedi 21	AB	Poaceae sp.	Phyto	30	100
Element 2	Sedi 21	AB	Chloridoideae sp.	Phyto	1	100
Element 2	Sedi 21	AB	[DIATOM]	[DIATOM]	2	100
Element 2	Sedi 21	AB	*Zea mays*	Phyto	9	100
Element 2	Sedi 21	AB	Panicoideae sp.	Phyto	40	100

Element 2	Sedi 21	AB	Poaceae sp.	Phyto	15	100
Element 2	Sedi 21	AB	Non diagnostic	Phyto	1	100
Element 2	Sedi 21	S	Non diagnostic	Phyto	1	100
Element 2	Sedi 21	S	cf. *Capsicum* sp.	Starch	1	100
Element 2	Sedi 21	S	Poaceae sp.	Phyto	11	100
Element 2	Sedi 21	S	Poaceae sp.	Phyto	41	100
Element 2	Sedi 21	S	Poaceae sp.	Phyto	23	100
Element 2	Sedi 21	S	*Zea mays*	Phyto	4	100
Element 2	Sedi 21	S	Panicoideae sp.	Phyto	19	100
Element 4	Sedi 22	AB	Non diagnostic	Phyto	1	29
Element 4	Sedi 22	AB	Poaceae sp.	Phyto	1	29
Element 4	Sedi 22	AB	cf. Marantaceae sp.	Phyto	1	29
Element 4	Sedi 22	AB	Panicoideae sp.	Phyto	2	29
Element 4	Sedi 22	AB	[POLLEN]	[POLLEN]	1	29
Element 4	Sedi 22	AB	Poaceae sp.	Phyto	23	29
Element 4	Sedi 22	S	Non diagnostic	Phyto	1	11
Element 4	Sedi 22	S	Dam starch	Starch	1	11
Element 4	Sedi 22	S	Poaceae sp.	Phyto	2	11
Element 4	Sedi 22	S	Poaceae sp.	Phyto	7	11
Element 5	Sedi 23	AB	Non diagnostic	Phyto	2	15
Element 5	Sedi 23	AB	Cyperaceae sp.	Phyto	1	15
Element 5	Sedi 23	AB	Poaceae sp.	Phyto	9	15
Element 5	Sedi 23	AB	Poaceae sp.	Phyto	3	15
Element 5	Sedi 23	S	Non diagnostic	Phyto	1	5
Element 5	Sedi 23	S	Poaceae sp.	Phyto	2	5
Element 5	Sedi 23	S	Poaceae sp.	Phyto	2	5
Element 5	Sedi 24	AB	Non diagnostic	Phyto	1	100
Element 5	Sedi 24	AB	Non diagnostic	Phyto	5	100
Element 5	Sedi 24	AB	Bambusoideae sp.	Phyto	7	100

Element 5	Sedi 24	AB	Chloridoideae sp.	Phyto	12	100
Element 5	Sedi 24	AB	Poaceae sp.	Starch	1	100
Element 5	Sedi 24	AB	Non diagnostic	Phyto	1	100
Element 5	Sedi 24	AB	Panicoideae sp.	Phyto	13	100
Element 5	Sedi 24	AB	Poaceae sp.	Phyto	39	100
Element 5	Sedi 24	AB	Poaceae sp.	Phyto	21	100
Element 5	Sedi 24	S	Non diagnostic	Phyto	1	100
Element 5	Sedi 24	S	Poaceae sp.	Phyto	52	100
Element 5	Sedi 24	S	Poaceae sp.	Phyto	47	100
Element 8	Sedi 25	AB	Non diagnostic	Phyto	3	100
Element 8	Sedi 25	AB	Poaceae sp.	Phyto	40	100
Element 8	Sedi 25	AB	Poaceae sp.	Phyto	57	100
Element 8	Sedi 25	S	Non diagnostic	Phyto	1	100
Element 8	Sedi 25	S	Non diagnostic	Phyto	1	100
Element 8	Sedi 25	S	Dam starch	Starch	1	100
Element 8	Sedi 25	S	Poaceae sp.	Phyto	51	100
Element 8	Sedi 25	S	Poaceae sp.	Phyto	46	100
Element 8	Sedi 26	AB	Aristidoideae sp.	Phyto	3	100
Element 8	Sedi 26	AB	Bambusoideae sp.	Phyto	2	100
Element 8	Sedi 26	AB	Poaceae sp.	Phyto	23	100
Element 8	Sedi 26	AB	cf. *Cyperus* sp.	Phyto	1	100
Element 8	Sedi 26	AB	Dam starch	Starch	1	100
Element 8	Sedi 26	AB	[POLLEN]	[POLLEN]	1	100
Element 8	Sedi 26	AB	Panicoideae sp.	Phyto	15	100
Element 8	Sedi 26	AB	Poaceae sp.	Phyto	54	100
Element 8	Sedi 26	S	Poaceae sp.	Phyto	35	100
Element 8	Sedi 26	S	Poaceae sp.	Starch	1	100
Element 8	Sedi 26	S	Poaceae sp.	Phyto	39	100
Element 8	Sedi 26	S	Panicoideae sp.	Phyto	25	100

Element 4	Sedi 27(1)	AB	Non diagnostic	Phyto	1	100
Element 4	Sedi 27(1)	AB	cf. Marantaceae sp.	Phyto	3	100
Element 4	Sedi 27(1)	AB	Chloridoideae sp.	Phyto	5	100
Element 4	Sedi 27(1)	AB	Poaceae sp.	Phyto	58	100
Element 4	Sedi 27(1)	AB	Poaceae sp.	Phyto	33	100
Element 4	Sedi 27(1)	S	Aristidoideae sp.	Phyto	1	100
Element 4	Sedi 27(1)	S	Panicoideae sp.	Phyto	12	100
Element 4	Sedi 27(1)	S	Poaceae sp.	Phyto	46	100
Element 4	Sedi 27(1)	S	Chloridoideae sp.	Phyto	11	100
Element 4	Sedi 27(1)	S	Poaceae sp.	Phyto	30	100
Element 4	Sedi 27(2)	AB	Non diagnostic	Phyto	1	100
Element 4	Sedi 27(2)	AB	Bambusoideae sp.	Phyto	2	100
Element 4	Sedi 27(2)	AB	UNK Phyto 10	Phyto	1	100
Element 4	Sedi 27(2)	AB	Panicoideae sp.	Phyto	21	100
Element 4	Sedi 27(2)	AB	Poaceae sp.	Phyto	47	100
Element 4	Sedi 27(2)	AB	Non diagnostic	Phyto	1	100
Element 4	Sedi 27(2)	AB	Poaceae sp.	Phyto	27	100
Element 4	Sedi 27(2)	S	Non diagnostic	Phyto	1	100
Element 4	Sedi 27(2)	S	[POLLEN]	[POLLEN]	6	100
Element 4	Sedi 27(2)	S	Poaceae sp.	Phyto	50	100
Element 4	Sedi 27(2)	S	Poaceae sp.	Phyto	43	100
Grave 1994-61	Sedi 28	AB	Non diagnostic	Phyto	3	100
Grave 1994-61	Sedi 28	AB	Poaceae sp.	Phyto	26	100
Grave 1994-61	Sedi 28	AB	cf. Piperaceae sp.	Phyto	1	100
Grave 1994-61	Sedi 28	AB	cf. *Zea mays*	Phyto	11	100
Grave 1994-61	Sedi 28	AB	cf. Marantaceae sp.	Phyto	2	100
Grave 1994-61	Sedi 28	AB	Poaceae sp.	Phyto	35	100
Grave 1994-61	Sedi 28	AB	Panicoideae sp.	Phyto	22	100
Grave 1994-61	Sedi 28	S	Non diagnostic	Phyto	4	100

Grave 1994-61	Sedi 28	S	Aristidoideae sp.	Phyto	2	100
Grave 1994-61	Sedi 28	S	*Cucurbita* sp.	Phyto	1	100
Grave 1994-61	Sedi 28	S	cf. *Zea mays*	Phyto	7	100
Grave 1994-61	Sedi 28	S	Poaceae sp.	Phyto	9	100
Grave 1994-61	Sedi 28	S	Poaceae sp.	Phyto	36	100
Grave 1994-61	Sedi 28	S	Poaceae sp.	Phyto	24	100
Grave 1994-61	Sedi 28	S	Panicoideae sp.	Phyto	17	100
Tomb 204	Sedi 29	AB	Non diagnostic	Phyto	4	100
Tomb 204	Sedi 29	AB	Arecaceae sp.	Phyto	4	100
Tomb 204	Sedi 29	AB	Aristidoideae sp.	Phyto	1	100
Tomb 204	Sedi 29	AB	Poaceae sp.	Phyto	17	100
Tomb 204	Sedi 29	AB	*Zea mays*	Phyto	4	100
Tomb 204	Sedi 29	AB	Fabaceae sp.	Phyto	1	100
Tomb 204	Sedi 29	AB	Panicoideae sp.	Phyto	28	100
Tomb 204	Sedi 29	AB	Poaceae sp.	Phyto	1	100
Tomb 204	Sedi 29	AB	Poaceae sp.	Phyto	21	100
Tomb 204	Sedi 29	AB	Chloridoideae sp.	Phyto	3	100
Tomb 204	Sedi 29	AB	cf. *Zea mays*	Phyto	15	100
Tomb 204	Sedi 29	AB	Bambusoideae sp.	Phyto	1	100
Tomb 204	Sedi 29	S	Non diagnostic	Phyto	2	100
Tomb 204	Sedi 29	S	Arecaceae sp.	Phyto	1	100
Tomb 204	Sedi 29	S	Bambusoideae sp.	Phyto	2	100
Tomb 204	Sedi 29	S	Chloridoideae sp.	Phyto	3	100
Tomb 204	Sedi 29	S	Dam starch	Starch	1	100
Tomb 204	Sedi 29	S	cf. *Zea mays*	Phyto	12	100
Tomb 204	Sedi 29	S	UNK Phyto 11	Phyto	1	100
Tomb 204	Sedi 29	S	Panicoideae sp.	Phyto	18	100
Tomb 204	Sedi 29	S	Poaceae sp.	Phyto	7	100
Tomb 204	Sedi 29	S	Poaceae sp.	Phyto	29	100

Tomb 204	Sedi 29	S	Poaceae sp.	Phyto	22	100
Tomb 204	Sedi 29	S	Aristidoideae sp.	Phyto	2	100
Tomb 204	Sedi 30	AB	Poaceae sp.	Phyto	27	100
Tomb 204	Sedi 30	AB	[DIATOM]	[DIATOM]	1	100
Tomb 204	Sedi 30	AB	*Zea mays*	Phyto	3	100
Tomb 204	Sedi 30	AB	cf. *Zea mays*	Phyto	8	100
Tomb 204	Sedi 30	AB	Poaceae sp.	Phyto	1	100
Tomb 204	Sedi 30	AB	Poaceae sp.	Phyto	32	100
Tomb 204	Sedi 30	AB	Panicoideae sp.	Phyto	28	100
Tomb 204	Sedi 30	S	Non diagnostic	Phyto	2	100
Tomb 204	Sedi 30	S	cf. *Zea mays*	Phyto	11	100
Tomb 204	Sedi 30	S	*Zea mays*	Phyto	4	100
Tomb 204	Sedi 30	S	Poaceae sp.	Phyto	27	100
Tomb 204	Sedi 30	S	Poaceae sp.	Phyto	35	100
Tomb 204	Sedi 30	S	Panicoideae sp.	Phyto	21	100
Tomb 207	Sedi 31	AB	Non diagnostic	Phyto	3	100
Tomb 207	Sedi 31	AB	cf. Fabaceae sp.	Phyto	1	100
Tomb 207	Sedi 31	AB	Arecaceae sp.	Phyto	2	100
Tomb 207	Sedi 31	AB	Aristidoideae sp.	Phyto	1	100
Tomb 207	Sedi 31	AB	cf. *Zea mays*	Phyto	12	100
Tomb 207	Sedi 31	AB	*Zea mays*	Phyto	7	100
Tomb 207	Sedi 31	AB	Panicoideae sp.	Phyto	24	100
Tomb 207	Sedi 31	AB	[POLLEN]	[POLLEN]	2	100
Tomb 207	Sedi 31	AB	Poaceae sp.	Phyto	29	100
Tomb 207	Sedi 31	AB	Poaceae sp.	Phyto	16	100
Tomb 207	Sedi 31	AB	Poaceae sp.	Phyto	3	100
Tomb 207	Sedi 31	S	Non diagnostic	Phyto	1	100
Tomb 207	Sedi 31	S	Aristidoideae sp.	Phyto	2	100
Tomb 207	Sedi 31	S	Poaceae sp.	Phyto	14	100

