

Early and mid Holocene tool-use and processing of taro (*Colocasia esculenta*), yam (*Dioscorea* sp.) and other plants at Kuk Swamp in the highlands of Papua New Guinea

Richard Fullagar^{a,*}, Judith Field^b, Tim Denham^c, Carol Lentfer^d

^a Department of Archaeology, University of Sydney, Sydney, NSW 2006, Australia

^b Australian Key Centre for Microscopy and Microanalysis & The School of Philosophical and Historical Inquiry, University of Sydney, Sydney, NSW 2006, Australia

^c School of Geography and Environmental Science, Monash University, Clayton Campus, Wellington Road, Clayton, VIC 3800, Australia

^d School of Social Sciences, University of Queensland, St. Lucia, QLD 4072, Australia

Received 15 November 2004; received in revised form 7 April 2005; accepted 22 July 2005

Abstract

Recent multidisciplinary investigations document an independent emergence of agriculture at Kuk Swamp in the highlands of Papua New Guinea. In this paper we report preliminary usewear analysis and details of prehistoric use of stone tools for processing starchy food and other plants at Kuk Swamp. Morphological diagnostics for starch granules are reported for two potentially significant economic species, taro (*Colocasia esculenta*) and yam (*Dioscorea* sp.), following comparisons between prehistoric and botanical reference specimens. Usewear and residue analyses of starch granules indicate that both these species were processed on the wetland margin during the early and mid Holocene. We argue that processing of taro and yam commences by at least 10,200 calibrated years before present (cal BP), although the taro and yam starch granules do not permit us to distinguish between wild or cultivated forms. From at least 6950 to 6440 cal BP the processing of taro, yam and other plants indicates that they are likely to have been integrated into cultivation practices on the wetland edge.

© 2005 Elsevier Ltd. All rights reserved.

Keywords: Starch grains; Taro (*Colocasia esculenta*); Yam (*Dioscorea* sp.); Banana (*Musa* spp.); Phytoliths; Plant processing; Usewear; Residues

1. Introduction

Over the last decade, starch grain analysis in archaeological contexts has become a highly significant new direction for reconstructing plant utilisation, processing technology and food production systems. In many parts of the world, research has targeted the identification of food and other economic plants, specifically, starch in roots, tubers [5,28,45,57,58,67–69,79,80,81] and seeds [29,41,66,82], and also in palm pith and arboreal fruit [2]. In the Pacific, a suite of starch-rich plants has been fundamental to subsistence [85] in both agricultural and hunter-gatherer societies. Kuk Swamp, Papua New Guinea,

has been central to debate about agricultural origins in the Pacific [23], and in this study we focus on evidence for the exploitation of taro (*Colocasia* spp.) and yams (*Dioscorea* spp.) at this site (Fig. 1).

Debate about when agriculture commenced at Kuk Swamp has hinged on interpretations of palaeochannels and palaeosurfaces, and the identification of potentially cultivated plants [22,21]. Although several plants had previously been suggested as likely candidates for cultivation, recent studies have now identified particular taxa from archaeobotanical remains [23]. The aim of this paper is to provide the detailed evidence from the lithic usewear and residue study that first established the identification of the yam and taro starch on a selection of artefacts from Phases 1 and 2 of human use of the wetland margin at Kuk Swamp [23]. Although the lithic study is not yet complete, the preliminary usewear results are

* Corresponding author. Tel.: +61 2 9351 6794; fax: +61 2 9351 5712.

E-mail address: richard.fullagar@arts.usyd.edu.au (R. Fullagar).

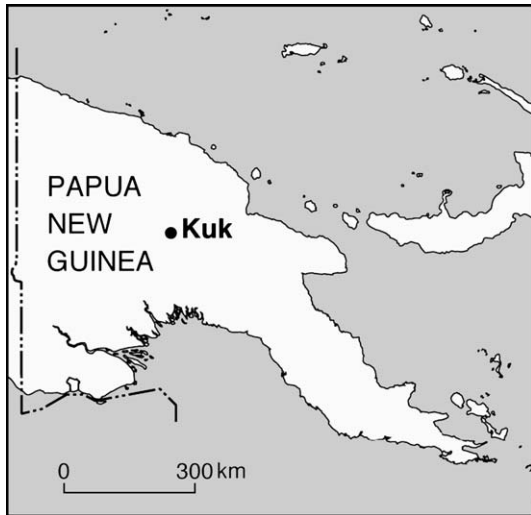


Fig. 1. Site location map. (After Denham et al. [23].)

significant for interpreting the early history of plant exploitation at Kuk Swamp, and broaden interpretations of the earliest cultivation practices.

