Pollen and Charcoal Record

Key issue in archaeological research
• is the integration of site-specific archaeological data with regional palaeoecological results.
• A way to overcome this is to directly examine palaeoecological evidence from the archaeological site.
• This data can then be integrated with the broader regional palaeoecological dataset.
• This approach (through pollen & charcoal analysis) has been undertaken on sediment samples from the Thundiy Excavation (Square B), Bentinck Island, Gulf of Carpentaria (Fig. 1).
• Provides the opportunity to examine human impact on the surrounding vegetation and fire regimes, which can then be compared with broader regional alterations.

Thundiy Site

• Key issue in archaeological research is the integration of site-specific archaeological data with regional palaeoecological results.
• A way to overcome this is to directly examine palaeoecological evidence from the archaeological site.
• This data can then be integrated with the broader regional palaeoecological dataset.
• This approach (through pollen & charcoal analysis) has been undertaken on sediment samples from the Thundiy Excavation (Square B), Bentinck Island, Gulf of Carpentaria (Fig. 1).
• Provides the opportunity to examine human impact on the surrounding vegetation and fire regimes, which can then be compared with broader regional alterations.

Pollen Analysis of a Midden Archaeological Site: Thundiy, Bentinck Island, Gulf of Carpentaria

Patrick Moss1, Sean Ulm2, Texas Nagel2, Daniel Rosendahl2, Lynley Wallis3 & Craig Sloss4

1School of Geography, Planning & Environmental Management, The University of Queensland, Australia, patrick.moss@uq.edu.au; 2College of Arts, Society & Education, James Cook University, Australia; 3Wallis Heritage Consulting, Australia; 4Earth, Environmental & Biological Sciences, Queensland University of Technology, Australia.

Figure 1. Ground surface of Thundiy site.

Figure 2. Topographic map of Thundiy, showing the location of the three excavation squares (A, B, & C). Excavation Square B forms the basis of this study:
• Thundiy is an archaeological midden site located on the northern coastline of Bentinck Island, southern Wellesley Archipelago, Gulf of Carpentaria (Figure 2).
• This site is around 4 km long (NE-SE), up to 150 m wide (NW-SW) and at least 50 cm deep in terms of cultural deposits. Making it one of the most extensively documented coastal archaeological sites in tropical Australia.
• Square B was excavated to 60 cm in 20 excavation units (XUs), with the stratigraphic profile consisting of a dense shell layer ~40 to 50 cm deep and overlying a 20 cm deep natural chenier deposit.
• Surrounding vegetation consists of savanna vegetation, with the presence of Pandanus trees and around 40 to 50 m from the coast, which is characterized by mangrove forest.
• The sediments from Square B have undergone archaeological and foraminifera (Nagel, 2013) analysis. Five radiocarbon dates have been undertaken on shells from this deposit and suggest that the cultural deposits have an age of 793±22 calibrated years Before Present (cal yr BP) at ~40 cm. The base of the chenier deposit has been dated to 5039±28 cal yr BP (Table 1).
• This study will present the pollen & charcoal results for the top 30 cm of the deposit.

Table 1. Square B 14C Ages. Calibrated using Ramsey (2009), Reimer et al. (2009) & Ulm et al. (in press)

<table>
<thead>
<tr>
<th>Lab #</th>
<th>FS Species</th>
<th>Depth (cm)</th>
<th>14C Cal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wk-34772</td>
<td>M. hiantina</td>
<td>0-2.5</td>
<td>370±30</td>
</tr>
<tr>
<td>Wk-28560</td>
<td>A. granosa</td>
<td>30.3-33.4</td>
<td>686±30</td>
</tr>
<tr>
<td>Wk-37498</td>
<td>M. hiantina</td>
<td>36.7-39.4</td>
<td>1192±22</td>
</tr>
<tr>
<td>Wk-36175</td>
<td>M. hiantina</td>
<td>57.5-60.4</td>
<td>4716±28</td>
</tr>
</tbody>
</table>

Figure 3. Pollen diagram (%) for the Square B Excavation, Thundiy archaeological site, Bentinck Island, South Wellesley Archipelago, Gulf of Carpentaria, northern Australia. Key vegetation groups include Arboreal Taxa, Herbs, Pteridophytes (Ferns), Aquatic Taxa and Mangroves. The base of the diagram is 30 cm and each level is ~3 cm in depth, two dates are shown and all samples are within the cultural sequence of the deposit.

Landscapes Change over the last 500 years
• The palynological analysis of the cultural deposits from the Thundiy site has shown that pollen and charcoal can be extracted directly from midden deposits and provides a site specific picture of vegetation and fire regimes directly from an archaeological context.
• Relatively low pollen concentrations are recorded but they do provide enough information to show that there has been alterations in vegetation, with an overall dominance of savanna vegetation over the last +500 years but with some changes in taxa. In addition, there was a very good recovery of microcharcoal (<125 microns), which also provides insight into changes in fire regimes at the site.
• Four pollen zones have been identified in the record and are discussed below:
  1. Thundiy A (FS 72 to FS 82; ~70 to 30 cm): Dominated by grass, with the increasing amounts of Casuarinaceae and Asteraceae. Chenopods and Convolvulaceae are an important component of this zone. Charcoal particles are under 2,000,000 particles per cm².
  2. Thundiy B (FS 80 to 18 cm): This zone is characterized by a sharp decline in Convolvulaceae and Chenopods and an increase in grass/arboreal taxa (particularly Pandanus). This zone has the highest charcoal peak in the record (~9,000,000 particles per cm²). The zone has a radiocarbon date of 510±25 cal yr BP.
  3. Thundiy C (FS 58 to 56); 15 to 24 cm: A decline in charcoal values is observed (to ~2,000,000 particles per cm²). Casuarinaceae abundances increase and Asteraceae is an important component of the pollen taxa (which increased in the previous zone).
  4. Thundiy D (FS 54 to FS 50; 9 to 3 cm): The top of this zone has been dated to 104 cal yr BP. Grass, as well as other herbaceous taxa, apart from Asteraceae, values increase in this zone, while there is a related decline in arboreal taxa. Charcoal values decline in this zone, while pollen concentrations are the highest in the record.

Conclusions
• This study has demonstrated that it is possible to extract a site-specific pollen and charcoal record from a northern Australian midden archaeological site.
• Provides important context, in terms of vegetation/fire history, for human occupation of Bentinck Island. The site is dominated by savanna vegetation (suggested by the high grass values) but there are some interesting changes in vegetation dynamics. A early coastal phase is seen in Thundiy A (suggested by higher values of Chenopods and Convolvulaceae); this is then followed by an increase in arboreal taxa, particularly Pandanus, as well as Asteraceae (Thundiy B and C) and this is marked by a large charcoal peak at 510 years ago (Thundiy B); and the last zone observe a decline in arboreal taxa and Asteraceae, with an increase in grass (Thundiy D), suggesting a more open landscape.
• Difficult to determine if climate or people are responsible for vegetation alterations but record is being extended and should reveal if there are significant differences between the pre-settlement and post-settlement periods, particularly in terms of burning. There is also the potential to develop a macrocharcoal (>125 micron fraction) record that may provide a more local picture of burning.

Acknowledgments
We would like to thank the Australian Research Council (Grant # - DP120103179) and the Kaiadilt Aboriginal Corporation for supporting this project.

References