Tomb 207	Sedi 31	S	Poaceae sp.	Phyto	32	100
Tomb 207	Sedi 31	S	Poaceae sp.	Phyto	26	100
Tomb 207	Sedi 31	S	Boraginaceae sp.	Phyto	1	100
Tomb 207	Sedi 31	S	Dam starch	Starch	1	100
Tomb 207	Sedi 31	S	Panicoideae sp.	Phyto	14	100
Tomb 207	Sedi 31	S	*Zea mays*	Phyto	4	100
Tomb 207	Sedi 31	S	cf. *Zea mays*	Phyto	5	100
Tomb 207	Sedi 32	AB	Non diagnostic	Phyto	1	100
Tomb 207	Sedi 32	AB	Poaceae sp.	Phyto	27	100
Tomb 207	Sedi 32	AB	*Zea mays*	Phyto	14	100
Tomb 207	Sedi 32	AB	cf. *Zea mays*	Phyto	13	100
Tomb 207	Sedi 32	AB	Non diagnostic	Phyto	1	100
Tomb 207	Sedi 32	AB	Poaceae sp.	Phyto	21	100
Tomb 207	Sedi 32	AB	Panicoideae sp.	Phyto	22	100
Tomb 207	Sedi 32	AB	cf. Marantaceae sp.	Phyto	1	100
Tomb 207	Sedi 32	S	Non diagnostic	Phyto	6	100
Tomb 207	Sedi 32	S	Poaceae sp.	Phyto	28	100
Tomb 207	Sedi 32	S	Boraginaceae sp.	Phyto	2	100
Tomb 207	Sedi 32	S	cf. Marantaceae sp.	Phyto	1	100
Tomb 207	Sedi 32	S	[DIATOM]	[DIATOM]	1	100
Tomb 207	Sedi 32	S	cf. *Zea mays*	Phyto	2	100
Tomb 207	Sedi 32	S	*Zea mays*	Phyto	1	100
Tomb 207	Sedi 32	S	Panicoideae sp.	Phyto	6	100
Tomb 207	Sedi 32	S	Poaceae sp.	Phyto	32	100
Tomb 207	Sedi 32	S	Poaceae sp.	Phyto	21	100
Tomb 213	Sedi 33	AB	Non diagnostic	Phyto	3	100
Tomb 213	Sedi 33	AB	Arecaceae sp.	Phyto	1	100
Tomb 213	Sedi 33	AB	Bambusoideae sp.	Phyto	3	100
Tomb 213	Sedi 33	AB	Poaceae sp.	Phyto	24	100

Tomb 213	Sedi 33	AB	Chloridoideae sp.	Phyto	6	100
Tomb 213	Sedi 33	AB	[DIATOM]	[DIATOM]	1	100
Tomb 213	Sedi 33	AB	UNK Remain 3	UNK	1	100
Tomb 213	Sedi 33	AB	Panicoideae sp.	Phyto	23	100
Tomb 213	Sedi 33	AB	Poaceae sp.	Phyto	38	100
Tomb 213	Sedi 33	S	Non diagnostic	Phyto	1	100
Tomb 213	Sedi 33	S	Poaceae sp.	Phyto	5	100
Tomb 213	Sedi 33	S	Chloridoideae sp.	Phyto	9	100
Tomb 213	Sedi 33	S	Cyperaceae sp.	Phyto	1	100
Tomb 213	Sedi 33	S	[DIATOM]	[DIATOM]	1	100
Tomb 213	Sedi 33	S	*Calathea* sp.	Phyto	2	100
Tomb 213	Sedi 33	S	Poaceae sp.	Phyto	34	100
Tomb 213	Sedi 33	S	Poaceae sp.	Phyto	25	100
Tomb 213	Sedi 33	S	Panicoideae sp.	Phyto	21	100
Tomb 213	Sedi 33	S	Bambusoideae sp.	Phyto	1	100
Tomb 213	Sedi 34	AB	Non diagnostic	Phyto	1	100
Tomb 213	Sedi 34	AB	Poaceae sp.	Phyto	25	100
Tomb 213	Sedi 34	AB	Cyperaceae sp.	Phyto	1	100
Tomb 213	Sedi 34	AB	[DIATOM]	[DIATOM]	12	100
Tomb 213	Sedi 34	AB	Panicoideae sp.	Phyto	23	100
Tomb 213	Sedi 34	AB	Poaceae sp.	Phyto	3	100
Tomb 213	Sedi 34	AB	Poaceae sp.	Phyto	27	100
Tomb 213	Sedi 34	AB	Chloridoideae sp.	Phyto	8	100
Tomb 213	Sedi 34	S	Non diagnostic	Phyto	2	100
Tomb 213	Sedi 34	S	Poaceae sp.	Phyto	24	100
Tomb 213	Sedi 34	S	cf. Boraginaceae sp.	Phyto	2	100
Tomb 213	Sedi 34	S	Chloridoideae sp.	Phyto	5	100
Tomb 213	Sedi 34	S	Cyperaceae sp.	Phyto	13	100
Tomb 213	Sedi 34	S	[DIATOM]	[DIATOM]	9	100

Tomb 213	Sedi 34	S	Poaceae sp.	Phyto	25	100
Tomb 213	Sedi 34	S	Panicoideae sp.	Phyto	14	100
Tomb 213	Sedi 34	S	Poaceae sp.	Phyto	6	100
Sacred Axis	Sedi 35	AB	Bambusoideae sp.	Phyto	9	100
Sacred Axis	Sedi 35	AB	cf. Marantaceae sp.	Phyto	3	100
Sacred Axis	Sedi 35	AB	Panicoideae sp.	Phyto	17	100
Sacred Axis	Sedi 35	AB	[POLLEN]	[POLLEN]	6	100
Sacred Axis	Sedi 35	AB	Poaceae sp.	Phyto	35	100
Sacred Axis	Sedi 35	AB	Poaceae sp.	Phyto	30	100
Sacred Axis	Sedi 35	S	Non diagnostic	Phyto	2	100
Sacred Axis	Sedi 35	S	cf. Marantaceae sp.	Phyto	1	100
Sacred Axis	Sedi 35	S	cf. *Zea mays*	Phyto	5	100
Sacred Axis	Sedi 35	S	Poaceae sp.	Phyto	5	100
Sacred Axis	Sedi 35	S	Poaceae sp.	Phyto	37	100
Sacred Axis	Sedi 35	S	Poaceae sp.	Phyto	29	100
Sacred Axis	Sedi 35	S	Panicoideae sp.	Phyto	21	100
Element 4	Sedi 36	AB	Poaceae sp.	Phyto	22	100
Element 4	Sedi 36	AB	cf. *Zea mays*	Phyto	2	100
Element 4	Sedi 36	AB	cf. Marantaceae sp.	Phyto	2	100
Element 4	Sedi 36	AB	Dam starch	Starch	1	100
Element 4	Sedi 36	AB	[DIATOM]	[DIATOM]	1	100
Element 4	Sedi 36	AB	Panicoideae sp.	Phyto	9	100
Element 4	Sedi 36	AB	Poaceae sp.	Phyto	63	100
Element 4	Sedi 36	S	Non diagnostic	Phyto	3	100
Element 4	Sedi 36	S	Poaceae sp.	Phyto	29	100
Element 4	Sedi 36	S	cf. *Zea mays*	Phyto	4	100
Element 4	Sedi 36	S	Marantaceae sp.	Phyto	1	100
Element 4	Sedi 36	S	Panicoideae sp.	Phyto	19	100
Element 4	Sedi 36	S	Poaceae sp.	Phyto	39	100

Element 4	Sedi 36	S	Poaceae sp.	Phyto	5	100
Grave 1994-62	Sedi 37	AB	Non diagnostic	Phyto	2	100
Grave 1994-62	Sedi 37	AB	Non diagnostic	Phyto	1	100
Grave 1994-62	Sedi 37	AB	Poaceae sp.	Phyto	27	100
Grave 1994-62	Sedi 37	AB	cf. Marantaceae sp.	Phyto	1	100
Grave 1994-62	Sedi 37	AB	[DIATOM]	[DIATOM]	7	100
Grave 1994-62	Sedi 37	AB	Panicoideae sp.	Phyto	33	100
Grave 1994-62	Sedi 37	AB	Poaceae sp.	Phyto	29	100
Grave 1994-62	Sedi 37	S	Non diagnostic	Phyto	4	100
Grave 1994-62	Sedi 37	S	Poaceae sp.	Phyto	27	100
Grave 1994-62	Sedi 37	S	[DIATOM]	[DIATOM]	2	100
Grave 1994-62	Sedi 37	S	Panicoideae sp.	Phyto	25	100
Grave 1994-62	Sedi 37	S	Poaceae sp.	Phyto	36	100
Grave 1994-62	Sedi 37	S	Poaceae sp.	Phyto	6	100
Structure W1-B	Sedi 38	AB	Non diagnostic	Phyto	1	100
Structure W1-B	Sedi 38	AB	Panicoideae sp.	Phyto	35	100
Structure W1-B	Sedi 38	AB	Poaceae sp.	Phyto	42	100
Structure W1-B	Sedi 38	AB	Poaceae sp.	Phyto	22	100
Structure W1-B	Sedi 38	S	Non diagnostic	Phyto	3	100
Structure W1-B	Sedi 38	S	Poaceae sp.	Phyto	32	100
Structure W1-B	Sedi 38	S	cf. Marantaceae sp.	Phyto	1	100
Structure W1-B	Sedi 38	S	Poaceae sp.	Phyto	1	100

Structure W1-B	Sedi 38	S	[POLLEN]	[POLLEN]	2	100
Structure W1-B	Sedi 38	S	Poaceae sp.	Phyto	41	100
Structure W1-B	Sedi 38	S	Panicoideae sp.	Phyto	20	100
Structure W1-C	Sedi 39	AB	Bambusoideae sp.	Phyto	9	100
Structure W1-C	Sedi 39	AB	Poaceae sp.	Phyto	15	100
Structure W1-C	Sedi 39	AB	cf. Marantaceae sp.	Phyto	1	100
Structure W1-C	Sedi 39	AB	cf. *Zea mays*	Phyto	1	100
Structure W1-C	Sedi 39	AB	Poaceae sp.	Phyto	55	100
Structure W1-C	Sedi 39	AB	Panicoideae sp.	Phyto	19	100
Structure W1-C	Sedi 39	S	Poaceae sp.	Phyto	14	100
Structure W1-C	Sedi 39	S	cf. Burseraceae sp.	Phyto	1	100
Structure W1-C	Sedi 39	S	cf. Cyperaceae sp.	Phyto	1	100
Structure W1-C	Sedi 39	S	cf. Marantaceae sp.	Phyto	1	100
Structure W1-C	Sedi 39	S	Poaceae sp.	Phyto	16	100
Structure W1-C	Sedi 39	S	Panicoideae sp.	Phyto	13	100
Structure W1-C	Sedi 39	S	Poaceae sp.	Phyto	45	100

Structure W1-C	Sedi 39	S	Bambusoideae sp.	Phyto	9	100
Structure W1-A	Sedi 40	AB	Non diagnostic	Phyto	3	100
Structure W1-A	Sedi 40	AB	Poaceae sp.	Phyto	24	100
Structure W1-A	Sedi 40	AB	cf. *Zea mays*	Phyto	7	100
Structure W1-A	Sedi 40	AB	*Zea mays*	Phyto	5	100
Structure W1-A	Sedi 40	AB	Panicoideae sp.	Phyto	19	100
Structure W1-A	Sedi 40	AB	Poaceae sp.	Phyto	33	100
Structure W1-A	Sedi 40	AB	Chloridoideae sp.	Phyto	9	100
Structure W1-A	Sedi 40	S	Non diagnostic	Phyto	1	100
Structure W1-A	Sedi 40	S	Poaceae sp.	Phyto	25	100
Structure W1-A	Sedi 40	S	Chloridoideae sp.	Phyto	13	100
Structure W1-A	Sedi 40	S	Panicoideae sp.	Phyto	19	100
Structure W1-A	Sedi 40	S	Poaceae sp.	Phyto	42	100
Structure W1-B	Sedi 41	AB	Non diagnostic	Phyto	2	100
Structure W1-B	Sedi 41	AB	Panicoideae sp.	Phyto	23	100
Structure W1-B	Sedi 41	AB	Poaceae sp.	Phyto	6	100

Structure W1-B	Sedi 41	AB	Poaceae sp.	Phyto	36	100
Structure W1-B	Sedi 41	AB	Poaceae sp.	Phyto	29	100
Structure W1-B	Sedi 41	AB	cf. *Zea mays*	Phyto	4	100
Structure W1-B	Sedi 41	S	Non diagnostic	Phyto	3	100
Structure W1-B	Sedi 41	S	Poaceae sp.	Phyto	21	100
Structure W1-B	Sedi 41	S	cf. *Zea mays*	Phyto	10	100
Structure W1-B	Sedi 41	S	Poaceae sp.	Phyto	2	100
Structure W1-B	Sedi 41	S	Panicoideae sp.	Phyto	27	100
Structure W1-B	Sedi 41	S	Poaceae sp.	Phyto	37	100
Altar	Sedi 42	AB	Non diagnostic	Phyto	1	100
Altar	Sedi 42	AB	Arecaceae sp.	Phyto	4	100
Altar	Sedi 42	AB	Aristidoideae sp.	Phyto	7	100
Altar	Sedi 42	AB	Poaceae sp.	Phyto	22	100
Altar	Sedi 42	AB	Chloridoideae sp.	Phyto	13	100
Altar	Sedi 42	AB	Cyperaceae sp.	Phyto	1	100
Altar	Sedi 42	AB	Panicoideae sp.	Phyto	9	100
Altar	Sedi 42	AB	Poaceae sp.	Phyto	43	100
Altar	Sedi 42	S	Poaceae sp.	Phyto	34	69
Altar	Sedi 42	S	Poaceae sp.	Phyto	23	69
Altar	Sedi 42	S	Chloridoideae sp.	Phyto	12	69
North Platform	Sedi 43	AB	Non diagnostic	Phyto	1	100
North Platform	Sedi 43	AB	Arecaceae sp.	Phyto	1	100

