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Short Topical Reviews

Archaeobotanical Approaches in the Study of Food Production in Remote Oceania

Maureece J. Levin[1*]

[1]Archaeology Center, Stanford University, Stanford, California, USA.
[*]mjlevin@stanford.edu

Abstract This short topical review discusses recent archaeobotanical approaches to understanding food production in Remote Oceania (eastern Melanesia, Micronesia, and Polynesia). The region presents some preservation and interpretative challenges, both due to the lack of cereal crops and the hot and humid climate that prevails through much of the area. Nevertheless, archaeobotanical analyses provide insight into topics such the transport of crops between islands and anthropogenic environmental change.

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Introduction

Food production is a major topic of archaeological and anthropological research in the region known as the Remote Pacific (eastern Melanesia, Micronesia, and Polynesia). This region encompasses a diversity of agricultural systems adapted to volcanic (high) islands and coral atolls. Most food production here relies heavily on crops and animals that people transported with them when they originally settled these islands (Kirch 2000). These imported products are largely drawn from an agricultural system that people living in the Malayo-Oceanic tropics had independently developed by 6950 cal BP (Denham et al. 2003).

Although the amount of archaeobotanical publication in Remote Oceania and even the Pacific in general is less than in locations such as Southwest Asia, China, or Mesoamerica, interest in the relationship between people and plants in the region's past has been of interest to researchers for decades. Especially notable is botanist Douglas Yen's work in the mid and late 20th century. In Remote Oceania, his extensive work includes the study of the early use of sweet potato (*Ipomoea batatas*) in the Pacific (e.g., Rosendahl and Yen 1971; Yen 1974, 1990) and human-environment relationships on the Polynesian outlier of Tikopia (Kirch and Yen 1982). Furthermore, there has been a florescence of research in the field over the past 25 years since Hather's (1992) review of the topic. This short review introduces some recent research and explores issues specific to conducting archaeobotanical research in Remote Oceania.

Geographical Setting

At a basic level, Remote Oceania is the region of the Pacific Islands that was settled by Austronesian-speaking peoples, beginning some three to four millennia ago, and their descendants. Initial settlement of the region is associated primarily with Lapita pottery producers (Denham et al. 2012; Sheppard 2011), although western Micronesia (e.g., The Mariana Islands and Palau) was settled separately by other Austronesian speakers (Carson and Switzerland 2013; Clark et al. 2006). The initial settlers of Remote Oceania all relied, to some extent, on imported domesticated plants of the Malayo-Oceanic tropics, which played a major role in the success of colonization (Kirch 2000). In this sense, the archaeobotany of the region is foundational to understanding both human migrations and human-environment dynamics.

Analytical Techniques

While in much of the world, agricultural systems rely on domesticated cereals, Remote Oceania is a major

region where cereals were not a staple in dietary prehistory. Instead, most of the domesticated staples are roots, tubers, or tree fruits. Charred plant macroremains can be recovered successfully through flotation, although charred remains other than wood charcoal are less common in Remote Oceania than in most temperate regions. Additionally, root and tuber macroremains (and, in most cases, tree fruits and nuts), cannot be quantified in the same way as cereals. However, they are present at some sites and can be useful in the study of subsistence. This is true of both tree crops (e.g., Kahn and Ragone 2013) and roots and tubers (e.g., Ladefoged et al. 2005; Ussher 2015). Compounding this is the generally poor preservation of organic materials in the environments of the tropical Remote Pacific, which are largely (though not exclusively) warm and humid, often with acidic volcanic or alkaline coral sediments.

