The interplay of ethnographic and archaeological knowledge in the study of past human subsistence in the tropics

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Much of what is currently known or believed about how humans procured and produced food in the past stems from ethnographic and historical evidence of the subsistence practices of foragers and farmers. It is often difficult or impossible to relate archaeological evidence directly to the ethnohistorical record, although these two very different sources of data potentially complement each other. The potential of such complementarity is now being enhanced by the use of novel techniques, such as parenchyma, phytolith, and starch-grain analysis, for identifying fragmentary and amorphous organic remains retrieved from archaeological deposits, and by the use of the AMS (accelerator mass spectrometric) radiocarbon method to date very small samples, such as single seeds. More conventional ethnoarchaeological methods, by which field evidence of subsistence-related structures is compared with information derived from ethnographic and historical accounts, also continue to yield valuable insights into past food procurement and production. In this essay, the reciprocal relationship between archaeobotanical and ethnohistorical data is exemplified by examining (a) recent applications of novel analytical techniques in investigations of the antiquity of root and tuber cultivation in the American, African, and Southeast Asian tropics, and (b) the use of more conventional methods in the study of past forager subsistence in tropical northeastern Australia.

Archaeologists concerned with the prehistory of human subsistence, and ethnobiologists who study traditional systems of environmental knowledge in non-industrial societies, have much to learn from each other. But they tend to pursue separate research agendas, and by so doing fail to gain insights that closer collaboration could yield. Their primary sources of data – fragmentary material remains and information from living people – are very different, but potentially complementary. The challenge is to bring together the evidence each discipline generates in a reciprocal relationship that enriches our understanding of how people have interacted with plants and animals.

Attempts to correlate archaeological and ethnobiological data are founded on the assumption that the present is the key to the past, or, in other words, that ethnographically observed practices are a valid guide to interpretation of the bioarchaeological record. But in trying to track archaeologically the antecedents of subsistence practices known from the ethnographically described present or recent past, we may disregard alternative interpretations of enigmatic archaeological evidence. In general,
the further back in time we go, the greater the likelihood of a lack of continuity between present and past human subsistence behaviour.

This problem is partially compensated by inferences we can draw from the anatomical, physiological, and behavioural characteristics of the plants and animals, including humans, identified in the archaeological record. For example, it is reasonable to infer, from the evidence of diagnostic butchery marks on the bones of large mammals killed by people at the Lower Palaeolithic site of Boxgrove in Sussex half a million years ago, that bone marrow was a prized human food at that time (Parfitt & Roberts 1999). Similarly, data from ecological studies of present-day mollusc populations on the north-west coast of Sicily, combined with analyses of shells from Mesolithic and early Neolithic occupation layers in nearby caves, indicate that shellfish were an important seasonal food for the inhabitants of the caves 10,000-5,000 years ago (Mannino & Thomas 2003/4; Thomas & Mannino 2003).

Nevertheless, the shorter the time gap between ethnographically observed and archaeologically inferred subsistence practices, the more confident we can be in interpreting the history of those practices. It is not surprising that the subdiscipline of ethnoarchaeology, which seeks to combine observation of present-day human activities with the recovery of archaeological evidence of such activities, has been most successful when the time gap is relatively short. Research on agricultural history in highland Papua New Guinea provides an example of how rewarding this approach can be. When Jack Golson began his archaeological investigations of early agriculture in the swamplands of the Waghi valley in the 1960s, he discovered well-preserved remains of wooden digging sticks. The implements were recognized by his Papuan assistants as the type of paddle-shape digging tools made by their ancestors to ditch and mound the swampy soils for root-crop cultivation, before steel spades were introduced in the twentieth century. By radiocarbon dating the wooden tools, Golson was able to demonstrate, for the first time, that agriculture in highland New Guinea had an antiquity of at least 2,300 years (Golson, Lampert, Wheeler & Ambrose 1967; Lampert 1967). Now, after more than four decades of ethnoarchaeological research in the Waghi valley by Golson and his colleagues, we know that crop cultivation in highland New Guinea dates back some 10,000 years (Denham, Haberle & Lentfer 2004; Denham et al. 2003; Golson 1997).