North Platform	Sedi 43	AB	Poaceae sp.	Phyto	23	100
North Platform	Sedi 43	AB	Chloridoideae sp.	Phyto	7	100
North Platform	Sedi 43	AB	[DIATOM]	[DIATOM]	1	100
North Platform	Sedi 43	AB	cf. *Zea mays*	Phyto	2	100
North Platform	Sedi 43	AB	Panicoideae sp.	Phyto	21	100
North Platform	Sedi 43	AB	Poaceae sp.	Phyto	39	100
North Platform	Sedi 43	AB	Poaceae sp.	Phyto	5	100
North Platform	Sedi 43	S	Non diagnostic	Phyto	7	70
North Platform	Sedi 43	S	Arecaceae sp.	Phyto	1	70
North Platform	Sedi 43	S	Aristidoideae sp.	Phyto	3	70
North Platform	Sedi 43	S	Dam starch	Starch	1	70
North Platform	Sedi 43	S	Panicoideae sp.	Phyto	11	70
North Platform	Sedi 43	S	Poaceae sp.	Phyto	7	70
North Platform	Sedi 43	S	Poaceae sp.	Phyto	27	70
North Platform	Sedi 43	S	Chloridoideae sp.	Phyto	1	70
North Platform	Sedi 43	S	Poaceae sp.	Phyto	12	70
Patio VG	Sedi 44	AB	Non diagnostic	Phyto	2	100
Patio VG	Sedi 44	AB	Bambusoideae sp.	Phyto	5	100
Patio VG	Sedi 44	AB	Poaceae sp.	Phyto	21	100
Patio VG	Sedi 44	AB	Chloridoideae sp.	Phyto	12	100
Patio VG	Sedi 44	AB	[DIATOM]	[DIATOM]	9	100
Patio VG	Sedi 44	AB	Panicoideae sp.	Phyto	25	100
Patio VG	Sedi 44	AB	Poaceae sp.	Phyto	21	100
Patio VG	Sedi 44	AB	Aristidoideae sp.	Phyto	5	100
Patio VG	Sedi 44	S	Non diagnostic	Phyto	1	100
Patio VG	Sedi 44	S	Non diagnostic	Phyto	5	100
Patio VG	Sedi 44	S	Aristidoideae sp.	Phyto	5	100
Patio VG	Sedi 44	S	Poaceae sp.	Phyto	19	100
Patio VG	Sedi 44	S	Panicoideae sp.	Phyto	22	100

Patio VG	Sedi 44	S	Poaceae sp.	Phyto	21	100
Patio VG	Sedi 44	S	Poaceae sp.	Phyto	15	100
Patio VG	Sedi 44	S	Chloridoideae sp.	Phyto	12	100
North Platform	Sedi 45	AB	Arecaceae sp.	Phyto	1	100
North Platform	Sedi 45	AB	Aristidoideae sp.	Phyto	7	100
North Platform	Sedi 45	AB	Poaceae sp.	Phyto	27	100
North Platform	Sedi 45	AB	Chloridoideae sp.	Phyto	11	100
North Platform	Sedi 45	AB	cf. *Zea mays*	Phyto	3	100
North Platform	Sedi 45	AB	*Zea mays*	Phyto	1	100
North Platform	Sedi 45	AB	Poaceae sp.	Phyto	41	100
North Platform	Sedi 45	AB	Panicoideae sp.	Phyto	9	100
North Platform	Sedi 45	S	Non diagnostic	Phyto	2	100
North Platform	Sedi 45	S	cf. Marantaceae sp.	Phyto	1	100
North Platform	Sedi 45	S	Panicoideae sp.	Phyto	5	100
North Platform	Sedi 45	S	Poaceae sp.	Phyto	46	100
North Platform	Sedi 45	S	Poaceae sp.	Phyto	28	100
North Platform	Sedi 45	S	Poaceae sp.	Phyto	11	100
North Platform	Sedi 45	S	Chloridoideae sp.	Phyto	7	100
North Platform	Sedi 46	AB	Aristidoideae sp.	Phyto	9	100
North Platform	Sedi 46	AB	Poaceae sp.	Phyto	23	100
North Platform	Sedi 46	AB	Chloridoideae sp.	Phyto	7	100
North Platform	Sedi 46	AB	cf. *Zea mays*	Phyto	2	100
North Platform	Sedi 46	AB	Panicoideae sp.	Phyto	21	100
North Platform	Sedi 46	AB	Poaceae sp.	Phyto	1	100
North Platform	Sedi 46	AB	Poaceae sp.	Phyto	37	100
North Platform	Sedi 46	S	cf. *Zea mays*	Phyto	6	100
North Platform	Sedi 46	S	Panicoideae sp.	Phyto	22	100
North Platform	Sedi 46	S	Poaceae sp.	Phyto	8	100
North Platform	Sedi 46	S	Poaceae sp.	Phyto	37	100

North Platform	Sedi 46	S	Poaceae sp.	Phyto	27	100
North Platform	Sedi 47	AB	Poaceae sp.	Phyto	29	100
North Platform	Sedi 47	AB	[DIATOM]	[DIATOM]	5	100
North Platform	Sedi 47	AB	cf. *Zea mays*	Phyto	7	100
North Platform	Sedi 47	AB	*Zea mays*	Phyto	2	100
North Platform	Sedi 47	AB	Panicoideae sp.	Phyto	19	100
North Platform	Sedi 47	AB	Poaceae sp.	Phyto	3	100
North Platform	Sedi 47	AB	Poaceae sp.	Phyto	35	100
North Platform	Sedi 47	S	Non diagnostic	Phyto	1	100
North Platform	Sedi 47	S	Arecaceae sp.	Phyto	1	100
North Platform	Sedi 47	S	[DIATOM]	[DIATOM]	4	100
North Platform	Sedi 47	S	Fabaceae sp.	Phyto	1	100
North Platform	Sedi 47	S	cf. *Zea mays*	Phyto	4	100
North Platform	Sedi 47	S	Panicoideae sp.	Phyto	19	100
North Platform	Sedi 47	S	Poaceae sp.	Phyto	39	100
North Platform	Sedi 47	S	Poaceae sp.	Phyto	30	100
North Platform	Sedi 47	S	*Zea mays*	Phyto	1	100
Mound III	Sedi 48	AB	Bambusoideae sp.	Phyto	2	100
Mound III	Sedi 48	AB	Poaceae sp.	Phyto	24	100
Mound III	Sedi 48	AB	Chloridoideae sp.	Phyto	9	100
Mound III	Sedi 48	AB	[DIATOM]	[DIATOM]	7	100
Mound III	Sedi 48	AB	cf. *Zea mays*	Phyto	1	100
Mound III	Sedi 48	AB	Panicoideae sp.	Phyto	22	100
Mound III	Sedi 48	AB	Poaceae sp.	Phyto	35	100
Mound III	Sedi 48	S	Poaceae sp.	Phyto	23	100
Mound III	Sedi 48	S	Chloridoideae sp.	Phyto	6	100
Mound III	Sedi 48	S	[DIATOM]	[DIATOM]	13	100
Mound III	Sedi 48	S	Panicoideae sp.	Phyto	8	100
Mound III	Sedi 48	S	Poaceae sp.	Phyto	50	100

Mound III	Sedi 49	AB	Poaceae sp.	Phyto	31	100
Mound III	Sedi 49	AB	[DIATOM]	[DIATOM]	21	100
Mound III	Sedi 49	AB	Panicoideae sp.	Phyto	2	100
Mound III	Sedi 49	AB	Poaceae sp.	Phyto	46	100
Mound III	Sedi 49	S	Non diagnostic	Phyto	1	100
Mound III	Sedi 49	S	[DIATOM]	[DIATOM]	7	100
Mound III	Sedi 49	S	*Zea mays*	Phyto	1	100
Mound III	Sedi 49	S	Panicoideae sp.	Phyto	2	100
Mound III	Sedi 49	S	Poaceae sp.	Phyto	58	100
Mound III	Sedi 49	S	Poaceae sp.	Phyto	31	100
Patio VG	Sedi 50(1)	AB	Poaceae sp.	Phyto	29	100
Patio VG	Sedi 50(1)	AB	cf. Cyperaceae sp.	Phyto	1	100
Patio VG	Sedi 50(1)	AB	Chloridoideae sp.	Phyto	3	100
Patio VG	Sedi 50(1)	AB	[DIATOM]	[DIATOM]	8	100
Patio VG	Sedi 50(1)	AB	Panicoideae sp.	Phyto	19	100
Patio VG	Sedi 50(1)	AB	Poaceae sp.	Phyto	34	100
Patio VG	Sedi 50(1)	AB	Aristidoideae sp.	Phyto	6	100
Patio VG	Sedi 50(1)	S	Non diagnostic	Phyto	6	100
Patio VG	Sedi 50(1)	S	Aristidoideae sp.	Phyto	3	100
Patio VG	Sedi 50(1)	S	Bambusoideae sp.	Phyto	2	100
Patio VG	Sedi 50(1)	S	Poaceae sp.	Phyto	32	100
Patio VG	Sedi 50(1)	S	Cyperaceae sp.	Phyto	1	100
Patio VG	Sedi 50(1)	S	[DIATOM]	[DIATOM]	2	100
Patio VG	Sedi 50(1)	S	cf. *Zea mays*	Phyto	1	100
Patio VG	Sedi 50(1)	S	Panicoideae sp.	Phyto	9	100
Patio VG	Sedi 50(1)	S	Poaceae sp.	Phyto	4	100
Patio VG	Sedi 50(1)	S	Poaceae sp.	Phyto	33	100
Patio VG	Sedi 50(1)	S	Chloridoideae sp.	Phyto	7	100
Patio VG	Sedi 50(2)	AB	Aristidoideae sp.	Phyto	5	100

Patio VG	Sedi 50(2)	AB	Poaceae sp.	Phyto	29	100
Patio VG	Sedi 50(2)	AB	Chloridoideae sp.	Phyto	7	100
Patio VG	Sedi 50(2)	AB	[DIATOM]	[DIATOM]	5	100
Patio VG	Sedi 50(2)	AB	*Zea mays*	Phyto	3	100
Patio VG	Sedi 50(2)	AB	Panicoideae sp.	Phyto	11	100
Patio VG	Sedi 50(2)	AB	Poaceae sp.	Phyto	40	100
Patio VG	Sedi 50(2)	S	Aristidoideae sp.	Phyto	5	100
Patio VG	Sedi 50(2)	S	Bambusoideae sp.	Phyto	4	100
Patio VG	Sedi 50(2)	S	Chloridoideae sp.	Phyto	9	100
Patio VG	Sedi 50(2)	S	[DIATOM]	[DIATOM]	3	100
Patio VG	Sedi 50(2)	S	cf. *Zea mays*	Phyto	6	100
Patio VG	Sedi 50(2)	S	Poaceae sp.	Phyto	1	100
Patio VG	Sedi 50(2)	S	Poaceae sp.	Phyto	37	100
Patio VG	Sedi 50(2)	S	Poaceae sp.	Phyto	30	100
Patio VG	Sedi 50(2)	S	Panicoideae sp.	Phyto	5	100
Grave 1993-17	Microbot 1	WW	Dam starch	Starch	1	7
Grave 1993-17	Microbot 1	WW	Unident starch	Starch	2	7
Grave 1993-17	Microbot 1	WW	Chloridoideae sp.	Phyto	1	7
Grave 1993-17	Microbot 1	WW	Poaceae sp.	Phyto	1	7
Grave 1993-17	Microbot 1	WW	Poaceae sp.	Phyto	2	7
Grave 1993-17	Microbot 1	SW	Unident starch	Starch	1	3
Grave 1993-17	Microbot 1	SW	*Phaseolus* sp.	Starch	1	3
Grave 1993-17	Microbot 1	SW	Non diagnostic	Phyto	1	3
Grave 1993-17	Microbot 2	WW	Dam starch	Starch	3	100
Grave 1993-17	Microbot 2	WW	[SPORES/POLLEN]	[SPORES/POLLEN]	95	100
Grave 1993-17	Microbot 2	WW	Non diagnostic	Phyto	1	100
Grave 1993-17	Microbot 2	WW	Poaceae sp.	Phyto	1	100
Grave 1993-17	Microbot 2	SW	Unident starch	Starch	1	7
Grave 1993-17	Microbot 2	SW	UNK Phyto 1	Phyto	1	7