For this reason, anthracological (wood charcoal) research has been a focus in Remote Oceania. For example, in New Caledonia, Dotte-Sarout (2017; Dotte-Sarout et al. 2013) has demonstrated the presence of highly domesticated forests in the second millennium cal A.D.. In the Marquesas Islands, Huebert has documented activities such as rapid changes in forest composition due to human habitation (Huebert and Allen 2016) and fuel use in earth ovens (Huebert et al. 2010). Murakami has long worked in anthracology throughout Remote Oceania, studying activities such as the development of agroforestry on Kosrae, Micronesia (Athens et al. 1996), and the introduction of breadfruit (*Artocarpus altilis*) to Hawai'i in the 13th century A.D. (McCoy et al. 2010). In the temperate zone of Remote Oceania (New Zealand and environs), Maxwell has recently studied Moriori managed forests on the Chatham Islands (e.g., Maxwell et al. 2016).

Additionally, archaeobotanical work in Remote Oceania increasingly emphasizes plant microremain analysis. Since the latter half of the 20th century, archaeologists working in this region have regularly used pollen from cores as complementary paleoenvironmental data. However, because wind-blown pollen grains are the most numerous and they provide a regional rather than strictly local signature, pollen is generally less useful than macroremains in direct dietary interpretation (but see also Horrocks et al. 2003 for an example of the use of pollen from coprolites for dietary studies). Phytoliths (silica bodies present in the structural part of many plants) and starch grains provide a more localized signature appropriate for questions about inter- and intra-site variability, crop processing, and specific agricultural practices.

Using multiple types of plant microremains, Horrocks has published on plant introductions and use throughout the Pacific region, including Fiji (Horrocks 2007), Hawai'i (Horrocks and Rechtman 2009), and the Mariana Islands (Horrocks et al. 2015), among other places. Allen and Ussher (2013), working on the Marquesas Islands, used starch to document the exploitation of several introduced plant species and to better understand tool use. Research from Tromp and Dudgeon (2015) on dental calculus from Rapa Nui (Easter Island) also shows the importance of sweet potato to human diet in East Polynesia prior to European contact. Moreover, it highlights how taphonomic pathways are a crucial consideration in microremain analysis. As the inclusion of microbotanical analyses in Remote Oceanic food production research continues to become more standard, we can expect to see modifications of and improvements in our understanding of human movement and subsistence strategies within the region.

Multi-Proxy Investigation

The use of multi-proxy methods to answer larger questions about food production in Remote Oceania is essential, especially because of the poor preservation in the humid tropics and the largely arboricultural economy. Many archaeobotanical studies in the region use multiple types of plant remains to study past food production (e.g., Horrocks et al. 2003, 2015; Horrocks and Rechtman 2009; Levin 2016; Tromp and Dudgeon 2015; Ussher 2015). As every class of archaeobotanical remains has its own limitations, a multi-proxy approach provides a more complete picture of food production in the past.

Larger projects, such as the Hawai'i Biocomplexity Project (Kirch et al. 2004; Vitousek et al. 2004) have developed broad, interdisciplinary agendas, incorporating archaeobotanical data with other lines of evidence such as soil chemistry and landscape archaeology. The Hawai'i Biocomplexity Project specifically investigated the prehistory of landscape use and sociopolitical systems on the Hawaiian Islands, much of which involved the study of terraced fields. These types of data are key to understanding the origins and spread of Pacific subsistence strategies that enabled the settlement of Remote Oceania. While multi-proxy strategies are certainly not new or

uncommon in many regions, a similar approach applied more broadly may yield new insights into the exploitation of roots, tubers, and trees, as well as human landscape management, even where other archaeobotanical data (such as charred seeds) are abundant.

Conclusion

In conclusion, archaeobotany, while previously underutilized in Remote Oceania, has been growing at a rapid pace since the late 20th century. Preservation can sometimes be an issue, due to the largely humid, tropical environment and coastal sites submerged by fluctuating sea levels. Nevertheless, archaeobotanical data are yielding new information about the food production systems that Pacific Islanders introduced to new environments and the ways that human-plant relationships have enabled settlement and survival. Ultimately, the field is moving towards a more integrated, multi-proxy approach, which will continue to remain important to answering the most pressing archaeobotanical questions in the region.

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