First, we outline the archaeological context and selection of artefacts. Second, we describe methods of analysis, and the characteristics of taro and yam starch granules from modern botanical specimens. Third, we summarise preliminary interpretations of usewear, and the starch and phytolith identifications. Discussion focuses on methodology and the significance of yam and taro starch granules.

2. Kuk Swamp and stone artefacts

Kuk Swamp is located at 1560 m above mean sea level in the upper Wahgi Valley, which is a large intermontane valley in the New Guinea highlands (Fig. 1). The Kuk vicinity has a mean annual temperature of 19 °C and mean annual rainfall of c. 2700 mm [21]. The archaeological site at Kuk is located on a wetland margin comprising a low-gradient alluvial fan deposited after 21,500 calibrated years before present (cal BP). Investigations into the antiquity of agriculture at the site began in 1969, with major field seasons in 1972–1977 [33,37,44] and 1998–1999 [17–19]. Recently published evidence from Kuk confirms New Guinea was a primary centre of agricultural development by at least 6950–6440 cal BP [21], well before the introduction of Southeast Asian domesticates associated with Austronesian expansion after 3500 cal BP [10].

The archaeological finds at Kuk represent several phases of prehistoric utilisation and drainage of the wetland margin for plant exploitation and cultivation. The earliest use of the wetland margin (Phase 1) dates to c. 10,220–9910 cal BP, although interpretations vary as to whether this represents agriculture [33,37], or an undetermined form of plant exploitation ([17,19,23]; see review in [21]). Researchers agree that the earliest unequivocal evidence of agriculture dates to 6950–6440 cal BP and comprises mounded cultivation on the wetland margin ([17,33]; see [18] for a review of evidence from other sites). Subsequent

phases consist of ditch networks constructed for drainage and cultivation, although network designs vary [7–9,17,33].

Until recently, the plants cultivated, exploited and present during each phase were not well-documented ([17,23]; cf. [71,84]). In particular, there was no information on root-crops, which are the staple crops of agriculture in the Highlands today. Consequently, evidence for the processing of root crops during the early and mid Holocene at Kuk, which has been presented in summary previously [23], accords generally with interpretations of plant exploitation and early agriculture based on archaeological evidence [17–19,21]. Additionally, the exploitation of root crops from the early Holocene accords with genetic interpretations of their independent domestication in the New Guinea region [52].

The stone artefacts examined in this study were collected during field programmes directed by Allen [3], Golson [33,34] and Denham [17]. cursory studies since 1990 by the late T.H. Loy (recently University of Queensland) and others have reported residues, retouch and other traces of use on the selection of artefacts that are analysed here. Consequently, the artefacts reported here do not constitute a random sample and all were expected to show signs of use. Subsequent functional analyses were undertaken in two stages at the Archaeology Laboratory, University of Sydney between 1999 and 2004.

The aim of the Stage 1 study was simply to determine the nature of residue preservation and the range of tool functions (from all levels) for a selection of artefacts from Kuk ($n = 55$), i.e., how tools were used (scraping, cutting, etc.), the broad class of contact materials (wood, bone, etc.), and the presence of starch. The aim of the Stage 2 study was to look specifically for yam and taro starch, and other identifiable residues on artefacts ($n = 12$) with precise early-to-mid Holocene provenance. Residue samples were extracted from the twelve tools associated with early and mid Holocene phases of wetland manipulation, as well as from the intervening 'grey clay' stratigraphic unit. All potential traces of use were re-examined, and starch granules and phytoliths were compared with modern reference collections for identification.

3. Methods and procedures

The principles of usewear and residue analysis are based largely on traces of use that are documented experimentally [26]. Processing of starchy plants is implied by the presence, frequency and distribution of starch granules¹ on stone artefacts usually (but not necessarily) in association with other residues (such as cellulose) and usewear, which may indicate hardness (or type of material) and direction of tool motion [49,50]. Biogeography and ethnography provide further information on the function of stone tools, and the kinds of tasks and available materials likely to have been utilised [39,74,83]. The use of stone artefacts to process a variety of

¹ Although 'starch granule' and 'starch grain' are often used interchangeably, we use 'granule' when specifically referring to individual (not composite) grains.

Download English Version:

<https://daneshyari.com/en/article/1036685>

Download Persian Version:

<https://daneshyari.com/article/1036685>

[Daneshyari.com](https://daneshyari.com)