Grave 1993-17	Microbot 2	SW	Dam starch	Starch	1	7
Grave 1993-17	Microbot 2	SW	Poaceae sp.	Phyto	1	7
Grave 1993-17	Microbot 2	SW	Poaceae sp.	Phyto	3	7
Grave 1993-17	Microbot 3	WW	Dam starch	Starch	1	6
Grave 1993-17	Microbot 3	WW	Poaceae sp.	Starch	1	6
Grave 1993-17	Microbot 3	WW	Unident Starch	Starch	2	6
Grave 1993-17	Microbot 3	WW	Poaceae sp.	Phyto	1	6
Grave 1993-17	Microbot 3	WW	cf. *Zea mays*	Starch	1	6
Grave 1993-17	Microbot 3	SW	cf. *Zea mays*	Starch	2	6
Grave 1993-17	Microbot 3	SW	Unident starch	Starch	1	6
Grave 1993-17	Microbot 3	SW	*Zea mays*	Starch	2	6
Grave 1993-17	Microbot 3	SW	Unident Starch	Starch	1	6
Grave 1994-69	Microbot 4	WW	*Sagittaria* sp.	Starch	1	19
Grave 1994-69	Microbot 4	WW	Poaceae sp.	Phyto	11	19
Grave 1994-69	Microbot 4	WW	Dam starch	Starch	6	19
Grave 1994-69	Microbot 4	WW	Poaceae sp.	Phyto	1	19
Grave 1994-69	Microbot 4	SW	Unident Starch	Starch	1	1
Grave 1994-69	Microbot 5	WW	Dam starch	Starch	5	16
Grave 1994-69	Microbot 5	WW	*Zea mays*	Starch	2	16
Grave 1994-69	Microbot 5	WW	Poaceae sp.	Phyto	4	16
Grave 1994-69	Microbot 5	WW	*Capsicum* sp.	Starch	2	16
Grave 1994-69	Microbot 5	WW	cf. *Zea mays*	Starch	1	16
Grave 1994-69	Microbot 5	WW	UNK Starch 1	Starch	1	16
Grave 1994-69	Microbot 5	WW	cf. *Ipomoea batatas*	Starch	1	16
Grave 1994-69	Microbot 5	SW	Unident Starch	Starch	1	4
Grave 1994-69	Microbot 5	SW	Poaceae sp.	Phyto	1	4
Grave 1994-69	Microbot 5	SW	Dam starch	Starch	2	4
Grave 1994-69	Microbot 6	WW	Poaceae sp.	Phyto	5	8
Grave 1994-69	Microbot 6	WW	Dam starch	Starch	2	8

Grave 1994-69	Microbot 6	WW	Unident starch	Starch	1	8
Grave 1994-69	Microbot 6	SW	Dam starch	Starch	1	3
Grave 1994-69	Microbot 6	SW	Poaceae sp.	Phyto	1	3
Grave 1994-69	Microbot 6	SW	Poaceae sp.	Phyto	1	3
Grave 1994-69	Microbot 7	WW	*Sagittaria* sp.	Starch	1	8
Grave 1994-69	Microbot 7	WW	UNK Phyto 2	Phyto	1	8
Grave 1994-69	Microbot 7	WW	Poaceae sp.	Phyto	1	8
Grave 1994-69	Microbot 7	WW	cf. *Ipomoea batatas*	Starch	5	8
Grave 1994-69	Microbot 7	SW	Unident starch	Starch	2	5
Grave 1994-69	Microbot 7	SW	Dam starch	Starch	1	5
Grave 1994-69	Microbot 7	SW	UNK Tissue 1	Tissue	1	5
Grave 1994-69	Microbot 7	SW	Poaceae sp.	Phyto	1	5
Grave 1994-69	Microbot 8	WW	Dam starch	Starch	7	17
Grave 1994-69	Microbot 8	WW	*Ipomoea batatas*	Starch	2	17
Grave 1994-69	Microbot 8	WW	*Zea mays*	Starch	2	17
Grave 1994-69	Microbot 8	WW	UNK Phyto 3	Phyto	1	17
Grave 1994-69	Microbot 8	WW	Poaceae sp.	Phyto	1	17
Grave 1994-69	Microbot 8	WW	Poaceae sp.	Phyto	3	17
Grave 1994-69	Microbot 8	WW	Unident starch	Starch	1	17
Grave 1994-69	Microbot 8	SW	Amorphous starch	Starch	1	9
Grave 1994-69	Microbot 8	SW	*Ipomoea batatas*	Starch	2	9
Grave 1994-69	Microbot 8	SW	Dam starch	Starch	2	9
Grave 1994-69	Microbot 8	SW	[DIATOM]	[DIATOM]	1	9
Grave 1994-69	Microbot 8	SW	Poaceae sp.	Phyto	2	9
Grave 1994-69	Microbot 8	SW	cf. *Zea mays*	Starch	1	9
Grave 1993-56	Microbot 9	WW	cf. *Zea mays*	Phyto	1	1
Grave 1994-62	Microbot 10	WW	Dam starch	Starch	1	5
Grave 1994-62	Microbot 10	WW	Poaceae sp.	Phyto	1	5
Grave 1994-62	Microbot 10	WW	Poaceae sp.	Phyto	1	5

Grave 1994-62	Microbot 10	WW	Poaceae sp.	Phyto	2	5
Grave 1994-62	Microbot 10	SW	Dam starch	Starch	2	7
Grave 1994-62	Microbot 10	SW	Non diagnostic	Phyto	1	7
Grave 1994-62	Microbot 10	SW	Poaceae sp.	Phyto	4	7
Grave 1994-62	Microbot 11	WW	UNK Remain 1	UNK	1	4
Grave 1994-62	Microbot 11	WW	cf. *Zea mays*	Starch	1	4
Grave 1994-62	Microbot 11	WW	Dam starch	Starch	1	4
Grave 1994-62	Microbot 11	WW	UNK Remain 2	UNK	1	4
Grave 1994-62	Microbot 11	SW	Dam starch	Starch	1	3
Grave 1994-62	Microbot 11	SW	Poaceae sp.	Phyto	1	3
Grave 1994-62	Microbot 11	SW	Poaceae sp.	Phyto	1	3
Grave 1994-62	Microbot 12	DW	Dam starch	Starch	1	4
Grave 1994-62	Microbot 12	DW	Poaceae sp.	Phyto	1	4
Grave 1994-62	Microbot 12	DW	UNK Remain 1	UNK	1	4
Grave 1994-62	Microbot 12	DW	Poaceae sp.	Phyto	1	4
Grave 1994-62	Microbot 12	WW	Poaceae sp.	Phyto	2	6
Grave 1994-62	Microbot 12	WW	Dam starch	Starch	1	6
Grave 1994-62	Microbot 12	WW	Poaceae sp.	Phyto	1	6
Grave 1994-62	Microbot 12	WW	[SPHERULITES]	[SPHERULITES]	2	6
Grave 1994-62	Microbot 12	SW	Dam starch	Starch	5	7
Grave 1994-62	Microbot 12	SW	Panicoideae sp.	Phyto	1	7
Grave 1994-62	Microbot 12	SW	Poaceae sp.	Phyto	1	7
Grave 1994-61	Microbot 13	WW	UNK Starch 2	Starch	1	1
Grave 1994-61	Microbot 14	WW	*Zea mays*	Starch	1	6
Grave 1994-61	Microbot 14	WW	Poaceae sp.	Phyto	1	6
Grave 1994-61	Microbot 14	WW	Dam starch	Starch	2	6
Grave 1994-61	Microbot 14	WW	[POLLEN|	[POLLEN|	1	6
Grave 1994-61	Microbot 14	WW	Panicoideae sp.	Phyto	1	6
Grave 1994-61	Microbot 14	SW	UNK Tissue 2	Tissue	2	7

Grave 1994-61	Microbot 14	SW	cf. Cyperaceae sp.	Phyto	1	7
Grave 1994-61	Microbot 14	SW	[SPHERULITES]	[SPHERULITES]	3	7
Grave 1994-61	Microbot 14	SW	*Zea mays*	Starch	1	7
Grave 1994-61	Microbot 15	WW	Poaceae sp.	Phyto	1	13
Grave 1994-61	Microbot 15	WW	Dam starch	Starch	5	13
Grave 1994-61	Microbot 15	WW	cf. *Zea mays*	Starch	1	13
Grave 1994-61	Microbot 15	WW	*Zea mays*	Starch	2	13
Grave 1994-61	Microbot 15	WW	Unident Starch	Starch	1	13
Grave 1994-61	Microbot 15	WW	[BUTTERFLY]	[BUTTERFLY]	1	13
Grave 1994-61	Microbot 15	WW	Poaceae sp.	Phyto	2	13
Grave 1994-61	Microbot 15	SW	Dam starch	Starch	2	4
Grave 1994-61	Microbot 15	SW	*Zea mays*	Starch	1	4
Grave 1994-61	Microbot 15	SW	[SPHERULITES]	[SPHERULITES]	1	4
Grave 1994-61	Microbot 16	WW	Poaceae sp.	Phyto	5	9
Grave 1994-61	Microbot 16	WW	Dam starch	Starch	2	9
Grave 1994-61	Microbot 16	WW	*Zea mays*	Starch	1	9
Grave 1994-61	Microbot 16	WW	[SPHERULITES]	[SPHERULITES]	1	9
Grave 1994-61	Microbot 16	SW	Poaceae sp.	Phyto	2	12
Grave 1994-61	Microbot 16	SW	cf. *Capsicum* sp.	Starch	1	12
Grave 1994-61	Microbot 16	SW	Dam starch	Starch	1	12
Grave 1994-61	Microbot 16	SW	Poaceae sp.	Phyto	1	12
Grave 1994-61	Microbot 16	SW	Unident Starch	Starch	3	12
Grave 1994-61	Microbot 16	SW	*Zea mays*	Starch	1	12
Grave 1994-61	Microbot 16	SW	[SPHERULITES]	[SPHERULITES]	3	12
Grave 1994-61	Microbot 17	WW	[SPHERULITES]	[SPHERULITES]	3	3
Grave 1994-61	Microbot 17	SW	[SPHERULITES]	[SPHERULITES]	1	2
Grave 1994-61	Microbot 17	SW	[DIATOM]	[DIATOM]	1	2
Tomb 196	Microbot 18	WW	Poaceae sp.	Phyto	11	42
Tomb 196	Microbot 18	WW	Chloridoideae sp.	Phyto	20	42

Tomb 196	Microbot 18	WW	Bambusoideae sp.	Phyto	4	42
Tomb 196	Microbot 18	WW	cf. Poaceae sp.	Starch	1	42
Tomb 196	Microbot 18	WW	Poaceae sp.	Phyto	2	42
Tomb 196	Microbot 18	WW	Panicoideae sp.	Phyto	2	42
Tomb 196	Microbot 18	WW	Poaceae sp.	Phyto	2	42
Tomb 196	Microbot 18	SW	Poaceae sp.	Phyto	1	3
Tomb 196	Microbot 18	SW	Unident Starch	Starch	1	3
Tomb 196	Microbot 18	SW	Dam starch	Starch	1	3
Tomb 202	Microbot 19	WW	Poaceae sp.	Phyto	9	16
Tomb 202	Microbot 19	WW	Dam starch	Starch	1	16
Tomb 202	Microbot 19	WW	Chloridoideae sp.	Phyto	4	16
Tomb 202	Microbot 19	WW	Poaceae sp.	Phyto	1	16
Tomb 202	Microbot 19	WW	[FUNGUS]	[FUNGUS]	1	16
Tomb 202	Microbot 19	SW	*Ipomoea batatas*	Starch	2	5
Tomb 202	Microbot 19	SW	Dam starch	Starch	1	5
Tomb 202	Microbot 19	SW	Unident Starch	Starch	2	5
Tomb 214	Microbot 20	WW	Poaceae sp.	Phyto	1	1
Tomb 214	Microbot 20	SW	Poaceae sp.	Phyto	1	6
Tomb 214	Microbot 20	SW	Dam starch	Starch	3	6
Tomb 214	Microbot 20	SW	Unident Starch	Starch	2	6
Tomb 214	Microbot 21	WW	[POLLEN|	[POLLEN|	1	1
Tomb 214	Microbot 21	SW	Dam starch	Starch	2	2
Tomb 214	Microbot 22	WW	Bambusoideae sp.	Phyto	1	39
Tomb 214	Microbot 22	WW	[BUTTERFLY]	[BUTTERFLY]	1	39
Tomb 214	Microbot 22	WW	Asteraceae/Cucurbitaceae sp.	Phyto	1	39
Tomb 214	Microbot 22	WW	[FUNGUS]	[FUNGUS]	3	39
Tomb 214	Microbot 22	WW	[POLLEN|	[POLLEN|	21	39
Tomb 214	Microbot 22	WW	Chloridoideae sp.	Phyto	2	39
Tomb 214	Microbot 22	WW	Dam starch	Starch	4	39