This example shows how successful a project can be that incorporates ethnographic and archaeological evidence in a reciprocal relationship to build and test hypotheses about the past. Unfortunately situations where this is possible have rapidly diminished in recent decades as modernization has quickened and penetrated ever more deeply into less developed areas of the world. Historical evidence of past subsistence practices can sometimes amplify or take the place of ethnographic evidence. It is particularly valuable in regions, such as parts of North America and Australia, where ethnographic data were recorded, systematically or more casually, before traditional subsistence practices were replaced under the impact of modernization (see, e.g., Allen 1974; Cane 1989; Hallam 1989; Harris 1984; R. Jones & Meehan 1989; Lawton, Wilke, DeDecker & Mason 1976; O’Connell, Latz & Barnett 1983; Steward 1930). But valuable as such historical evidence often is, it tends to be frustratingly incomplete, and those who use it to interpret past practices need to be aware of, and make allowance for, the cultural mindsets of the original observers.

These benefits and limitations of the ethnographic and historical evidence are paralleled by the merits and deficiencies of the archaeological evidence. It too is often
frustratingly inadequate, for example in providing direct evidence of methods of cultivation and of how foods were processed and consumed. Also, poorly preserved organic remains often cannot be identified by their external morphology, either visually or using conventional microscopy. However, in recent decades, several novel techniques have become available that use microanatomical, histological, and cytological criteria to identify fragmentary and amorphous plant remains – and they are increasingly being applied to the analysis of such remains from archaeological sites, particularly in the tropics (Hather 1994). This trend, coupled with the ability of AMS (accelerator mass spectrometric) radiocarbon dating to determine the age of individual seeds and other very small samples of organic material (Gowlett & Hedges 1986; Harris 1987a), is adding even greater interdisciplinary breadth to the already wide spectrum of ethnoarchaeology. It has the capacity to transform research on past human subsistence, across the entire continuum of interaction between people, plants, and animals that stretches from the procurement of wild resources by hunter-fishergatherer foragers through the exploitation of selected plants and animals in systems of ‘low-level food production’ (Smith 2001) to agriculture based on domesticated crops and livestock raised by farmers and pastoralists (Harris 1996: 444-56).

In addition to these new approaches, conventional ethnoarchaeological methods remain valid means of investigating past subsistence practices, for example comparing field evidence of subsistence-related structures, such as field boundaries, terraces, irrigation and drainage channels, fish traps, and food-processing and -storage sites, with information derived from ethnographic and historical accounts. In this contribution, my purpose is to illustrate some of these novel and more conventional approaches by summarizing aspects of research on two themes: the antiquity of root and tuber cultivation in parts of the American, African, and Southeast Asian tropics; and past forager subsistence in tropical northeastern Australia. In the first part I discuss mainly research undertaken recently by other workers, whereas the second is based on field and ethnohistorical research I undertook in the 1970s and 1980s.

**Tropical root and tuber cultivation**

It has long been assumed by students of early agriculture in the tropics that vegetatively reproduced root and tuber crops, such as yams, taro, sweet potato, and manioc, have a very long history of cultivation and were probably among the earliest tropical food plants to be cultivated and domesticated (Harris 1972; 1973; Lathrap 1977; Sauer 1936; 1952: 45-8). This view rested on ethnographic and historical evidence of their place in the tropical agricultural systems of the American, African, South and Southeast Asian tropics, which showed that they were commonly more important staples than seed-reproduced cereals, pulses, or tree crops. The supposition that root and tuber cultivation was a very ancient practice was also based in part on the dubious assumption that, because vegetative propagation was thought to be simpler than raising plants from seed, it was likely to have preceded seed-crop cultivation.

