Polynesian earth ovens and their fuels: interpretation of wood charcoal remains from Anaho Valley, Nuku Hiva, Marquesas Islands

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Summary: *Earth ovens are, and were, a key component of many traditional Polynesian societies. As repositories of wood charcoal, they potentially offer an opportunity to date prehistoric activities, study cultural practices, and reconstruct the flora of past landscapes. In this study, over 800 fragments of wood charcoal from Anaho Valley, Nuku Hiva Island in the Marquesas Islands were analysed for information on fuel sources, cultural usage patterns, and the prehistoric lowland vegetation. The materials come from seven ovens distributed across the valley and date to two broad time periods: 1450-1650 AD and post-1640. Methodological issues relevant to wood charcoal analysis are discussed and considered in relation to these assemblages prior to interpretation of the results. Examination of a single functional class of fire features (ovens) allows formation processes to be held relatively constant across the set of samples. Varied quantitative issues are explored, including measures of abundance and variability in sample size.* Thespesia populnea *(Pacific rosewood, mi'o) and* Sapindus saponaria *(soapberry, koku'u), two native hardwoods, are identified as dominants in this assemblage. This is perhaps not unexpected given that oven stones are heated to high temperatures, and good quality fuel is desirable for this purpose. As a corollary, charcoal derived from oven features is likely to offer an incomplete view of past vegetation, although it may reflect the dominant local vegetation. Finally, joint consideration of ethnohistoric and archaeological evidence suggests the possibility that anthropogenic impacts led to declines in an important economic species,* Thespesia populnea*.*

Key words: *wood charcoal, earth ovens, fuel wood, anthracology, Polynesia.*

INTRODUCTION

The study of archaeological wood charcoal is of particular value in reconstructing ancient vegetation patterns on Pacific Islands where the native flora has been substantially modified by centuries of human settlement and, more recently, by introduced European herbivores. Charcoal from archaeological contexts also aids understanding of past cultural activities, including patterns of fuel use, cooking practices, timber choices and ritual activities. In this study, we look at fuel remains from the traditional Polynesian earth oven (Fig. 1). Using a case study from the Marquesas Islands, East Polynesia, we consider why particular woods may have been used as oven fuels and the degree to which archaeological oven samples provide useful profiles of local vegetation. Several methodological issues are also explored, including how to best quantify and compare wood charcoal assemblages, and the potential impact of sample size on certain measures of interest.

DATA AND RESULTS

The present analysis was a pilot study aimed at exploring the potential of wood charcoal from Polynesian archaeological contexts to inform on past cultural practices and environmental conditions. It was also designed to evaluate two alternative models of fuel use: one that fuel selection is largely opportunistic; the other that purposeful fuel selection may occur in some situations. The present analysis tests these alternatives using a single class of fire feature, the closed earth oven. It is argued that this specific type of fire feature potentially had demanding fuel requirements to thoroughly heat the associated cooking stones.

FIGURE 1. Anaho Valley residents arranging food in a contemporary Marquesan earth oven.

This study draws on samples from Anaho, a broad valley on the northeast coast of Nuku Hiva. Microclimate conditions within Anaho are varied, ranging from xeric on the northern slopes to mesic in the south. As a result, the valley flora is of mixed composition. Samples come from features associated with two temporal contexts: a relatively early subsurface occupation layer on the northern coastal flat dating to 1450-1650 AD, where stone architecture is lacking, and deposits associated with late prehistoric (post-1640 AD) raised stone structures which are widely distributed throughout the valley.

Nine woody species, as well as coconut and other monocotyledon tissues, were identified in this assemblage of over 800 fragments from seven features (Fig. 2). Taxa identified include *Celtis pacifica*, *Cocos nucifera* (coconut), *Cordia subcordata*, *Sapindus saponaria* (soapberry) and *Thespesia populnea* (Pacific rosewood); several others were designated as unknown. Overall, in most samples, a narrow range of woody species was found. This is notable given that even within this single functional category (i.e., ovens), some variability might be anticipated based on occupant status, site location and the types of food being cooked.