Tomb 214	Microbot 22	WW	cf. *Zea mays*	Phyto	5	39
Tomb 214	Microbot 22	WW	Unident Starch	Starch	1	39
Tomb 214	Microbot 22	SW	Dam starch	Starch	1	1
Tomb 214	Microbot 23	WW	[SPORES/POLLEN]	[SPORES/POLLEN]	40	50
Tomb 214	Microbot 23	WW	Dam starch	Starch	1	50
Tomb 214	Microbot 23	WW	[POLLEN|	[POLLEN|	3	50
Tomb 214	Microbot 23	WW	Asteraceae/Cucurbitaceae sp.	Phyto	1	50
Tomb 214	Microbot 23	WW	[FUNGUS]	[FUNGUS]	3	50
Tomb 214	Microbot 23	WW	[DIATOM]	[DIATOM]	1	50
Tomb 214	Microbot 23	WW	Poaceae sp.	Phyto	1	50
Tomb 214	Microbot 23	SW	[SPORES/POLLEN]	[SPORES/POLLEN]	16	19
Tomb 214	Microbot 23	SW	Dam starch	Starch	1	19
Tomb 214	Microbot 23	SW	[FUNGUS]	[FUNGUS]	1	19
Tomb 214	Microbot 23	SW	Unident Starch	Starch	1	19
Tomb 214	Microbot 24	WW	Dam starch	Starch	4	10
Tomb 214	Microbot 24	WW	Zea mays	Starch	1	10
Tomb 214	Microbot 24	WW	[FUNGUS]	[FUNGUS]	2	10
Tomb 214	Microbot 24	WW	[POLLEN|	[POLLEN|	3	10
Tomb 214	Microbot 25	WW	Dam starch	Starch	1	10
Tomb 214	Microbot 25	WW	Poaceae sp.	Phyto	1	10
Tomb 214	Microbot 25	WW	Unident Starch	Starch	1	10
Tomb 214	Microbot 25	WW	cf. *Zea mays*	Phyto	1	10
Tomb 214	Microbot 25	WW	Panicoideae sp.	Phyto	1	10
Tomb 214	Microbot 25	WW	[FUNGUS]	[FUNGUS]	1	10
Tomb 214	Microbot 25	WW	[DIATOM]	[DIATOM]	1	10
Tomb 214	Microbot 25	WW	Non diagnostic	Phyto	1	10
Tomb 214	Microbot 25	WW	[SPHERULITES]	[SPHERULITES]	2	10
Tomb 214	Microbot 25	SW	Unident Starch	Starch	1	2
Tomb 214	Microbot 25	SW	[SPHERULITES]	[SPHERULITES]	1	2

Tomb 214	Microbot 27	WW	cf. Poaceae sp.	Starch	1	19
Tomb 214	Microbot 27	WW	[POLLEN|	[POLLEN|	18	19
Tomb 214	Microbot 27	SW	UNK Starch 3	Starch	1	6
Tomb 214	Microbot 27	SW	Unident Starch	Starch	1	6
Tomb 214	Microbot 27	SW	Dam starch	Starch	2	6
Tomb 214	Microbot 27	SW	[POLLEN|	[POLLEN|	1	6
Tomb 214	Microbot 27	SW	[SPHERULITES]	[SPHERULITES]	1	6
Tomb 213	Microbot 28	DW	Poaceae sp.	Phyto	1	3
Tomb 213	Microbot 28	DW	[SPHERULITES]	[SPHERULITES]	2	3
Tomb 213	Microbot 28	WW	[SPHERULITES]	[SPHERULITES]	6	8
Tomb 213	Microbot 28	WW	Poaceae sp.	Phyto	1	8
Tomb 213	Microbot 28	WW	cf. *Zea mays*	Phyto	1	8
Tomb 213	Microbot 28	SW	Dam starch	Starch	2	8
Tomb 213	Microbot 28	SW	Unident Starch	Starch	5	8
Tomb 213	Microbot 28	SW	cf. *Maranta* sp.	Starch	1	8
Tomb 213	Microbot 29	DW	Dam starch	Starch	3	6
Tomb 213	Microbot 29	DW	Unident Starch	Starch	1	6
Tomb 213	Microbot 29	DW	cf. *Cyperus* sp.	Phyto	1	6
Tomb 213	Microbot 29	DW	[SPHERULITES]	[SPHERULITES]	1	6
Tomb 213	Microbot 29	WW	Poaceae sp.	Phyto	4	14
Tomb 213	Microbot 29	WW	Chloridoideae sp.	Phyto	2	14
Tomb 213	Microbot 29	WW	Poaceae sp.	Phyto	1	14
Tomb 213	Microbot 29	WW	Dam starch	Starch	1	14
Tomb 213	Microbot 29	WW	[FUNGUS]	[FUNGUS]	1	14
Tomb 213	Microbot 29	WW	[POLLEN|	[POLLEN|	1	14
Tomb 213	Microbot 29	WW	[SPHERULITES]	[SPHERULITES]	4	14
Tomb 213	Microbot 29	SW	Dam starch	Starch	1	3
Tomb 213	Microbot 29	SW	[SPHERULITES]	[SPHERULITES]	2	3
Tomb 213	Microbot 30	DW	Chloridoideae sp.	Phyto	1	5

Tomb 213	Microbot 30	DW	Panicoideae sp.	Phyto	1	5
Tomb 213	Microbot 30	DW	[FUNGUS]	[FUNGUS]	1	5
Tomb 213	Microbot 30	DW	[SPHERULITES]	[SPHERULITES]	1	5
Tomb 213	Microbot 30	DW	Dam starch	Starch	1	5
Tomb 213	Microbot 30	WW	Unident Starch	Starch	2	5
Tomb 213	Microbot 30	WW	Poaceae sp.	Phyto	1	5
Tomb 213	Microbot 30	WW	Poaceae sp.	Phyto	1	5
Tomb 213	Microbot 30	WW	UNK Phyto 4	Phyto	1	5
Tomb 213	Microbot 30	SW	*Zea mays*	Starch	1	1
Tomb 213	Microbot 31	DW	cf. Fabaceae sp.	Starch	1	2
Tomb 213	Microbot 31	DW	Dam starch	Starch	1	2
Tomb 213	Microbot 31	WW	Poaceae sp.	Phyto	1	7
Tomb 213	Microbot 31	WW	Chloridoideae sp.	Phyto	4	7
Tomb 213	Microbot 31	WW	UNK Phyto 4	Phyto	2	7
Tomb 213	Microbot 31	SW	Poaceae sp.	Phyto	2	4
Tomb 213	Microbot 31	SW	Chloridoideae sp.	Phyto	1	4
Tomb 213	Microbot 31	SW	[FUNGUS]	[FUNGUS]	1	4
Tomb 207	Microbot 32	DW	*Zea mays*	Starch	1	2
Tomb 207	Microbot 32	DW	cf. Cyperaceae sp.	Phyto	1	2
Tomb 207	Microbot 32	WW	*Capsicum* sp.	Starch	1	7
Tomb 207	Microbot 32	WW	Dam starch	Starch	3	7
Tomb 207	Microbot 32	WW	[SPHERULITES]	[SPHERULITES]	2	7
Tomb 207	Microbot 32	WW	cf. Fabaceae sp.	Starch	1	7
Tomb 207	Microbot 32	SW	Dam starch	Starch	1	1
Tomb 207	Microbot 33	DW	*Zea mays*	Starch	2	6
Tomb 207	Microbot 33	DW	Dam starch	Starch	3	6
Tomb 207	Microbot 33	DW	[SPHERULITES]	[SPHERULITES]	1	6
Tomb 207	Microbot 33	WW	Chloridoideae sp.	Phyto	3	34
Tomb 207	Microbot 33	WW	Poaceae sp.	Phyto	22	34

Tomb 207	Microbot 33	WW	*Zea mays*	Phyto	1	34
Tomb 207	Microbot 33	WW	cf. *Zea mays*	Phyto	1	34
Tomb 207	Microbot 33	WW	Non diagnostic	Phyto	5	34
Tomb 207	Microbot 33	WW	[SPHERULITES]	[SPHERULITES]	2	34
Tomb 207	Microbot 33	SW	Poaceae sp.	Phyto	1	21
Tomb 207	Microbot 33	SW	Chloridoideae sp.	Phyto	2	21
Tomb 207	Microbot 33	SW	Dam starch	Starch	3	21
Tomb 207	Microbot 33	SW	Poaceae sp.	Phyto	7	21
Tomb 207	Microbot 33	SW	Panicoideae sp.	Phyto	1	21
Tomb 207	Microbot 33	SW	Non diagnostic	Phyto	3	21
Tomb 207	Microbot 33	SW	[DIATOM]	[DIATOM]	1	21
Tomb 207	Microbot 33	SW	Poaceae sp.	Phyto	2	21
Tomb 207	Microbot 33	SW	*Zea mays*	Phyto	1	21
Tomb 207	Microbot 33	SW	[SPHERULITES]	[SPHERULITES]	2	21
Tomb 204	Microbot 34	WW	Dam starch	Starch	1	3
Tomb 204	Microbot 34	WW	cf. *Zea mays*	Starch	1	3
Tomb 204	Microbot 34	WW	Unident Starch	Starch	1	3
Tomb 204	Microbot 34	SW	Dam starch	Starch	2	3
Tomb 204	Microbot 34	SW	Unident Starch	Starch	1	3
Tomb 204	Microbot 35	WW	[BUTTERFLY]	[BUTTERFLY]	1	4
Tomb 204	Microbot 35	WW	[DIATOM]	[DIATOM]	1	4
Tomb 204	Microbot 35	WW	Poaceae sp.	Phyto	2	4
Tomb 204	Microbot 35	SW	cf. Poaceae sp.	Starch	1	1
Tomb 204	Microbot 36	WW	Fabaceae sp.	Starch	1	7
Tomb 204	Microbot 36	WW	Dam starch	Starch	2	7
Tomb 204	Microbot 36	WW	cf. *Zea mays*	Phyto	1	7
Tomb 204	Microbot 36	WW	*Zea mays*	Starch	1	7
Tomb 204	Microbot 36	WW	Unident Starch	Starch	1	7
Tomb 204	Microbot 36	WW	Panicoideae sp.	Phyto	1	7

Tomb 204	Microbot 37	DW	Poaceae sp.	Phyto	5	13
Tomb 204	Microbot 37	DW	Poaceae sp.	Phyto	3	13
Tomb 204	Microbot 37	DW	Chloridoideae sp.	Phyto	1	13
Tomb 204	Microbot 37	DW	Dam starch	Starch	1	13
Tomb 204	Microbot 37	DW	cf. *Zea mays*	Phyto	2	13
Tomb 204	Microbot 37	DW	Aristidoideae sp.	Phyto	1	13
Tomb 204	Microbot 37	WW	Poaceae sp.	Phyto	2	11
Tomb 204	Microbot 37	WW	Poaceae sp.	Phyto	1	11
Tomb 204	Microbot 37	WW	Chloridoideae sp.	Phyto	4	11
Tomb 204	Microbot 37	WW	cf. *Zea mays*	Phyto	3	11
Tomb 204	Microbot 37	WW	Poaceae sp.	Phyto	1	11
Tomb 204	Microbot 37	SW	Dam starch	Starch	2	5
Tomb 204	Microbot 37	SW	*Zea mays*	Starch	1	5
Tomb 204	Microbot 37	SW	Unident Starch	Starch	1	5
Tomb 204	Microbot 37	SW	Poaceae sp.	Phyto	1	5
Tomb 204	Microbot 38	WW	Dam starch	Starch	3	3
Tomb 204	Microbot 38	SW	Poaceae sp.	Phyto	1	3
Tomb 204	Microbot 38	SW	Unident Starch	Starch	1	3
Tomb 204	Microbot 38	SW	Dam starch	Starch	1	3
Tomb 204	Microbot 39	WW	Bambusoideae sp.	Phyto	1	7
Tomb 204	Microbot 39	WW	Poaceae sp.	Phyto	3	7
Tomb 204	Microbot 39	WW	Chloridoideae sp.	Phyto	1	7
Tomb 204	Microbot 39	WW	cf. Boraginaceae sp.	Phyto	1	7
Tomb 204	Microbot 39	WW	Unident Starch	Starch	1	7
Tomb 204	Microbot 39	SW	Fabaceae sp.	Starch	1	2
Tomb 204	Microbot 39	SW	*Manihot* sp.	Starch	1	2
Tomb 204	Microbot 40	WW	Poaceae sp.	Phyto	1	10
Tomb 204	Microbot 40	WW	Dam starch	Starch	1	10
Tomb 204	Microbot 40	WW	Asteraceae/Cucurbitaceae sp.	Phyto	2	10