Archaeological evidence was needed to substantiate these ethnohistorically derived inferences, but the soft tissues of roots and tubers decay quickly and their remains seldom survive in a condition that allows them to be identified from gross morphological features. Whole root and tuber organs or fragments thereof have occasionally been found in very dry, cold, or waterlogged contexts sufficiently well preserved to be identified (see, e.g., Rosendahl & Yen 1971; Ugent, Pozorski & Pozorski 1982; 1986), but this happens too rarely to contribute significantly to our knowledge of the history of...
agriculture in the tropics. The hard-coated seeds of cereals, pulses, and other seed crops survive much better than roots and tubers and are more commonly recovered, by dry sieving or flotation, in the course of excavation. This bias in the archaeological record in favour of such seed crops as maize, rice, sorghum, and beans has made it particularly difficult to test hypotheses about the importance of roots and tubers in early tropical agriculture. But this unsatisfactory situation is now changing, as the development and application of novel techniques of identification begin to generate direct evidence of the ancient cultivation of root and tuber crops. In particular, three techniques – parenchyma, phytolith, and starch-grain analysis – have the capacity to add substantially to our present meagre knowledge of the prehistory of root-crop cultivation.

**Parenchyma analysis**

Parenchyma analysis was pioneered at the Institute of Archaeology in London by Jon Hather (1988; 1991; 1994), who succeeded in demonstrating that vegetative parenchymous storage organs (which store carbohydrates and sugars in swollen roots and stems) could survive charring and that the tissues and individual cells were sufficiently diagnostic to allow several root and tuber taxa to be identified to genus or even species level. By using scanning electronic microscopy to compare experimentally charred samples of known taxa with charred fragments from various tropical archaeological sites, he was able to identify the remains of a species of yam (*Dioscorea bulbifera*) from Samoa (Hather 1994: 55-6), sweet potato from Mangaia Island in central Polynesia (Hather & Kirch 1991), and manioc from the Mayan site of Cuello in Belize (Hather & Hammond 1994). These results demonstrated the feasibility of the technique, and they produced direct evidence of the pre-Columbian presence of the sweet potato (of South American origin) in central Polynesia and of the cultivation of manioc in the Preclassic period in Central America. Following the success of these early results, Hather trained several archaeobotanists in parenchyma analysis and published a guide to the technique (Hather 2000). It is beginning to be applied more widely, for example by Fuller, Korisettar, Venkatasubbaiah, and Jones (2004: 125-6) in southern India, but the great contribution it could make to our knowledge of the history of root and tuber cultivation in the tropics as a whole is far from being realized.

**Phytolith analysis**

Phytolith analysis has also begun to produce direct evidence of early root and tuber cultivation in the tropics. Phytoliths are silicified particles of plant tissue that retain the shape of individual cells and can often be identified to the level of family, genus, or, sometimes, species. They resist decay and are widely preserved in soils and sediments in temperate as well as tropical environments. The use of phytolith analysis in archaeology was pioneered in the 1980s, particularly by the American archaeobotanists Dolores Piperno (1988) and Deborah Pearsall (1994), and it is now a well-established technique used in archaeobotanical and geoarchaeological research. It is especially valuable in investigations of early agriculture in the humid tropics, where macroscopic remains of plants tend to survive less successfully than they do in drier tropical and temperate environments.

Initially, phytolith specialists focused their investigations of early agriculture on seed crops, particularly maize (see, e.g., Piperno 1989: 545-7; Piperno, Husum Clary, Cooke, Ranere & Weiland 1985), but more recently Piperno has identified phytoliths of two tropical American tuber crops – arrowroot (*Maranta arundinacea*) and leren (*Calathea*
allouia) – in archaeological deposits at a site (the Aguadulce rockshelter) in central Panama (Piperno & Pearsall 1998: 213-17). Both plants belong to the indigenous, ethnographically described root-crop complex of the tropical American lowlands, the antiquity of which has, in the absence of direct evidence, been the subject of much speculation. These new findings indicate that at least those two tuber species were being cultivated in Central America 7,000 years ago, and demonstrate the potential value of phytolith analysis in research on the beginnings of root-crop cultivation in the American tropics.