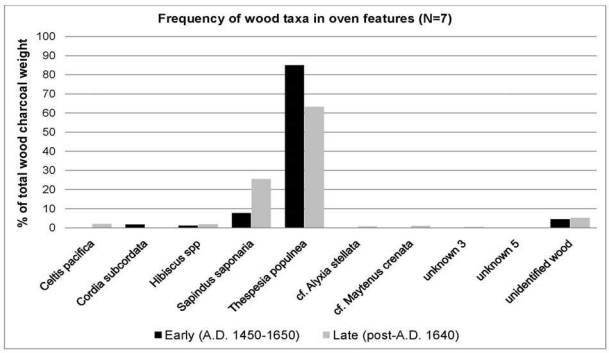

FIGURE 2. Frequency of wood charcoal taxa by weight.

Although all of the recovered species are found today within walking distance of the archaeological sites, two vegetation habitats are represented: typical human-modified lowland vegetation and arid vegetation of the northern valley slopes and ridgelines. To consider the possibility of temporal change in fuel use, features from the two time periods outlined above were compared. There are three dimensions of variability that are of interest: variation in species composition changes in the proportional contribution of different wood taxa over time, and changes in species richness. In most of the Anaho ovens only one to three taxa were identified (Fig. 3); when other species were observed, they generally were represented by extremely small amounts of material. Overall, there is little change in species composition across the seven ovens examined. Similarly, there is little variation in species richness. There are two changes of consequence: first, there is a modest decline in the abundance of *Thespesia* and a modest increase in *Sapindus* as measured by both frequency and, more conservatively, ubiquity values. Second, it is notable that monocot tissues are present in only one early oven but occur in all late ovens.

DICUSSION AND CONCLUSIONS

A relatively large charcoal assemblage, by tropical Pacific standards, was identified from seven oven features dispersed throughout Anaho Valley. This assemblage includes samples from both coastal and inland locations over a time span of roughly 200 to 350 years. During this period, residences shifted from a concentration on the coast to a wider dispersal throughout the valley. However, there was only modest variation in the types of wood used as fuels with two locally available species, *Thespesia populnea* and

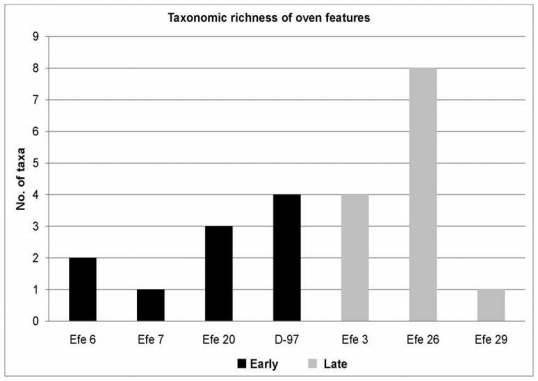

FIGURE 3.Taxonomic richness by oven feature.

Sapindus saponaria, dominating. The prevalence of these two species, which are high quality fuels, is consistent with the idea that fuels used in the Anaho ovens were the result of selective rather than opportunistic behaviour. While additional samples from both ovens and other contexts are needed to fully evaluate this hypothesis, it cannot be discounted on present evidence. Moreover, these findings are broadly consistent with studies elsewhere in the Pacific (Allen, 2005; Di Piazza, 1998). An important corollary of these findings is that earth oven samples in isolation provide a poor basis on which to reconstruct ancient vegetation patterns; charcoal samples from a broader range of fire features and depositional contexts are critical to such an exercise.

The combined archaeological and ethnohistoric evidence also intimate that an important fuel species, *Thespesia populnea*, was reduced over time either through purposeful harvesting or more generally as a result of changes in the local vegetation. As a result, Anaho Valley residents may have travelled further and over more steeply sloping ground to secure another high quality fuel wood, *Sapindus saponaria*, or used alternative sources. Human impact on local plant resources is not unexpected given the now well-documented anthropogenic effects on faunal resources and island landscapes (e.g., Kirch and Hunt, 1997). This study, however, may be the first archaeological analysis to suggest anthropogenic impact(s) on an important Pacific timber species, which was once widely, used for fuel, utilitarian, ornamental and religious purposes.

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