Prehistoric Maize Consumption in Chaco Canyon, New Mexico

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Introduction

Between 850 and 1150 CE, Chaco Canyon flourished as a sociopolitical entity in the heart of New Mexico's San Juan Basin. Coprolite analysis provides insights into the dietary patterns of any archaeological source. This study examined the presence and amount of maize pollen in the coprolites to determine if maize agriculture was conducted inside of Chaco Canyon. The UNL-SNR palynology lab has previously analyzed ancestral Pueblo diet from sites that include two villages that were maize-dependent and where maize was grown locally [Salmon Ruin, NM and Antelope House in northeast AZ (Reinhard et al. 2006)]. As well as the site Antelope Cave in northwest AZ where maize cultivation was limited due to environmental constraints. Coprolites from 3 prehistoric archaeological sites in Chaco Canyon , coprolites from Pueblo Bonito, Atlatl Cave and Kin Kletso were analyzed and compared to the pollen abundance from these previously studied sites to assess whether or not maize was locally grown inside Chaco Canyon.

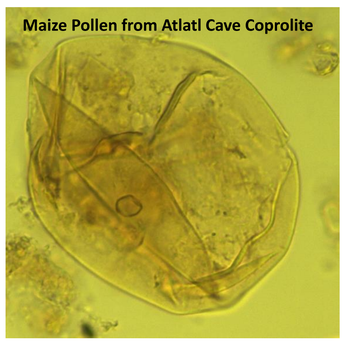
We hypothesize that there was a significant local production of maize in the canyon as well as a widespread use of maize pollen for various religious purposes. If maize was produced locally as the main source of food for Chaco Canyon then we can hypothesize that we will discover no significant difference in the amount of maize pollen observed in each different area and from the known agricultural comparative sites (e.g. Salmon Ruins). If maize was imported from outside of the canyon for food consumption, then we can hypothesize that we will see less maize pollen in the coprolites, especially when compared to Salmon Ruin and Antelope House.

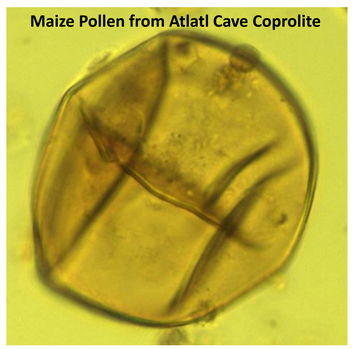
Methods

- Collect 19 samples from Chaco Canyon National Historic Park in New Mexico from the sites Atlatl Cave, Pueblo Alto, Pueblo Bonito, and Kin Kletso
- Rehydrate samples based on methods described in Callen and Cameron (1960)
- Add a Lycopodium tablet to act as a marker grain when doing pollen concentration; total of 12,500 spores added
- Screen samples with geological screens and centrifuge
- Process samples via acetolysis, acetic anhydrous and acetic acid, to remove unnecessary organic material
- Wash samples with distilled water and centrifuge
- Mount samples on microscope slides with glycerine.
- Pollen spores viewed by light microscopy and counted to a 200 grain count
- Pollen concentration values calculated by the following equation:

Pollen Concentration= ((p/m) x e) / w

p = # grains counted
m = # marker grains counted
e = # marker grains added (12,500)
w = weight of sample





Data

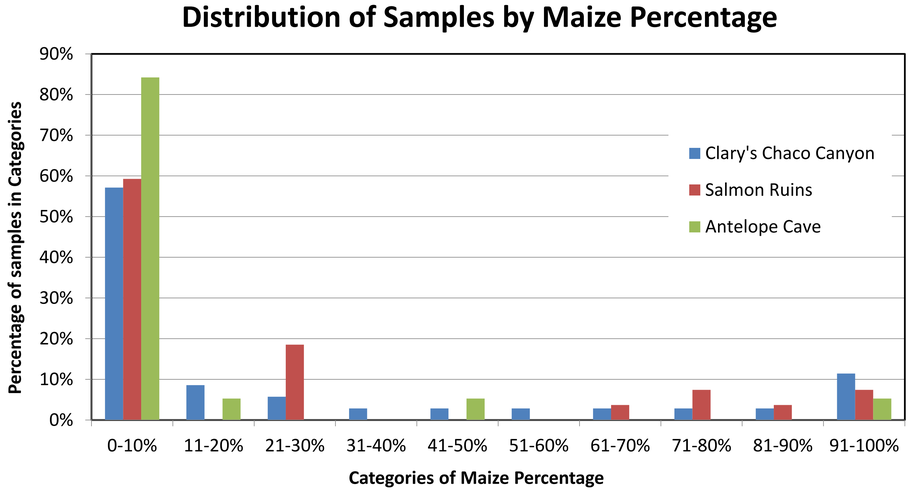


Figure 1: Summary data from prior coprolite analyses from three sites; Pueblo Alto and Pueblo Bonito in Chaco Canyon, Salmon Ruins, and Antelope Cave. The data is compiled Maize pollen concentrations from each site. The horizontal axis represents the ranges of pollen concentration values that were calculated from the pollen counts. The vertical axis represents the amount of Maize pollen concentration values that fell into the percentage range.

