The Ohio State University/Anthropology Department

Woods and Grains: Windows Into an Ancient World

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INTRODUCTION

Paleoethnobotany, the study of the relationship between people and plants in prehistory, utilizes plant material recovered from archaeological sites to understand human exploitation of the environment over the millennia (Pearsall 2015). Hearths, or firepits, are a primary context for burning episodes, and an important resource for paleoethnobotanical research. The carbonization that occurs during burning allows for the preservation of plant materials that would otherwise decay. Analysis of plant remains recovered from burning episodes provides information on past human actions such as trade, fuel choice, agriculture or construction. I used these techniques to analyze the remains of a 3kya site in Dhufar, Oman. Due to a variety of geographic and environmental factors, the Arabian peninsula sits at a critical junction connecting Europe, Asia and Africa and is thus vitally important to understanding the ancient economies of the Indian Ocean and beyond (Boivin & Fuller 2009).

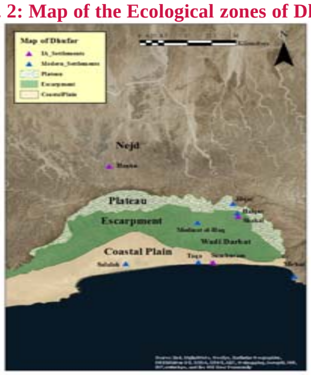
Fig. 1: Arabian Peninsula Map

Map provided by ViaMichelin

BACKGROUND: ASOM PROJECT

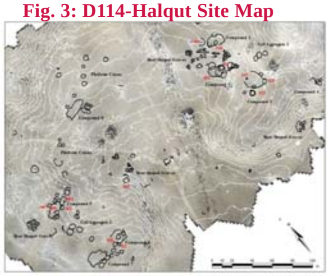
This project analyzes remains from a variety of primary contexts from Iron Age (3200-1600 BP) sites in Oman. The broad goal of the "Ancient Socio-Ecological Systems in Oman Project" (ASOM) is to determine under which environmental conditions territoriality emerges in pastoral ecosystems and also how territorial regimes in turn shape the environment. Due to the tight restriction of plant taxa to particular ecological zones over time, Dhufar provides an exemplary opportunity to understand the relationship between pastoralists and the environment through the archaeological record (Buffington & McCorriston)

Fig. 2: Map of the Ecological zones of Dhufar



Map of Dhufar ecological zones (Buffington & McCorriston)

Fig. 3: D114-Halqut Site Map



Map credited to A. Buffington

OBJECTIVES & HYPOTHESES

The primary objective of my research was to investigate the population's agricultural development and exchange economies in the broader context of the Indian Ocean Interaction Sphere.

- H0: There are no spatial nor temporal differences between samples based on context, structure or date.
- H1a: As site population increases over time, we expect the assemblage to reflect a change in wood preference.
- H1b: Structures with different functions will reflect different choices in wood.

MATERIALS & METHODS

I utilized standard macrobotanical analysis to collect data about people's vegetative resources over time (Hastorf & Popper 1988). I sorted twelve flotation samples, representing four broadly contemporaneous structures dating from 789 B.C. to 421 A.D. Through the use of a riffle splitter, a dual-stage compound microscope and a light microscope, I analyzed the remains of primary deposits via incremental sorting based on Chabal's Law of Fragmentation (1988).

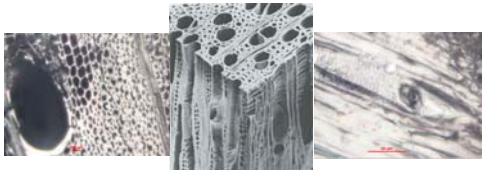
For charcoal, I selected hand-picked samples that:

1.) contributed to a broad representation of the site and different contexts such as: primary burning (in situ hearth), structure collapse, intact floor surface, and prebuilding (general charcoal noise sample)

2.) had radiocarbon dates and accompanied a macrobotanical flotation sample

I used a dual-stage compound microscope at 40x and 10x magnification to make taxa identification. After data collection, I coded the data in Excel, derived the diversity index and analyzed the data using Pearson and Partial Pearson correlations. I used these simple bivariate correlations to determine wood patterning at the site over time and space.

Fig. 3: Planes for Taxa Identification



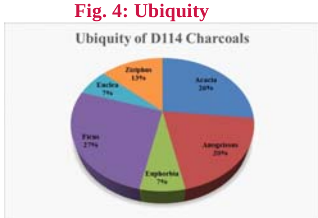
Left to Right: Transverse plane of Acacia, SEM image of each plane, Radial plane of Ziziphus (Panshin & Zeeuw 1980) * mention captured images with Z-stack etc.

