Plant Microfossils Recovered from Dental Calculus at Casas Grandes, Mexico

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INTRODUCTION

In an attempt to better understand the diet and nutrition of the people of prehistoric Casas Grandes, we analyzed samples of dental calculus (tartar) recovered from the human remains of 110 people found at Paquime and other sites in the Casas Grandes region of Chihuahua, Mexico. These remains are curated at the Museo de las Culturas del Norte in Casas Grandes and represent those who lived in the northeastern region of Chihuahua from about 700–1450 A.D. The samples were extracted by Kyle Waller during the summers of 2012 and 2013, and Daniel King processed the samples in the summer of 2014 when he was a PhD candidate at the University of Arizona, performed the microscopy of the samples and provided a report of his findings in 2015.

Our research is based on previous projects in which dental calculus has been successfully used to help reconstruct prehistoric diets. As Boyajian et al. (2007) suggest, analyzing plant remains in the form of microfossils “could render information about specific plants eaten and manipulated with the teeth.” It is an ideal complementary method to stable isotopic reconstruction, because the dental calculus provides information about food eaten a short time before death (from days to weeks, depending on the size of the deposit), whereas isotopic analysis provides a long-term perspective on diet.

METHODS

Dental calculus was removed from archaeological teeth by Kyle Waller at the Museo de las Culturas del Norte in June 2014 during analysis of the human skeletal remains. All individuals with teeth from the Casas Grandes site (Viejo period, 700–1200 A.D.) and Paquime period (1200–1540 A.D.) were examined macroscopically for adhering calculus. If calculus was noted, the tooth was cleaned with double-distilled water using a soft-bristled toothbrush. This was particularly necessary for Viejo period skeletons that appeared to have not been as sufficiently cleaned or organized as Medio period skeletons. The teeth were then allowed to air dry. A scalpel that had been sterilized in ethanol and rinsed in double-distilled water was used to remove the calculus samples from teeth, and the samples were then placed on weighing paper. Each calculus sample was placed in a labeled, sterile plastic sample vial, and weighed using a precision milligram scale.

Once the calculus was removed, it had to be digested in order to extract the microfossils in preparation for slide creation and eventual microscopic analysis. Hydrochloric acid was first used to begin the digestion process, with little to no addition or heating. Second, the samples were rinsed using distilled water to stop further digestion. Each sample was processed in a mini centrifuge at 800 rpm for 20 seconds. Third, and lastly, the samples were stored in ethyl alcohol so as to prevent osmosis of any microfossil cells, primarily starches.

The samples were then mounted on microscope slides and microscopy was conducted with an Olympus BX21, equipped with light microscopy using a magnification of 50x. Using these methods, microfossils were then identified, classified, and examined for signs of possible use-wear.

RESULTS

Of the 110 samples analyzed, 63 (57%) yielded some type of microfossil (Table 1). Numerous starch grains and fungal spores were recovered from the dental calculus samples. Some phytoliths and pollen grains were recovered, but they were few in number. In addition, microremains of water organisms, diatoms, chrysophytes, and sponge spicules, were also recovered, but rare.

Phytoliths

Phytoliths are microscopic silica structures found in certain parts of plants, including stems, leaves, and roots (Peasnell 2010:356). Phytoliths were present in 32 (29%) of the samples (Figure 1), and morphological characteristics suggest the presence of cool and warm season grasses, sagebrush, and squash. Interestingly, no maize phytoliths were identified and the lack of these could suggest the use of nixtamalization, a process that increases the nutritional value of maize.

Some phytoliths were noted to be heavily damaged, indicating that they were probably derived from plant material that was roasted. This is consistent with the identification of maize granules with eccentric hilum, diagnostic of maize-based dishes. The nature of the damage and the type of phytolith identified can be used to differentiate between maize-specific damage and damage to other plants. For example, maize granules with eccentric hilum can be used to indicate the use of maize-based foods, but not necessarily the use of maize itself. The presence of damaged phytoliths in the archaeological record suggests that maize was being used in the diet, even if not the only food staple.

Starch Granules

Starch grains were present in 47 (43%) of the samples (Figure 2). Starch was by far the most common microfossil identified, and maize starches represented the majority of this category in 23 Casas grains. Other starches (e.g., little barley) and one tuber starch were also identified. Lenticular starch glands showed signs of damage and drying (preservation). While maize starches showed the most damage, some of these grains were preserved, indicating that some maize-based foods were consumed.

Diatoms

Diatoms are a group of microalgae that have a calcareous, silica-based, or organic wall. They are commonly found in aquatic environments, including ponds, lakes, and oceans. In addition to their ecological importance, diatoms have been used as indicators of past environmental conditions, such as temperature and salinity. They can also be used as indicators of human activity, such as the use of water for drinking or irrigation.

Diatoms are typically found in freshwater environments, such as lakes and rivers, and have been identified in dental calculus from various archaeological sites. In this study, 12 diatom taxa were identified, including species of Aulacoseira, Eunotia, and Navicula. These diatoms are commonly found in freshwater environments and are used as indicators of past environmental conditions. They can also be used as indicators of human activity, such as the use of water for drinking or irrigation.

Diatoms were identified in 33 of the samples, and were present in varying amounts. Some samples had a high number of diatoms, while others had very few. However, the presence of diatoms in the samples suggests that water was being used in the diet of the people from Casas Grandes.

CONCLUSIONS

Based on our results, maize seems to have been the most common plant food represented in our samples from Casas Grandes. Maize constitute 92% of the starch grains identified, which is consistent with previous studies of prehistoric diets in the region. It is likely that maize was an important staple in the diet of the people from Casas Grandes, and that it was consumed in a variety of forms, such as maize-based foods and maize grits.

The presence of diatoms in the samples suggests that water was being used in the diet of the people from Casas Grandes. Diatoms are commonly found in freshwater environments, such as lakes and rivers, and have been identified in dental calculus from various archaeological sites. In this study, 12 diatom taxa were identified, including species of Aulacoseira, Eunotia, and Navicula. These diatoms are commonly found in freshwater environments and are used as indicators of past environmental conditions. They can also be used as indicators of human activity, such as the use of water for drinking or irrigation.

Fungal Spores

Fungal spores were present in 34 (31%) of the samples, including those from pine trees, which grow in the mountain forests of the Sierra Madre to the west. Ingestion of these grains was likely inadvertent due to the ubiquitous nature of pine pollen in this environment. Yellowish flecks of unknown origin were also present in several samples. While these samples could not be identified to the species level, they are likely to be fungal spores, which are common in archaeological samples.

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