Tomb 204	Microbot 40	WW	[FUNGUS]	[FUNGUS]	1	10
Tomb 204	Microbot 40	WW	Non diagnostic	Phyto	1	10
Tomb 204	Microbot 40	WW	[POLLEN|	[POLLEN|	4	10
Tomb 204	Microbot 40	SW	Dam starch	Starch	1	1
Tomb 204	Microbot 41	WW	Poaceae sp.	Phyto	1	7
Tomb 204	Microbot 41	WW	Dam starch	Starch	1	7
Tomb 204	Microbot 41	WW	Poaceae sp.	Phyto	1	7
Tomb 204	Microbot 41	WW	[POLLEN|	[POLLEN|	2	7
Tomb 204	Microbot 41	WW	Poaceae sp.	Phyto	2	7
Tomb 204	Microbot 41	SW	Poaceae sp.	Phyto	3	6
Tomb 204	Microbot 41	SW	Unident Starch	Starch	1	6
Tomb 204	Microbot 41	SW	Panicoideae sp.	Phyto	1	6
Tomb 204	Microbot 41	SW	Poaceae sp.	Phyto	1	6
Tomb 204	Microbot 42	WW	[BUTTERFLY]	[BUTTERFLY]	1	5
Tomb 204	Microbot 42	WW	Poaceae sp.	Phyto	1	5
Tomb 204	Microbot 42	WW	[POLLEN|	[POLLEN|	2	5
Tomb 204	Microbot 42	WW	Poaceae sp.	Phyto	1	5
Tomb 204	Microbot 42	SW	[POLLEN|	[POLLEN|	1	1
Grave 1993-19	Microbot 43	WW	[BUTTERFLY]	[BUTTERFLY]	1	100
Grave 1993-19	Microbot 43	WW	Poaceae sp.	Phyto	4	100
Grave 1993-19	Microbot 43	WW	[POLLEN|	[POLLEN|	2	100
Grave 1993-19	Microbot 43	WW	Poaceae sp.	Phyto	1	100
Grave 1993-19	Microbot 43	WW	[SPORES/POLLEN]	[SPORES/POLLEN]	92	100
Grave 1993-19	Microbot 43	SW	Poaceae sp.	Phyto	1	1
Tomb 208	Microbot 44	WW	Dam starch	Starch	1	2
Tomb 208	Microbot 44	WW	[POLLEN|	[POLLEN|	1	2
Tomb 208	Microbot 44	SW	Dam starch	Starch	1	1
Tomb 208	Microbot 45	WW	cf. *Sagittaria* sp.	Starch	1	9
Tomb 208	Microbot 45	WW	cf. *Zea mays*	Phyto	1	9

Tomb 208	Microbot 45	WW	Dam starch	Starch	4	9
Tomb 208	Microbot 45	WW	*Ipomoea batatas*	Starch	1	9
Tomb 208	Microbot 45	WW	Unident Starch	Starch	2	9
Tomb 208	Microbot 45	SW	Dam starch	Starch	2	3
Tomb 208	Microbot 45	SW	Unident Starch	Starch	1	3
Tomb 208	Microbot 46	WW	[POLLEN|	[POLLEN|	1	2
Tomb 208	Microbot 46	WW	Poaceae sp.	Starch	1	2
Tomb 208	Microbot 47	WW	[POLLEN|	[POLLEN|	1	1
Tomb 208	Microbot 47	SW	Dam starch	Starch	3	6
Tomb 208	Microbot 47	SW	*Zea mays*	Starch	1	6
Tomb 208	Microbot 47	SW	Unident Starch	Starch	2	6
Tomb 208	Microbot 48	WW	UNK Phyto 4	Phyto	1	4
Tomb 208	Microbot 48	WW	[FUNGUS]	[FUNGUS]	1	4
Tomb 208	Microbot 48	WW	[POLLEN|	[POLLEN|	1	4
Tomb 208	Microbot 48	WW	Unident Starch	Starch	1	4
Tomb 208	Microbot 48	SW	Dam starch	Starch	6	8
Tomb 208	Microbot 48	SW	[POLLEN|	[POLLEN|	1	8
Tomb 208	Microbot 48	SW	Poaceae sp.	Phyto	1	8
Tomb 208	Microbot 49	WW	[BUTTERFLY]	[BUTTERFLY]	1	3
Tomb 208	Microbot 49	WW	Cyperaceae sp.	Phyto	1	3
Tomb 208	Microbot 49	WW	[POLLEN|	[POLLEN|	1	3
Tomb 208	Microbot 49	SW	Dam starch	Starch	1	2
Tomb 208	Microbot 49	SW	Poaceae sp.	Starch	1	2
Tomb 208	Microbot 50	WW	Dam starch	Starch	5	13
Tomb 208	Microbot 50	WW	*Ipomoea batatas*	Starch	1	13
Tomb 208	Microbot 50	WW	*Zea mays*	Starch	2	13
Tomb 208	Microbot 50	WW	Unident Starch	Starch	1	13
Tomb 208	Microbot 50	WW	[POLLEN|	[POLLEN|	4	13
Tomb 208	Microbot 50	SW	Unident Starch	Starch	1	2

Tomb 208	Microbot 50	SW	Dam starch	Starch	1	2

Appendix B: Extraction from Artifacts Protocols

Protocols for Microbotanical Residue Extractions from Artifacts and Teeth
McMaster Paleoethnobotanical Research Facility (MPERF)
Developed by Shanti Morell-Hart
Changes made by Éloi Bérubé are in italics

Overview of extraction process:

During microbotanical residue extractions, three washes are taken from each targeted artifact. The first dry wash (DW) is taken to identify material in the surrounding matrix and track potential contamination. The second wet wash (WW) is taken to track movement of material between artifact and surrounding sediments. The third sonicated wash (SW) is taken to recover residues most closely associated with artifact use. Ideally, the first and third washes identify material uniquely related to surrounding matrix and artifact use respectively, while the second wash tracks the movement of material between the artifact and surrounding sediments.

The same general methodology is followed for all artifacts. The general process includes the following steps: 1) labelling sterile 20mL and 50mL capped centrifuge tubes, 2) preparing the workstation and materials for extractions, 3) preparing the artifact for extractions, 4) dry washing the artifact using powder-free gloves, 5) wet washing the artifact using powder-free gloves, 6) sonicating the artifact, and 7) cleaning the workstation in preparation for the next set of extractions. Sterile, POWDER-FREE gloves should be used and changed frequently to avoid contamination (more details below).

Photographs should be taken before, during, and after the artifact washes. Notes are also taken to detail aspects of the context/feature/location where the artifact was recovered, the artifact morphology/condition/etc., and extraction process (quantity and quality of material removed; any potential contaminants). All data and notes from each artifact sample can be entered into an Excel spreadsheet or similar.

After extractions, the residues may be immediately analysed or sent to a laboratory for analysis. This analysis involves 8) concentrating the botanical residue with centrifugation, 9) mounting the residue on slides, and 10) scanning and identification of starch grains, phytoliths, and other microremains.

1) Labelling of tubes:

For each artifact selected for analysis,

- Prepare three tubes from the artifact tag (supplemented with other information as available).
- Assign each sample a number based on provenance, and add “PEB [#]” as a suffix to this string. Further designate each sample as DW (1st dry wash), WW (2nd wet wash), or SW (3rd sonicated wash).

<u>2) Preparation of materials and workstation:</u>

Generally, it is better to keep sterile materials—pipets, centrifuge tubes, water bottles, kim wipes, etc.—stored in large plastic bags to avoid airborne contamination.

- Between artifact washes for each artifact, wash petri dishes, sonicator, and dental tools with soapy water, then filtered water, then a final rinse with distilled water just before use.
- Change powder-free gloves between each artifact wash.
- Prepare the workstation by washing all surfaces such as plastic trays, counters, tables, etc.
- Place fresh paper towels over the workstation area.
- Place fresh kim wipes over the paper towels. Note: the paper towel reduces general contamination and absorbs excess water, while the kim wipe (low powder) provides a "buffer" from the paper towel.
- Set a cleaned and distilled water-rinsed petri dish on the workstation area, unless the artifact is too large (e.g. metate fragment). In such cases, multiple kim wipes can be placed on the workstation and the exterior of the (unsampled) artifact positioned directly on the kim wipes.
- Change gloves before next step.

<u>3) Preparation of artifact:</u>

- Remove each artifact from the labelled bag with fresh gloves
- Photograph the unwashed artifact with artifact tag and label, to show the general level of visible adhering residue.
- Take notes on the artifact context (e.g. "hearth in housemound 6"), general morphology (e.g. "from large metate"), and condition (e.g., "~30% fragment, lightly eroded, obvious grinding polish").
- For large artifacts, cover the unsampled portion of the artifact with sterile plastic bags and tape, to keep exposed fracture interfaces from contaminating the rest of the sample.
- Change gloves before next step.

<u>4) Dry Wash (DW) of artifact</u>**:**

- Just before each dry wash, retrieve a sterile pipet (wearing clean gloves).
- Insert the pipet into the labelled dry wash tube. Note: retrieve the pipet only just before use, to reduce potential contaminants blowing into the tube.
- Begin to dry wash the artifact by gently rubbing the targeted surface and margins with the fingers of the clean glove, letting material fall into the clean and sterilized petri dish.
- Some clinging residue may require gentle scratching using a gloved fingernail.
- Dry wash only those areas targeted for analysis (see below for specific artifact protocols).
- Gently rub the artifact until no more material can be removed using this method.

- a) In some cases, the dry wash material will be of sufficient quantity to gently brush dry into the labelled tube.
- b) In other cases, there is so little dry wash material that it must be put into solution using a small amount of distilled water. This material can then be pipetted from the petri dish into the labelled tube.
- Dry brush the remainder of the artifact to remove possible sources of falling material during later washes.
- Change gloves, clean the petri dish, and rinse the petri dish with distilled water.

This step was made for each artifact, but since they had been previously washed, most of these did not yield any residues. The visible residues were kept when available and analyzed

5) Wet Wash (WW) of artifact:

- Just before each wet wash, retrieve a sterile pipet (wearing clean gloves).
- Insert the pipet into the labelled wet wash tube. *Note: retrieve the pipet only just before use, to reduce potential contaminants blowing into the tube.*
- For the wet wash, protocols will vary (see below for specific artifact protocols). In general:
- Wet washed artifact by gently rubbing targeted areas with wet gloved fingers, occasionally irrigating the surface with distilled water and rinsing the cleansing fingers in the wet wash water.
- Ideally, the final irrigation with water will flow clear (ceramics and metate fragments are some exceptions)—this process may take several washes.
- Pipet the wet wash material into a labelled tube.
- Rinse the remainder of the artifact to remove possible sources of falling material during the sonicated wash.
- Change gloves, clean the petri dish, and rinse the petri dish with distilled water.

6) Sonicated Wash (SW) of artifact:

Sonication takes place at roughly 30–40 kHz, as cavitation occurs and small bubbles lift out the adhering material in the pores, crevices, and fissures of the artifact. This material goes into solution in the distilled water medium. *Note: maintaining a distilled water medium is necessary for the sonication process, as the movement of sound waves into artifact pores and fissures is facilitated by an aqueous medium.*

- Just before each sonicated wash, retrieve a sterile pipet (wearing clean gloves).
- Insert the pipet into the labelled sonicated wash tube. *Note: retrieve the pipet only just before use, to reduce potential contaminants blowing into the tube.*
- For the sonicated wash, protocols will vary (see below for specific artifact protocols). In general, begin procedure by either a) immersing targeted artifact surfaces in a petri dish partially filled with distilled water (e.g., chipped stone and human teeth), OR b) filling the cupped interior area of the artifact itself with distilled water (e.g., metates and ceramic sherds).

- Each artifact is sonicated by either a) inserting the spatula of the sonicator next to the surface of the artifact, underwater in the petri dish (e.g., chipped stone and handheld groundstone) OR b) inserting the spatula of the sonicator in the distilled water immediately above the surface of the artifact (e.g., metates and ceramic sherds), using the concavity of the artifact surface to contain the water.
- Activate the sonicating device, circling around the targeted artifact surface. The amount of time needed for sonication varies, but is generally in the range of 2–5 minutes. Cease sonication immediately if any damage appears to be occurring to the artifact (e.g. temper spalling off ceramics)
- Sonication takes place one to several times, depending on the artifact (see specific artifact protocols).
- Once sonication is complete, pipet the sonicated material into a labelled tube.

7) Completion of wash process:

- Pat the artifact dry with kim wipes.
- Photograph the clean artifact with label.
- Repackage artifact into original bag for curation. Mark the bag as having undergone analysis by labelling bag and/or label with "PEB 2016," or similar.
- Complete notes on the extraction process: quantity and quality of residue removed (e.g. "small quantity of visible residue, very muddy"), potential sources of contaminants (e.g. "some spalling of ceramic sherd temper into solution"), irregularities in the process (e.g., "had to rotate grinding stone surface for sonication"), etc.
- Clean and prepare the workstation for the next set of artifact extractions.

8) Concentrating botanical residues:

- Centrifuge the samples for 5 min at 3000 RPM.
- Pipet off the supernatant down to about 5 mL of solution. Note: there may be no residue visible at the bottom of the tubes, as is often the case for obsidian blades with the sonicated wash.

9) Mounting solution on slides:

Note: centrifuge tubes cannot be left open for drying, as starch grains especially are easily airborne and can contaminate open samples. For this reason, the mounting medium is the original extraction solution.

- Pipet a few drops per slide and cover with cover slip
- Seal the edges of the coverslip with your favorite color of opaque nail polish (Sally Hansen Hard As Nails is recommended).
- Slides will dry out fairly quickly (within several days or weeks) so produce only 6–9 slides at a time (i.e. two or three artifacts' worth).
- Slides can be curated, but dry material is not very compatible with microscopy—starch grains and phytoliths cannot be rotated in dry slide environment.