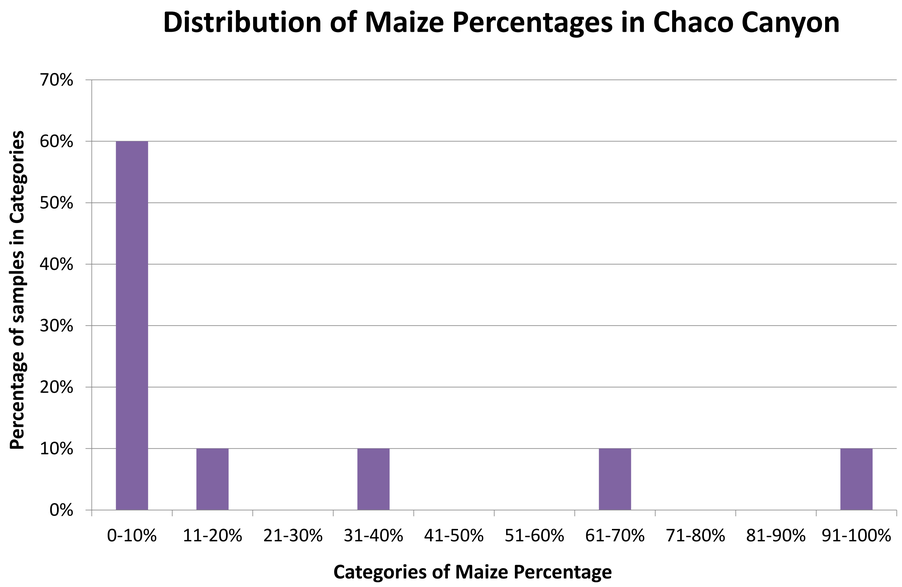


Figure 2: Displays data from our pollen counts done during this UCARE project on samples from three sites in Chaco Canyon. The data shown represents the compiled pollen concentration values from the eleven sites we analyzed. Those sites include Atlatl Cave, Pueblo Bonito and Kin Kletso. The horizontal axis represents the ranges of pollen concentration values that were calculated from the pollen counts. The vertical axis represents the amount of Maize pollen concentration values that fell into the percentage range. Most of our data fell in the 0-10% pollen concentration range.

Results

Graph 1 represents the three sites of previous palynological research done on the pueblo diet in the Chaco Region. This graph shows the percentage of samples at each site that had pollen concentration values within a certain range; most samples fell in the 0-10% range. Clary's data from Pueblo Bonito and Pueblo Alto in Chaco Canyon shows that 57% of the samples had a 0-10% Maize pollen concentration, Salmon Ruins had 59% of its samples within the 0-10% pollen concentration range, and Antelope Cave had 84% of its samples in the 0-10% range. The previous counts for Pueblo Bonito and Pueblo Alto sites in Chaco Canyon completed by Clary were not full 200 grain counts at the time. We know that Antelope Cave was positioned in the northwest corner of Arizona and that Antelope Cave was a rabbit hunting site so Maize cultivation was not the main activity there. The maize pollen that does show up in the Antelope Cave counts was brought there since locally grown maize was unavailable. Salmon Ruin was a site where Maize was cultivated. The data from Salmon Ruins is a representation of a place where local maize cultivation occurs and will be a good site to compare our data to.

The second graph shows the results of our Chaco Canyon pollen counts. It shows that 60% of the samples counted had a pollen concentration of less than 10%. The other 40% of the samples fell into four different ranges. Comparing the two graphs we can see that our pollen concentration values are similar to the concentrations found in Clary's counts. Salmon Ruins also has pollen concentration values that are similar to Chaco Canyon. While completing the pollen concentration data, some other species of plants dominated the samples. *Pinus*, *Cheno-Am*, *Cleome*, and *Poacece* were commonly found in high concentrations. The low pollen concentration values are a result of poorly preserved coprolites from the oxidative environment from which the coprolites were recovered. The samples also contained fungus, mites and nemitod larva (Paseka 2010). Our pollen concentration values weakly support that there was some maize cultivation in the canyon but there was also maize imported into the canyon.

Some of the problems we encountered during our pollen counts began with the bad preservation of the pollen. The samples were full of sand that had caused there to be no significant amount of pollen to be recoverable. The sand contamination also caused us to have lower pollen concentration values which are represented in the 60% of the samples showing a pollen concentration value of less than 10%. These low pollen concentration values were not as insightful had they been protected from decomposition. We also had difficulties reaching a 200 grain count in some samples due to the poor preservation. The oxidative environment could also have an effect on the poorly preserved pollen samples as well as if the pollen was inhaled it could also cause it to be poorly preserved.

Conclusion & Acknowledgments

Comparing our data in Graph 2 to the data found from previous archeological studies represented in Graph 1 we can conclude that there was most likely some maize grown within Chaco Canyon because our data is similar to the found at Salmon Ruin where we know with certainty that maize was cultivated. The small concentrations of maize pollen in some samples may indicate that maize was also imported from and outside source. The data we found in our study is similar the data found at Pueblo Bonito and Pueblo Alto in Clary's study. The poor preservation of the samples did not help our pollen counts. Maize smut and maize starch was also present in the samples. This could indicate maize being used as a daily routine or consumed through atypical ceremonial practices that involves the crushing or grinding of plants, such as maize. From the findings of fungus, mites and nemitods we know that the coprolites were in a wet conditions where the fungus was able to grow and accessible to organisms for feeding. This is an ongoing project and further research is necessary to gain more insights into the full diet of the residents of Chaco Canyon. The presence of other pollen types such as *Pinus*, *Cheno-Am*, *Cleome,* etc. would be ideal to look into in order to discover more about where the food sources were coming from. With *Pinus* being present in large quantities it would be ideal to start looking at surrounding pine tree sources to explore potential importation sites for maize and other plants consumed in the ancient Chacoan diet.

I would to give a special thank you to Carrie Heitman and Karl Reinhard for all the help and guidance they have provided on this project. Also thanking Karl Reinhard for sharing the data found during the previous studies on Salmon Ruins and Antelope Cave. The shared data was important to our study and comparison.

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