Phytolith analysis has yet to make a significant contribution to the investigation of early root-crop cultivation in the African or Southeast Asian tropics, but the technique has yielded new evidence of the antiquity of banana cultivation in both regions. Ethnographic and historical data show that bananas of the genus *Musa* were an integral part of the associations of vegetatively reproduced plants (most of which are root and tuber crops) cultivated in historical times in the humid tropics of Southeast Asia, Africa, and South America, but the ancestral wild forms occur only in southeastern Asia from eastern India to New Guinea and in northeastern Australia (Simmonds 1976). Phytoliths of banana (*Musa* sp., of the Eumusa and Ingentimusa sections of the genus) were first identified at the Kuk archaeological site in the Waghi valley in highland Papua New Guinea by Wilson (1985); and Bowdery (1999) detected at Kuk a change from phytoliths characteristic of wet-habitat plants to those typical of drier habitats that may relate to the history of drainage of the swamp for banana and root-crop cultivation (Denham, Haberle & Lentfer 2004; Denham et al. 2003). These data suggest that bananas were being cultivated at Kuk by about 7,000 years ago, and that they were locally domesticated rather than, as had previously been assumed, introduced to New Guinea from mainland Southeast Asia. This conclusion is independently supported by the results of genetic research (Lebot 1999: 621-2), and adds an interesting new dimension to the long-debated but unresolved question of when and by what routes *Musa* bananas were introduced to tropical Africa and South America.

Some light has recently been shed on this question by the recovery of phytoliths of banana type at the archaeological site of Nkang in Cameroon dated to about 2,500 years ago (Mbida et al. 2001; Mbida, van Neer & Vrydaghs 2000). The phytoliths are identified as of *Musa* type, rather than from the allied banana genus *Ensete*, which is native to East Africa. The report of phytoliths from Nkang has been questioned (Vansina 2004), and re-affirmed (Mbida et al. 2004), and their discovery appears to constitute the first direct archaeobotanical evidence of banana cultivation in tropical Africa. Phytolith analysis has not yet yielded any comparable evidence of banana cultivation in South America, but it has the potential to do so and thus help to resolve the question of whether bananas were introduced before Europeans began to colonize the continent after AD 1500 – an untested inference based on the importance of bananas in traditional systems of swidden and house-garden cultivation in Amazonia – or, as is more usually assumed, reached the area after AD 1500 and were rapidly adopted because they were a valuable resource well suited ecologically to integration into the pre-existing suite of root and tree crops (see, e.g., Harris 1971).

**Starch-grain analysis**

Starch-grain analysis is the third novel technique that promises to contribute to our knowledge of early root and tuber cultivation in the tropics. It depends on the fact that starch grains occur in plants in many forms, that they tend to survive in a wide variety

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of depositional environments, and that they are diagnostic of genus and sometimes species. They are of particular interest to archaeologists because they are often preserved in organic residues found adhering to stone tools (Loy 1994). Their systematic study in archaeological contexts has only recently begun, but the potential of the technique has already been demonstrated by Piperno and others. In Panama she and her colleagues (Piperno & Holst 1998; Piperno, Ranere, Holst & Hansell 2000) have identified arrowroot starch grains embedded in grinding stones excavated at the Aguadulce rockshelter, where the phytoliths of arrowroot and leren were recovered, and also starch grains of manioc and yams (probably wild yam species and also the domesticated American yam Dioscorea trifida), all from preceramic stratigraphic horizons dated to between 7,000 and 6,000 years ago.

