A Molecular and Palynological Analysis of Ancient Turkey Coprolites from the American Southwest

BreAnne M. Nott, John G. Jones, and Brian M. Kemp
Washington State University
Primarily Basketmaker II site
Baskemaker II Human Subsistence

- Aasen 1984 Pollen Analysis
Documenting Domestication

- **Using ancient DNA analysis of Coprolites**
  - Were wild birds depositing coprolites at the site?
  - Does the sex ratio of the turkey coprolites deviate from wild populations?

- **Using palynological analysis of Coprolites**
  - Is the diet of aHap2 similar to the domesticated aHap1 lineage?
  - Were Humans and Turkeys likely inhabiting TPR concurrently?
Could wild birds around TPR be depositing feces at the site?

Fisher’s exact test

- TPR significantly different than sites observed by Mock et al. 2002
- P-value: 0.00000 except at Spanish Peaks (p-value 0.00025)

<table>
<thead>
<tr>
<th>Location</th>
<th>Maternal Lineage (Mitotype) from Mock et al. 2002</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (aHap2)</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Colorado Springs, CO</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Spanish Peaks, CO</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Stoneman Lake, AZ</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>White Mountain, AZ</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Ruidoso, NM</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Raton Mesa, CO</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>All Merriam’s Found By Mock et al. 2002</td>
<td>43</td>
<td>2</td>
</tr>
</tbody>
</table>
Expectation: Sex Ratios of domesticated populations would have a lower male:female ratio

- Collier et al. (2007)
  - Wild turkey populations ~50:50 male/female

- D’Costa and Pettite (1998)
  - Multiplex PCR
  - 2 genes: PstI, ATP Synthase

- No successful amplifications
Dietary Analysis: aHap1 vs. aHap2

- Expectation: Wild turkey diet differ from domestic populations
  - aHap1 is a domesticated lineage
  - If aHap2 not domesticated likely have different diet
Turkey Diet at Turkey Pen Ruin

Samples

Pollen Percentage

- Zea mays
- Cheno-Ams
- Other Non-arboreal
- Arboreal
No observable differences in diet between aHap1 and aHap2
Soil Contamination

- Similar pollen due to soil contamination?
Soil Pollen

The chart above represents the distribution of soil pollen from various locations labeled from A3 to D1. Each location is compared against different categories including Zea mays, Cheno-Am, Other Non-Arboreal, and Arboreal. The chart visually indicates the percentage of each category at each location.
Coprolites and Soil

- Pollen concentrations used in Chi-Square analysis
- Coprolite and Soil pollen significantly different at the .05 level

<table>
<thead>
<tr>
<th></th>
<th>Salix</th>
<th>Juniperus</th>
<th>Picea</th>
<th>Zea mays</th>
<th>Chenopodium</th>
<th>Sarcocaps</th>
<th>Quercus</th>
<th>Artemisia</th>
<th>Asteraceae high spine</th>
<th>Asteraceae low spine</th>
<th>Pyrrosia</th>
<th>Pinus</th>
<th>Celtis</th>
<th>Erionymum</th>
<th>Populus</th>
<th>Fraxinus</th>
<th>Euphorbia</th>
<th>Cylindrocarpus</th>
<th>Fabaeeae</th>
<th>Dakea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration in Coprolite</td>
<td>6501</td>
<td>10643</td>
<td>2964</td>
<td>4345</td>
<td>1456</td>
<td>1246</td>
<td>1571</td>
<td>343</td>
<td>1546</td>
<td>1234</td>
<td>3187</td>
<td>190</td>
<td>470</td>
<td>25</td>
<td>38</td>
<td>407</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Concentration in Soil</td>
<td>1804</td>
<td>4103</td>
<td>721</td>
<td>997</td>
<td>1073</td>
<td>47</td>
<td>66</td>
<td>303</td>
<td>436</td>
<td>151</td>
<td>3628</td>
<td>18</td>
<td>1120</td>
<td>28</td>
<td>85</td>
<td>873</td>
<td>9</td>
<td>37</td>
<td>113</td>
<td>10</td>
</tr>
<tr>
<td>% Pollen Coprolites</td>
<td>19</td>
<td>24</td>
<td>7</td>
<td>15</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>% Pollen Soil</td>
<td>10</td>
<td>24</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Simultaneous Occupation of TPR

- Aasen 1984 & Lepofsky 1986
  - Argue Summer/Fall Occupation
  - Maize concentrations (Summer)
  - Abundance of Pine Nuts (Fall)

- Turkey Coprolites
  - High Maize Concentrations (Summer)
  - Pinus Present (Fall)
  - Absence of Spring Pollen (*Populus/Cactaceae*)

- Could have been simultaneously occupied
Were wild birds depositing coprolites at the site?
• Not likely

Does the sex ratio of the turkey coprolites deviate from wild populations?
• Can’t Tell

Overall it appears that wild turkeys were not depositing coprolites at the site.
Is the diet of aHap2 similar to the domesticated aHap1 lineage?
  • Cannot Distinguish Diet between aHap1 and aHap2
  • Soil contamination likely not masking diet

Were humans and turkeys likely inhabiting TPR simultaneously?
  • Could have been a concurrent occupation

aHap1 and aHap2 do not show significantly different diets, likely both domestic lineages
Acknowledgments

- Thesis Committee
  - B.M. Kemp
  - J.G. Jones
  - J.W. Busch
- W.D. Lipe & Diane Curewitz
- Andrew Duff
- Jodi Barta & Cara Monroe
- School Biological Sciences
- Department of Anthropology
- WSU Graduate School