RESULTS & DISCUSSION

Wood Analysis Table

Sample	Site	Description	Context	Time	Animal Vs. Human	# of frags ided	Acacia	Anogeissus	Ficus	Euphorbia	Euclea	Ziziphus
1536	D114-006 A-007-1-1	sediment between pavement & bedrock	Floor	Early Settlement	N/A	13		11	1	1		
1548	D114-004 B-012-2-4	primary collapse level in courtyard of D114.001	Collapse	Late Settlement	Animal	2			2			
1551	D114-004 B-013-3-3	highly charred above bedrock	Primary Charring	Late Settlement	Animal	20	3		17			
1557	D114-004 A-005-8	hearth feature in section wall	Floor	Late Settlement	Human	12	4	8				
1567	D114-004 A-008-4	ashy layer above bedrock, heath cobble	Floor	Late Settlement	Human	25	21					4
1571	D114-028 A-004-1-5	dark soil above bedrock	Primary Charring	Late Settlement	Animal	20	2	8	4			6
1576	D114-085 A-004-1-3	dense ash and bone below pavement	Floor	Prime Settlement	Human	5					5	
Total						97	30	27	24	1	5	10
%						100.0	30.9	27.8	24.7	1.0	5.2	10.3
Total Wt (g)						8.450	1.536	1.473	4.893	0.036	0.263	0.249
%						100.0	18.2	17.4	57.9	0.4	3.1	2.9

Fig. 4: Ubiquity



This study found zero cultivated seeds and therefore no evidence of agriculture. The charcoal analysis revealed zero exotic woods. All of the recovered charcoal remains derive from woods present in modern Dhufar and the plateau region in which the site is found (see Fig. 2). Thus, we can infer that the wood resources during the Iron Age inhabitation were similarly accessible as today.

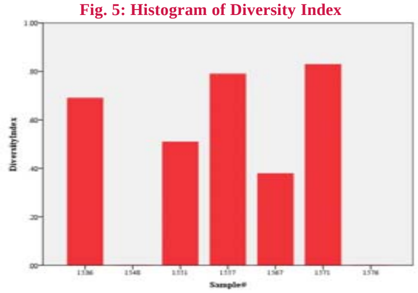
Figure 4 indicates that *Ficus* sp. and *Acacia* sp. were the most ubiquitous species with *Anogeissus* sp. also occurring commonly. *Euphorbiaceae* sp. and *Euclea* sp. are rare (only in 1 sample) and *Ziziphus* sp. slightly more common (appeared in 2 samples). The most common taxa in the assemblages are also the most common types that we find today (Buffington & McCorriston).

Pearson Correlation	Corr.	p-value
Acacia and Human vs. Animal Structure?	0.988	**0.012**
Ficus and Diversity Index	-0.871	0.129
Anogeissus and Context	-0.853	0.35
Context and Diversity Index	0.616	0.141
Time and Diversity Index	-0.571	0.181
Anogeissus and Time	-0.522	0.65
Partial Pearson Correlation	**Corr.**	**p-value**
Ficus and Diversity Index acct. for Context	-0.974	0.145

Statistical analysis of the spatial distribution of taxa revealed a series of informative patterns.

- Context associated with human-occupied residential units (floor surfaces, construction debris) possessed the lowest diversity of taxa.
- In contrast, context associated with outdoor hearths (primary charring/in situ burning, general charcoal "noise") have the greatest diversity.
- Acacia commonly found in structures associated with human occupation. Ethnographic records indicate use because of dense branches and termite resistance (Miller & Morris 1988).
- Negative correlation between Ficus and taxa diversity was determined.
- The statistical analysis for taxa over time revealed a negative correlation between time and diversity. As time progresses, the taxa are more restricted.
- *Anogeissus* sp. was more prevalent in sites with radiocarbon dates reflective of earlier site occupation. We know that *Anogeissus* sp. is a very important food for animal feeding (Sale 1980). People may be less likely to select it for firewood as its needed for cattle fodder increases.

Fig. 5: Histogram of Diversity Index



CONCLUSIONS

The analysis revealed zero evidence of plant agriculture, indicating a surprising absence of cereal or grass processing on the site. This absence of agriculture may contribute to an extremely rare example of pastoral self-sufficiency in late prehistory.

This research provides a model of what a self-reliant pastoral community looks likes archaeologically and allows us to infer the decision-making process in terms of fuel choice in such an economy. Further, the data interpreted from this research contributes to the establishment of a baseline for the ecological history of Dhufar, a region with little archaeological investigation.

To improve this study, further sampling is required. More samples could improve the power of the statistical correlations. Currently, the power of the discerned correlations is low with only seven samples. I was able to obtain a broad representation of the sites, but our samples are uneven in terms of time and structure. I can reject the null hypothesis that there is no differentiation over time and space but cannot definitively prove hypothesis 1a or 1b.

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