Starch residues on stone tools from a site in southern Venezuela have also recently been investigated by Linda Perry (2002; 2004). She has analysed starch grains preserved on microlithic flakes that functioned as the ‘teeth’ of ceramic grater boards found at the site of Pozo Azul Norte-1 in the middle Orinoco basin, dated to c.AD 740. She was able to identify securely starch grains from three plants with edible underground storage organs: yam, arrowroot, and guapo (Myrosma sp.), and also maize, the grains of which exceeded those from any other taxon. Surprisingly, no grains of manioc starch were found – a result that undermines the widespread assumption in the archaeological literature on prehistoric agriculture in Amazonia that ceramic graters and associated microliths are reliable indicators of bitter-manioc cultivation. Here we have an interesting example of how a new archaeobotanical technique can produce data that fail to support a long-held inference derived originally from ethnographic observations and historical accounts. These results do not falsify the assumption that ceramic graters armed with microliths were used in prehistoric times to process bitter manioc, but they do reveal that these artefacts have been used to process a wider variety of starch-yielding plants, including maize, and that archaeological evidence of them should no longer be uncritically regarded as a proxy indicator of manioc cultivation.

These data from analyses of starch grains and phytoliths in Panama and Venezuela demonstrate the potential value of both techniques for overcoming the general lack of direct archaeobotanical evidence, and they currently provide the earliest evidence of root-crop cultivation in the Americas. Starch-grain analysis has not yet yielded any definite evidence of early root-crop cultivation in the Southeast Asian or African tropics, but at the site of Niah Cave in Sarawak (Barker 2002) recent analyses by Huw Barton and Victor Paz (in press; Barton 2005) of starch grains from tubers and rhizomes, and charred parenchyma tissues from tubers (and fruits), have produced evidence of the exploitation of tuberous plants such as taros and yams in the Late Pleistocene. Two of the parenchyma fragments have been identified as from the highly toxic yam Dioscorea hispida, the large tubers of which have to be carefully processed before they can safely be consumed (Burkill 1966 [1935]: 832). These results demonstrate very early, pre-agricultural use of tubers by rain-forest foragers, presumably for food and perhaps also, in the case of D. hispida, for poisons used in hunting, a use of this species recorded ethnographically elsewhere in Southeast Asia by Burkill (1966 [1935]: 831-4).

As all these new techniques come to be more widely applied, we can expect to learn much more about the prehistory of root and tuber cultivation in the American, African, South and Southeast Asian tropics and its relationship to the early cultivation
of such seed crops as maize, rice, sorghum, and other millets. But it is more difficult
to determine whether starch grains, phytoliths, and fragments of parenchyma derive
from wild plants or (morphogenetically) domesticated crops than it is when identi-
fying seeds and other macroscopic plant remains. Nevertheless, by comparing
parenchyma, phytoliths, and starch grains of wild and domestic living plants, it is
possible to establish criteria, such as larger cell and grain size, by which to identify
the domestic forms. All three techniques also have the potential to generate new evi-
dence of past tropical forager subsistence, as is demonstrated by the discovery and
identification of parenchyma fragments and starch grains of Late Pleistocene age at
Niah Cave.

Tropical forager subsistence
The novel techniques discussed in the previous section can be expected to make impor-
tant contributions in the future to investigations of plant use by past tropical hunter-
fisher-gatherers, but, as was pointed out in the introduction, much can still be learned
through the use of more conventional ethnoarchaeological methods based on the com-
parison of field evidence with ethnographic and historical data. In the second half of
this paper, I illustrate this point by summarizing research that I have undertaken on
pre-European subsistence in two contrasted areas in tropical northeastern Australia:
the north-Queensland rain forest and the western Torres Strait Islands.

Pre-European subsistence in the northeast Australian rain forest
The aim of my research in the Queensland rain forest (Harris 1978; 1987b) was to
examine the relationship between historical accounts of Aboriginal life in the forest,
archaeological evidence, and rain-forest ecology. When Europeans first penetrated the
forest in the late nineteenth century they encountered tribal groups who differed physi-
cally and culturally from the Aboriginal inhabitants of the adjacent areas of savanna
woodland, and who were living at higher population densities entirely within the forest
(i.e. at c.2 km²/person). It is clear from the early European descriptions, and confirmed
by more recent testimony of descendants of the Aboriginal forest dwellers, that tree
nuts were a staple food, systematically harvested, stored, and processed. Fish from the
many rivers that traverse the forest were also an important source of food, with ter-
restrial animals contributing less to Aboriginal diet.