<u>10) Scanning and identifying microremains: General Notes</u>

- Counts: target 100 total per extracted sample. Many counts will be many fewer (~2–5 microremains per wash).
- Magnification power for scanning slides: 400x is recommended, with further investigation and photography at 650x.
- Beginning in one corner of the slide, move systematically from top to bottom, left to right (as though reading a book). Moving from left to right, begin by moving to a field of view which overlapped only slightly with the previous, then slowly shift focus in and out. This enables a view "through" the transparent phytoliths, in order to gauge broad morphology. (I.e. starting on top surface, moving through the phytolith, then ending with the bottom surface).
- Morphology is also inspected by gently depressing the slide with a rubber-coated paperclip tip or blunted needle probe, in order to rotate the microremains in the aqueous medium. This is especially helpful with phytoliths such as rondels, which appear spherical in planar view but appear like spools in profile.
- Do not count the elongate and bulliform phytoliths that are common in grasses, since these are incredibly abundant and ubiquitous, and will dominate all slide densities and slow the identifications considerably (i.e., you would needed to bump the counts to 1000 or more per slide).
- Make sure to photograph each (significant/diagnostic/novel) microremain at three focal points, at least, then rotate (when possible) and take additional photos. For starch grains, also photograph under polarized light.
- Make sure to photograph at least one microremain per artifact wash.
- Slides can be curated, but dried material is not compatible with microscopy—starch grains and phytoliths cannot be rotated in dry slide environment.

Appendix C: Preparation of Sediment Samples Protocols

Processing and Analyzing Sediment Samples for Phytoliths (2018)
McMaster Paleoethnobotanical Research Facility (MPERF)
Developed by Shanti Morell-Hart
(In consultation with Dolores Piperno in 2006; Rob Cuthrell in 2008; MARS representative Jessica Giles in 2017; independent experimentation at UCB and the MPERF)

Phytolith Extraction from Sediments: Basic procedure sequence (in parentheses, time estimates for a 20 sample batch = 40 processed samples total)
Total time for 20 sample batch (equaling 40 processed samples) = 36–58 business days

1) sediment sterilization of pathogens for foreign samples (1 day)
2) deflocculating sediment samples in water (1–10 days—depends on sediment composition)
3a) dividing sediment into a, b, and s fraction sizes (1 day)
3b) removing clay (1–10 days—depends on sediment composition)
4) microwave chemical digestion: removing carbonates with hydrochloric acid (HCl) solution, removing organic materials with nitric acid (HNO_3) solution, removing humics with hydrogen peroxide (H_2O_2) solution (1 day)
5) floating phytoliths with sodium polytungstate (SPT) solution and drying phytolith sample (1 day)
6) clean-up and waste removal (continuous during processing; in total, can take 1–3 days)
7) mounting phytolith sample (1 day)
8) scanning for phytoliths under the microscope (avg. 2–3hours per slide = 80–120 hours total)

- There are multiple washes and centrifuging steps between stages 3, 4, and 5.

NOTE: ***If extracting phytoliths for dating purposes, boil and sterilize all glassware and glass tubes.***

1) Sediment sterilization for foreign samples, following CFIA requirements

This is to eliminate any potential pathogens. The heating process will also remove some degree of organics and starch grains, so is inappropriate for a piggyback-style extraction process.

—Prepare and label foil envelopes for sediment samples.
—Heat muffle furnace to 200C.
—Put ~150mL of sediment from each sample into the appropriately labeled foil packet.
—Note the location of the foil packets in the muffle furnace.
—Soak any used tools, implements, etc. in bleach water solution in marked bucket.
—Heat sediment samples in furnace at 200C for at least 6 hours.
—Allow samples to cool in oven overnight. Samples are likely to clump a bit from the low-firing.

—Dispose of any contaminated materials (sample bags, packaging materials, gloves, disposables) in the Stericycle or Daniels bin for incineration.

2) Deflocculating Sediment Samples in Water—Rinse set of 1000mL beakers.
—Label each beaker with masking tape and sharpie.
—Gently break up each sediment sample in the foil placket, then put each sample into the corresponding labeled beaker. Start with ~150 mL of dry sediment per beaker (beaker needs a height of at least 12 cm).
—Add 1–2 tbs. deflocculant (***sodium hexametaphosphate if dating phytoliths, baking soda [sodium bicarbonate] if not dating phytoliths***), and 1000 mL of *very hot* water. Stir.
—Consider sonicating samples for 10 mins each (several batches of 5) in the large sonicating bath, to speed deflocculation (following Lombardo et al. 2016).
—Stir every 15 min., about 20 times total (takes ~3 days). Mixture should be uniformly cloudy, with NO remaining clumps, and clays should be relatively suspended in solution at the last stir.
—On day of sieving, give one last stir, then wait at least 1 hour before sieving to make sure silts have settled adequately.

3a) Removing Sand (S) Fraction and Larger Sediments (D) Fraction—Set up a set of sieves in this order: No. 60 (250 um, for D fraction) on top of No.270 (53 um, for S fraction) on top of base pan (for A and B fractions).
—Label a set of 1000 mL beakers with same sample info as current 1000 mL beakers, with the addition of "A/B" to represent fraction.
—(***To reiterate***) After waiting at least 1 hour for silts to settle, pour off top 500 mL from samples (this is to reduce the liquid volume, so that the remaining water fits in sieve pan).
—Give mixture another vigorous stir, until all sediments are relatively suspended.
—Pour 1/3 of mixture through set of sieves, wait for liquid to go through, pour another 1/3, wait for liquid to go through, pour last portion.
—Keep an eye out for particulate charcoal (can be dated—only 100 micrograms needed for AMS dating, but NOT if sodium bicarbonate was used).
—Add 400 mL of clean water to corresponding labeled "A/B" beaker.
—Using A/B beaker clean "rinse water", rinse off the upper fraction through screens and into the base pan. Pour approximately 100 mL at a time (any silt lumps can be gently "mashed" into the top screen with a clean pipet while rinsing).
—Keep an eye on run-off from screens into base pan—when this water is fairly clean, remove upper (D) fraction. If D fraction is still not fairly clean, do an early pour-off of base pan liquid into corresponding labeled beaker and continue rinsing process until water is fairly clear.
—Pour contents of bottom pan (A&B fractions) back into corresponding labeled beaker.
—Total contents of beaker are usually +/- 1000 mL, unless more rinsing is needed for in-screen fractions, and more than one beaker has been used.
—If particulate charcoal is needed for dating (or to preserve potential macrobots or fauna or lithics), save the D fraction by overturning screen contents onto a labeled paper towel (wait a few days until fully dry, and bag this sample).

—If not preserving D fraction, dispose of screen No. 60 contents using proper soils protocols—Clean off No. 60 screen.
—**Replace** upper No. 60 screen, clean No.270 screen under No.60 screen, under running water, until water is completely clear. This is because the No. 270 screen is VERY delicate and can be damaged by too much water pressure.
—Concentrate sand (S) fraction in the No. 270 screen (still UNDER the No. 60 screen) by running tap water onto screen while tilting screen so that water pushes the sand up against one side of the pan.
—Pour sand fraction (S) into labeled 50mL tube. This is messy, and some sand will be lost. Multiple tubes may be necessary.
—Keep adding a bit of water (under No. 60 screen), concentrating sand and pouring into labeled tubes, until most of the sand has been removed from the screen (some particles will remain in the screen).
—Clean off both screens. **Always leave larger No. 60 screen over smaller No. 270 screen to prevent damage.**

3b) Removing Clay from Fine (A) and Course Silt (B) Fractions—Add water up to 900 mL mark (10 cm in height) to each beaker containing the A and B fractions.
—Stir vigorously—quickly and sequentially so that everything is approximately at the same stage of stirring.
—Cover in plastic wrap.
—Let sit for 1.5 hours.
—Pour off +/- 400 mL of excess water.
—Add water up to the 900 mL mark and stir vigorously.
—Let sit for 1 hour.
—Rinse, repeat 1 hour sequence (3 to 30 times) until water is fairly clear of suspended clay (whole procedure takes 1–10 days, depending on clay content).
—After the last pour-off, pour the solution into a prepared 500mL beaker (simply move the masking tape label) and let the samples sit in the beakers overnight.
—The next day, pour off excess water and pour samples into labeled centrifuge tubes.

3c) Preparing samples for Chemical Digestion—Redistribute fractions in labeled 50 mL centrifuge tubes to maximize processing. Coarse silt (B) and fine silt (A), and sand (S) should each have 1.5-2.0 cm of sediment at the bottom of the tubes—Process one or several tubes of each sample at a time (depending on recovery strategy).
—Centrifuge tubes for 5 min. @ 1,000 rpm to consolidate sediments at the bottom of the tube
Don't use more than 1,000 rpm when sediment is in the tube at any time, but at phytolith isolation, washing, and drying stages, you can go up to 1,500 rpm for 10 min.
—Pour off excess water, leaving only the damp plug at base.
—In some cases you will want to make sure sediments are dried thoroughly (can dry overnight at roughly 65 degrees F in the oven) before weighing sediments and placing in beakers. In other cases, you can leave the sediments as damp samples and record the wet weights.

—Label a set of 600 mL beakers, using the number (1–40) that will eventually correspond to the microwave vessel number on the carousel. **Note which number on the carousel corresponds with which sample in your laboratory notebook.**
—Transfer sediments to labeled 600mL beakers, weighing the material in the beaker (taring for empty beaker weight) to target 10g per sample.
—Record the weight of each unprocessed sediment sample in your laboratory notebook or spreadsheet.

4a) Preparing the microwave equipment—Ready the microwave vessel carousel—ensure all vessels and fittings are clean. There are 40 microwave vessels on the carousel, each holding a roughly 50 mL volume of material. Pressure sensors are at the base of the microwave.
—Place the vessels in the carousel. **Carousel with tubes will get fairly heavy once full, so be careful!**
—Ensure that you have at least 8 tubes in the carousel for processing. The vessels placed in the microwave carousel should all be filled—dummy tubes with water work. Otherwise, microwave power will be too concentrated for the few tubes inside. For more than 8 tubes but fewer than 40, you can leave the carousel slots empty. Make sure to place tubes in the carousel according to p.13 of the manual. This will optimally match tubes to sensors.

4b) Preparation of sediment and solution in microwave tubes—Take the set of samples in labeled (1–20, etc.) 600mL beakers, and place under fume hood in order. Put a glass stirring rod in each.
—Put on lab coat, goggles, safety mask, and two pairs of gloves (double up).
—Prepare a beaker of distilled water (to clean syringe).
—Prepare a bucket in the sink with ~2 gallons of water and 1 box of baking soda. Stir baking soda into solution using one of the large glass stirring rods.
—Under the fume hood, prepare three beakers: nitric acid, hydrochloric acid, and hydrogen peroxide (or potassium chlorate). Have a syringe ready for each.
—Recommended for 10 g of sediment (halve quantities for 5 g of sediment) in each tube:
1) 6 mL hydrochloric acid (10% aqueous solution)
2) 10 mL nitric acid (68–70% aqueous solution)
3) 2 mL hydrogen peroxide (30% aqueous solution)—Using a 50 mL or 15mL syringe, express chemicals, in turn, into each 600 mL beaker, while stirring gently with a glass rod. **Add each chemical slowly, as they may rapidly start to bubble up.** For samples high in carbonates, the hydrochloric will react vigorously. In other cases, the nitric and hydrogen peroxide will react vigorously with organics. Make sure to mark vigorous reactions of various chemicals or any spillage in your lab notebook.

In case of overflow or spillage: stay calm! It's okay if a little material spills onto your double-gloved hands. If you get any material on exposed skin or clothing, neutralize immediately with the baking soda solution, then rinse clean in cool water. You can use paper towels, sponges, and kim wipes dipped in the baking soda solution to clean up the mess under the fume hood, then put all these contaminated materials in the baking soda solution to neutralize the acids. As you clean, be careful not to drip any of this baking soda solution into the beakers as it will

neutralize the acids and/or potentially contaminate the sample. While cleaning, also make sure no sample has spilled into another. If you suspect cross-contamination, you'll need to start again with fresh material from the affected samples.

—Use the beaker of distilled water, as needed, to cleanse the syringe if besmirched by accidentally touching material in the beakers.
—Wait for chemical reactions in the beaker to slow down or visibly cease (this may take 15–40 minutes).
—Stir each sample again with the corresponding glass stirring rod.
—Wait for chemical reactions in the beaker to slow down or visibly cease (this may take 15–40 minutes).
—Pour each labeled (1–40) chemical mixture into the corresponding microwave vessel tube (1–40). There may still be slight bubbling, but there should be no danger of bubbling over of the sample.
—Using 1–2 mL of nitric acid, rinse remaining sediment mixture adhering to each beaker into each microwave tube. Gently swirl in the beaker, then pour into microwave tube. (There will still be small amounts of sediment residue visible in each beaker.)
—Place pressure plug on each microwave tube, then screw on each cap very tightly, using one click of the white plastic torque wrench (in drawer).
—Place tube in Kevlar sleeve, and fit each vessel tube into corresponding number on microwave carousel.
—Make sure all vessels are flush with the Kevlar sleeves and patted down to base of carousel.
—Place all glass stirring rods gently into the bucket of baking soda solution. Rinse each soiled beaker in this sodium bicarbonate solution before washing each beaker with alconox solution at the sink.

