Plant Microfossils Recovered from Dental Calculus at Casas Grandes, Mexico

Daniel King  
*Brigham Young University - Provo*

Michael T. Searcy  
*Brigham Young University - Provo, msearcy@byu.edu*

*See next page for additional authors*

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King, Daniel; Searcy, Michael T.; and Waller, Kyle, "Plant Microfossils Recovered from Dental Calculus at Casas Grandes, Mexico" (2016). *All Faculty Publications*. 1729.  
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Authors
Daniel King, Michael T. Searcy, and Kyle Waller

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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 Paquimé and other sites in the Casas Grandes river valley in 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 2014. That year Chad A. Pearsall, 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 Boyadjian 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 foods 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 (Viagejo period, 700-1200 A.D.) and Paquimé samples (1200-1850 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 Veijo 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 added heat or agitation. 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, 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 microscopic treatment was conducted with an Olympus B2-210 transmitted light microscope 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 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 (Prasad 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, sedge, and squash. Interestingly, no maize phytoliths were identified and the lack of these could suggest the use of nixtamalization to process the grains, which would eliminate the phytoliths from the microfossil record.

Perhaps the most interesting results were evidence for maize fermentation. Corn beer, or chicha, has been recorded elsewhere in South and Central America. Three samples all showed damage resulting from the fermentation process. The grains exhibited striate from grinding, were swollen, or were gelatinous. Moreover, the three samples exhibit damage from three distinct heating temperatures, perhaps representing the entire chicha-making process. Whalen and Minnis (2015:51) have found some evidence of possible fermentation at a site west of modern-day Mata Ortiz. They found a number of pottery fragments from large vessels with interior pitting that might have been the result of erosion due to the fermentation of a beer or from the alkaline treatment of large amounts of corn. Yost (2015) suggests that “the presence of two maize diatoms in two diatom-starch aggregates indicates that fish and/or other marine aquatic resources were utilized.” While the presence of diatoms is not surprising, it may suggest other food sources not commonly accounted for in the literature or the archaeological record.

CONCLUSIONS

Based on our results, maize seems to have been the most common plant food represented in our samples from Casas Grandes. Cool season C3 grasses were also found and many lenticular starch grains showed signs of grinding, dry roasting, and cooking. Corn smut (Ustilago maydis) was found as well, which is unsurprising as this fungal pathogen has been determined to have originated and evolved along with maize domestication. There is strong evidence, ethnographic and archaeological, for the intentional consumption of corn smut (Valverde, et al. 1995), although unintentional calceus contamination is still a possibility.

The high numbers of maize and grass starch granules found, the near complete absence of phytoliths is interesting. As mentioned, the absence may suggest the use of nixtamalization to process the grains, which would eliminate the phytoliths from the microfossil record.

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Even more exciting are the complementary data being generated by other scholars concerning Casas Grandes health and diet. Katzenberg et al. 2015 have conducted preliminary analyses of skeletal morphometrics, isotopic characterizations, DNA, and paleopathologies of several of the same individuals studied in this research. We expect that these data will enhance our findings and provide unique dietary, genetic, health, and nutritional information regarding those who inhabited this desert region of Chihuahua.

REFERENCES