By combining fieldwork, study of the Aboriginal plant names recorded by early
European observers, and correlation of the names with the scientific binomials
and descriptions provided by the botanist who published a catalogue and flora of
Queensland plants at the beginning of the twentieth century (Bailey 1899-1905; 1909),
I was able to identify most of the plants reported to have been exploited for food in
the rain forest. The historical accounts contain many references to the dietary impor-
tance of tree nuts, and I succeeded in identifying eleven tree species that were staple
or supplementary sources of edible nuts (Table 1). However, the kernels of seven of
these species, six of which appear to have been staple foods, are sufficiently toxic to
require laborious processing, by pounding, grating, and leaching in water, before they
can safely be consumed. I therefore turned to the question of why they made such an
important contribution to Aboriginal subsistence.

Their importance was revealed not only by the historical accounts but also by the
existence of two highly distinctive types of stone tool, both of which were evidently
used for nut-processing. One type consisted of a large anvil stone pitted with small

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spherical hollows, accompanied by a hammer stone, and the other was an ovate or rectangular grooved slab associated with a small crushing stone (Figs 1 and 2). Many of these tools have been found in the forest, and when land has been cleared. The question then arose of which nuts were processed with these tools. The answer was provided partly by consideration of the properties of the nuts themselves, partly by references to the tools in the historical accounts, and partly by the testimony of Aboriginal people who retained knowledge of their former use.

Measurement of the average weights of samples of several of the nuts that were staple foods revealed an extreme contrast in the ratio of shell to kernel between the nuts of the yellow walnut (*Beilschmiedia bancroftii*) and the Queensland almond (*Elaeocarpus bancroftii*): respectively 2.9:1.00 and 13.6:1.00. They also differ in another significant way – the yellow walnut kernels are toxic and need to be leached whereas those of the Queensland almond can be eaten raw. These contrasts, coupled with the historical and oral information about nut-processing, indicate the specialized functions of the stone tools: the anvil and hammer stones were used to crack the exceptionally thick shells of the Queensland almond; and the grooved slabs and crushing stones were used to macerate the toxic kernels of the yellow walnut (also those of the black walnut, *Endiandra palmerstonii*) before the resultant mash was leached in water.

The two walnuts have thin, easily removed, shells and were evidently particularly important staple foods in the wet season (Meston 1904: 6). In contrast, the Queensland almond has a very hard, thick shell and a single small kernel, and cracking open

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**Table 1. Principal nut-yielding trees that contributed to Aboriginal diet in the northeast Australian rain forest.**