4c) Preparation of microwave—**Ensure the damper above the microwave is open.** If it isn't, unscrew the screw, slide out the metal sheet, and tighten the screw. Fumes from the microwave and oven go into the fume hood through the hosing attached to each.
—Make sure to place tubes in the carousel according to p.13 of the MARS microwave manual. This will optimally match tubes to sensors. Again, you will need to run a minimum of 8 tubes (some may be dummy tubes with only water).
—Place carousel in the microwave, matching up the divot at the base, to lock carousel securely onto microwave tray.
—With the microwave door open, flip the ON switch on the right side of the microwave. This will turn the carousel a full rotation, once, both clockwise and counterclockwise, to test the internal sensors.
—Close the microwave door.

4d) Setting and running the microwave—After closing the microwave door, go to the main menu.
—Press the button for "One Touch Methods."
—Find the "ARCH SEDS" stored method for processing archaeological sediments and hit "enter".

—Check to make sure the protocols are correct:
ARCH SEDS
Control type:> ramp to temp
Vessel type:> Xpress
Sample type:> Organic
Temp Guard: On; >220C
Sample prep notes [chemical quantities listed above]
Ramp time: 20:00
Hold time: 55:00
Temp: 180C
Power: (variable—One Touch method auto corrects with more power for more samples)
Stirring: Off—Press "play" icon (>) to start the program. The entire microwaving time should be ~130 minutes. **Do not attempt to uncap the tubes for AT LEAST 5 hours, but ideally you can simply wait until the next day after cooling overnight.**

4e) When microwaving is complete

(to reiterate) **Ideally, leave tubes overnight to cool in microwave. Before removing the tubes from the microwave, make sure the pressure is down to roughly 20 PSI or less.**

—Check the log of the ARCH SED method to ensure all samples heated appropriately. If not, step 4d may need to be repeated.
—Remove the carousel of tubes and place under the fume hood. With gloves and goggles on, release/unscrew the cap of each microwave tube slowly. Allow the fumes to ventilate into the fume hood duct (10-80 mins).
—After the fumes have been ventilated, unscrew the caps fully. Remove the pressure plugs, and stir the sediment and solution in each microwave tube with clean glass stirring rods. This will aid removal from tube.
—Pour the mixture from each tube into an empty and **labeled** 50 mL centrifuge tube.
—After pouring the mixture, carefully squirt water (using H2O squirt bottle) into the microwave tube to rinse remainder into the prepared 50 mL tube.
—Prepare a tub of 2 L water plus 1 box baking soda.
—Put empty microwave tubes, stirring rods, and any acid-residue materials into this tub to neutralize any remaining acids. Let materials sit for at least 30 minutes before cleaning.
—Centrifuge the 50 mL tubes @3000 rpm for 5 minutes.
—Under the fume hood, dispose of this supernatant into a (single) beaker, then **transfer the combined beaker contents into the sealable container marked for special removal of hazardous waste with a yellow chemical waste sticker**.
—Send each sample through a series of two rinses using distilled water. In each rinse, add water to the 50 mL mark, agitate until sediments go into solution, then centrifuge @3000 rpm for 5 minutes.
—After each water rinse, pour off supernatant into the tub of baking soda solution to neutralize any remaining acids.

4g) Clean-up of chemical waste—After soaking for 30 minutes in the baking soda solution: tubes, caps, and pressure plugs (but NOT Kevlar sleeves) may be cleaned with contrex or alconox solution.

—If residues remain in microwave test tubes, they may be cleaned with acetone and rewashed.
—Make sure all chemical waste is in a sealed container, labeled with the chemical waste sticker, and under the fume hood.

5a) Making Heavy Liquid Solution—Start with 150 mL of water per pound of sodium polytungstate, THEN add 5 mL water at a time, measuring on scale until 2.3 g/mL is reached. *(Final specific gravity: aim for 2.3 (i.e. weight of 1 mL of solution is 2.3 g) Don't go under this specific gravity with too much water!)*
—Use dry sodium polytungstate. One pound of sodium polytungstate will make roughly 175 mL of heavy liquid.
—Start with water, add sodium polytungstate.
—Make solution, shaking slowly, and adding a bit at a time.
—Set scale to zero with an empty 2 mL capsule.
—Add 1 mL liquid, reweigh capsule.
—Add water to solution (5mL at a time) until 2.3g specific gravity is reached. It's okay to be within 0.05g of the 2.3g requirement.
If you run out of chemicals, and still aren't at the right specific gravity, you can boil the liquid or let evaporate slowly to increase specific gravity.

5b) Flotation of Phytoliths: Heavy Liquid Solution step—Label a set of 15 mL centrifuge tubes, one for each 50 mL processed sample.
—Add heavy liquid solution to each centrifuge tube, to about 2 cm above the top of the sediment. This may mean that the surface of the supernatant is a bit more difficult to access with the pipet, if the 50 mL tube has only a little processed material remaining.
—If organic material is still present in sample, the heavy liquid will turn red or black. This does not damage the sample, but may mean more organic "background noise" ultimately on the slide.
—Cap the centrifuge tube, stir, shake, and invert each tube to put all sediment into solution.
—Invert slowly (+/- 5 times) **just before** centrifuging. Put into centrifuge immediately.
—Centrifuge for 5 min. @ 1,000 rpm.
—Lift test tubes out one at a time, **slowly**, to reserve surface tension (milky film atop test tube is phytolith "crust").
—Use a pipet to remove upper "crust" of phytoliths in a circular motion around the sides of the tube, just skimming the surface (first suction step)—add this solution to labeled 15mL tube.
—Use pipet to suction from center of centrifuge tube solution, and "clean" the sides of the tube with the pipet, then quickly remove upper portion of phytolith material in a circular motion around the sides of the tube, just skimming the surface (second suction step)—add this solution to labeled 15mL tube.
REPEAT (2 centrifuge extractions total):—Cap the centrifuge tube, stir, shake, and invert each tube to put all sediment into solution. invert slowly (+/- 5 times) **just before** centrifuging.
—Put into centrifuge immediately.
—Centrifuge for 5 min. @ 1,000 rpm.
—Lift test tubes out one at a time, **slowly**, to reserve surface tension (milky film atop test tube is phytolith "crust").

—Use a pipet to remove upper “crust” of phytoliths in a circular motion around the sides of the tube, just skimming the surface (first suction step)—add this solution to labeled 15mL tube.
—Use pipet to suction from center of test tube solution, and “clean” the sides of the tube with the pipet, then quickly remove upper portion of phytolith material in a circular motion around the sides of the tube, just skimming the surface (second suction step)—add this solution to test tube.
Do not fill labeled 15 mL tube to more than 1/3 of total volume with phytolith/liquid solution.

5c) Isolating Phytoliths: Removal of Heavy Liquid and Drying Phytolith Sample—Add distilled water to 15mL centrifuge tube containing phytolith/solution extraction (up to the top of line markings)—this will lower the specific gravity and cause phytoliths to sink.
—Cap the tube, invert, mix, and shake until heavy liquid and water are in solution.
—Centrifuge for 10 min. @ 1,000 rpm.
—Slowly invert test tube to pour off supernatant, leaving behind phytolith “plug” at base. If plug begins to loosen and go into solution, stop pouring off supernatant immediately and continue to next step.
—Re-add distilled water, repeat entire process.
—Perform 2–3 water washes total, until water emerges clear.
—Pour off last of water supernatant from tube (after centrifuging).
—Invert tube, quickly blot tube on a paper towel.

If drying immediately, add sample to a GLASS or POLYPROPELENE (not polycarbonate!) test tube and complete next 4 steps. Otherwise, skip to next section.
—Add acetone up to bottom of labeled tape.
—Stir, invert with parafilm, until all sediment is dislocated from bottom of tube.
—Centrifuge 10 min. @ 1,500 rpm.
—Slowly pour off acetone supernatant.

With or without acetone step:—Cover open centrifuge tubes loosely with parafilm or plastic wrap (to prevent blow-ins) and allow to completely desiccate (several days to several weeks) inside the fume hood.
—Samples should eventually appear like a white or beige clay or powder.

6) Clean-up and Waste Removal—All glassware, stirring rods, etc. should be clean, dry, and placed back on the shelves.
—Microwave tubes, pressure plugs, and caps should be thoroughly cleaned and stored back in the microwave carousel. Store the clean Kevlar sleeves in the drawer next to the microwave.
—Wash all goggles used.
—Launder all lab coats used. The location of the drop off is the 1T area CSS—Customer Support Services; Stores and Linen in Hamilton Health Sciences (behind

the yellow elevators). There is a fee of $2.50 for each lab coat laundered, which will be charged directly to an MPERF account.

—Make sure all chemical waste jars are labeled using the yellow chemical waste stickers and waiting on the shelf under the fume hood. These stickers are available at the ABB Stores (B166) and from: www.workingatmcmaster.ca/eohss**—Schedule waste pick-up using the chemical waste removal forms.**

7) Mounting the Phytolith Concentrate Material

For larger samples (the roughly 10 gram samples), the processing should leave 1–2 grams' worth of material. At this point, the phytolith concentrate will be in the labeled 15 mL tubes.

—When the samples are fully dry, label a set of small 2 mL centrifuge tubes with the same set of labels. This will be the dry archived collection (separate from the wet archived collection and separate from the slides).

—Loosen the material in the 15 mL tubes, with a shaker, by hand, by pipet, or all of the above.

—Remove part of the material from the 15 mL tubes, and archive it in the 2 mL tubes. (A pipet works well for this—but **use separate pipets for individual samples**!

—Break off the end of a clean glass pipet, and use this as the reserved pipet for the immersion oil.

—Lay out a large kim wipe—the immersion oil is messy. Keep a set of small kim wipe on hand.

(Immersion oil used: Type B from Cargille. Code 1248. Standardized at 23 degrees Celsius. Non-drying for microscopy. Viscosity, cSt = 1250 +/- 10%. Fluorescence = Low, relative to Cedarwood Oil.)

—On a clean small kim wipe, label a slide with the same information listed on the tube, in both Sharpie and pencil.

—In each 15 mL tube, drop by drop, add enough immersion oil (with a clean pipet) to thin the phytolith material sufficiently for a slide. You'll want to be able to transmit light through the slide, and be able to distinguish different materials (vs. overly dark & overcrowded conditions on the slide due to too much material).

—Using the reserved individual pipet, mix the oil with the material.

—Drop one drop of mixture onto the center of the slide. If material seems too filled with phytolith material, add a drop of pure immersion oil. Add, in total, 1–3 drops of liquid.

—Place a coverslip (large) over the mixture, and press very lightly until mixture is evenly dispersed under the coverslip. Try to remove all of the air bubbles.

—Wipe any excess mixture from the sides of the slide.

—Apply a thick coat of color nail polish to seal the edges. (Opaque Sally Hansen Hard As Nails is the best)—Make sure to curate the slides on their "backs", not edges.

8) Scanning for Phytoliths under the Microscope: General Notes

Samples are already divided into AB and S fractions, processed, floated, and mounted on slides.

—Counts: 100 in AB fraction and 100 in S fraction = 200 total per sediment sample

—Note: many additional phytoliths of an AB size are sometimes released into S fraction after chemical processing. By analyzing both fractions, this presents a better way to get phytoliths more fully trapped in sediments.
—Magnification power for scanning slides: for S fraction, at 200x, for AB, at 400x.
—Beginning in one corner of the slide, move systematically from top to bottom, left to right (as though reading a book). Moving from left to right, begin by moving to a field of view which overlapped only slightly with the previous, then slowly shift focus in and out. This enables a view "through" the transparent phytoliths, in order to gauge broad morphology. (i.e. starting on top surface, moving through the phytolith, then ending with the bottom surface).
—Morphology is also inspected by gently depressing the slide with a rubber-coated paperclip tip or blunted needle probe, in order to rotate the phytoliths in the immersion oil. This is especially helpful with phytoliths such as rondels, which appear spherical in planar view but like spools in profile.
—Do not count the elongate and bulliform phytoliths that are common in grasses, since these are incredibly abundant and ubiquitous, and will dominate all slide densities and slow the identifications considerably (i.e., you would needed to bump the counts to 1000 or more per slide).
—Make sure to photograph each (significant/diagnostic/novel) phytolith at three focal points, at least, then rotate and take additional photos.

Appendix D: Experimental Procedure to Retrieve Starches from Sediment

Protocol elaborated by Éloi Bérubé based on Zimmermann (2019)

1. Collect 0.25 mL of sediment and place it in a 2 mL plastic centrifuge tube
2. Add 1.75 mL of a solution of HCl (Concentration of 10%)
3. Wait 30 minutes for the chemical reaction to stop (wait more if bubbles still visible at that point)
4. Close the tubes and centrifuge them at 3500 RPM for 10 minutes
5. Poor off the acid from the tubes in a designated container
6. Fill the tubes with UltraPure water

7. Centrifuge the tubes containing sediment and UltraPure water at 3500 RPM for 10 minutes
8. Poor off the UltraPure water from the tubes in a designated container
9. Repeat steps 6–8 twice
10. Place the sediment on a thin slide and prepare it for analysis following protocols found in **Appendix B**.