<table>
<thead>
<tr>
<th>Family and binomial</th>
<th>English name</th>
<th>Inferred status</th>
<th>Leached</th>
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</thead>
<tbody>
<tr>
<td>Lauraceae</td>
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<tr>
<td><em>Beilschmiedia bancroftii</em></td>
<td>Yellow walnut</td>
<td>PS</td>
<td>X</td>
</tr>
<tr>
<td><em>Endiandra palmerstonii</em></td>
<td>Black walnut</td>
<td>PS</td>
<td></td>
</tr>
<tr>
<td><em>Endiandra pubens</em></td>
<td>Hairy walnut</td>
<td>SS</td>
<td>X</td>
</tr>
<tr>
<td><em>Endiandra tooram</em></td>
<td>Brown walnut</td>
<td>SS</td>
<td></td>
</tr>
<tr>
<td>Elaeocarpaceae</td>
<td></td>
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<td></td>
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<tr>
<td><em>Elaeocarpus bancroftii</em></td>
<td>Queensland almond</td>
<td>PS</td>
<td></td>
</tr>
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<td>Proteaceae</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><em>Macadamia whelanii</em></td>
<td>Silky oak</td>
<td>SS</td>
<td>X</td>
</tr>
<tr>
<td><em>Hicksbeachia pinnatifolia</em></td>
<td>Ivory silky oak</td>
<td>SS</td>
<td></td>
</tr>
<tr>
<td><em>Helicia diversifolia</em></td>
<td>White oak</td>
<td>SS</td>
<td></td>
</tr>
<tr>
<td>Euphorbiaceae</td>
<td></td>
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<tr>
<td><em>Aleurites moluccana</em></td>
<td>Candlenut</td>
<td>SP</td>
<td></td>
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<tr>
<td>Leguminosae</td>
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</tr>
<tr>
<td><em>Castanospermum austral</em></td>
<td>Black bean</td>
<td>SP</td>
<td>X</td>
</tr>
<tr>
<td>Podocarpaceae</td>
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<tr>
<td><em>Podocarpus amarus</em></td>
<td>Black pine</td>
<td>SP</td>
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</table>

PS = primary staple; SS = secondary staple; SP = supplementary source of starchy food (modified from Harris 1987b: Table 14.1).
the shell to extract the kernel is a laborious task. It therefore seems surprising that the almond too was an important staple. However, closer consideration of its properties suggests why it was a preferred species: first, each fruiting tree yields large numbers of nuts that accumulate on the forest floor and are easily collected; second, their thick shells confer some protection against predation by rodents and ensure that the nuts store well; and third – as nutritional analysis showed – their kernels are rich in vegetable oil, unlike those of the yellow walnut (45.11 vs 0.59%), and they also contain appreciable amounts of carbohydrate and protein. The starch-rich walnuts and oil-rich almonds thus complemented each other nutritionally and offered contrasting tastes in what was a predominantly vegetarian diet. They also provided significant quantities of protein which supplemented the rather meagre supplies of animal protein obtained from fish, birds, reptiles, insects, and small mammals.

This study illustrates how consideration of ecological and (in this case very limited) archaeological data can substantiate and elaborate an interpretation of past forager subsistence that is based mainly on historical evidence. So too does my second example, based on fieldwork in the western Torres Strait Islands.
Pre-European subsistence in the western Torres Strait Islands
In Torres Strait I undertook a comparative study of pre-European subsistence along the chain of islands between Cape York and the Papuan coast (Harris 1977: 439-48; 1979), where historical and ethnographic sources indicated that the importance of crop cultivation as a component of the subsistence economy increased from south to north across the Strait. The inhabitants of the southwestern islands obtained almost all their food from wild animals and plants, principally fish, marine turtles, dugongs, shellfish, wild yams, and mangrove shoots, whereas in the midwestern and northwestern islands small-scale cultivation of yams, taro, sweet potato, sugar cane, bananas, and coconuts was an important subsistence activity.

Fieldwork in the islands in 1974 and subsequent years added ethnobiological and archaeological dimensions to the picture of mid-nineteenth-century economy and society in the western islands that could be drawn from the historical and ethnographic sources. In general, this new information reinforced and added to the ethnohistorical evidence. Thus, we found evidence of former agricultural mounds, ditches, and terraces on the midwestern and northwestern islands but not in the southwestern group, and coastal middens containing fish, turtle, and dugong bones, and the remains of fish traps on offshore reefs, were most abundant in the southwestern and midwestern islands. Our attempts to excavate and date some of the agricultural mounds were only partially successful, largely due to the lack of stratified organic remains that could be radiocarbon dated, but we did obtain a date of c.700 years ago for the construction of a mound on the northwestern island of Saibai (Barham & Harris 1985: 261-7).

Figure 2. Grooved stone slab (morah) and hand-held crushing stone (moogi) used principally to macerate the toxic kernels of Endiandra palmerstonii; the moogi has been turned upside down to show the worn surface caused by rocking it back and forth as the kernels are mashed (Queensland State Forestry Office, Atherton, photo D.R. Harris, September 1974).
One particularly interesting example of the interplay of ecological and historical data arose from my ethnobiological fieldwork. There is an exceptionally detailed and revealing account of life on the largest of the southwestern islands, Muralug (Prince of Wales Island), left by a young Scottish woman, Barbara Thompson, who lived with the islanders for four years in the 1840s after being shipwrecked (Moore 1978). She was rescued in October 1849 by the crew of HMS *Rattlesnake* and described her life on Muralug to the expedition artist, Oswald Brierly. She told him how each year during the wet season, when wild yams and most other plant foods were unavailable and it was difficult to procure fish, turtle, or dugong, the whole population of the island congregated on the sheltered south coast close to the only place on the island where a species of mangrove grew that was evidently the main source of food during the wet season (Brierly in Moore 1978: 275). She recalled how unpleasant it was collecting the mangrove ‘pods’ (actually germinating embryos) and struggling back in the rain with heavy baskets full of them to the long communal hut in which all the families lived (Brierly in Moore 1978: 276).

We tend not to think of mangroves as a source of human food, and may be inclined to doubt the truth of Barbara Thompson’s statement that they were the wet-season staple, but during fieldwork at Lockhart on the east coast of the Cape York Peninsula, and also in Papuan coastal villages north of Torres Strait, I was told by informants that the ‘fruits’ of one species of mangrove (*Bruguiera gymnorrhiza*) had been a staple food in the recent past (Harris 1977: 432, 449). This is almost certainly the species that was exploited for food on the island of Muralug. Barbara Thompson described how the embryos had to be processed by steaming them in an earth oven, scraping out the soft tissues, and mashing and leaching them in water to produce an edible pulp that was then moulded by hand into balls before being eaten. Macgillivray (1852), who was the naturalist on board HMS *Rattlesnake*, described the pulp as a grey slimy paste, and later European authors regarded *Bruguiera gymnorrhiza* as a famine or lean-period food (Flecker, Stephens & Stephens 1948: 12; Hale & Tindale 1933: 115). However, nutrient analysis of the embryos showed them to contain 4.45 per cent crude protein, which would have made a valuable contribution to the wet-season diet of the islanders.

Archaeological reconnaissance and trial excavations carried out by Moore (1978: 14) in the area of the wet-season settlement on Muralug produced evidence of earth ovens, cooking stones, bone fragments, and the remains of edible shellfish, and a charcoal sample was radiocarbon dated to c.600 years ago, but although mangrove embryos had probably been processed in the earth ovens, their soft tissues could not be expected to have survived in recognizable form in the archaeological deposits. It is possible that residues from mangrove-processing could now be identified by phytolith or starch-grain analysis, but the fact that no stone or shell artefacts were found in the course of Moore’s excavations suggests that it would be very difficult to demonstrate mangrove-processing unequivocally. Nevertheless, this case study, like that of forager subsistence in the Queensland rain forest, demonstrates how, by evaluating ethnohistorical evidence against data derived from ethnobiological fieldwork, new knowledge can be gained, and, conversely, how the former can inform and guide the latter.

**Conclusion**

In this paper I have shown how several novel analytical techniques are being used to identify previously unidentifiable traces of plant remains and are providing valuable new evidence of, especially, early root and tuber cultivation in the tropics. These
techniques not only generate wholly new data; they can also be used to evaluate existing inferences derived from ethnobotanical and archaeological evidence, as is shown by Linda Perry’s investigation (2002; 2004) of starch grains preserved on microliths from ceramic graters that were previously assumed to be diagnostic of bitter-manioc cultivation but are now known to have been used to process maize as well as manioc and other root crops.

This example is particularly illuminating because it demonstrates the value of using a new archaeobotanical technique to test and refine a pre-existing body of archaeological and ethnographic evidence. It goes beyond the discovery and identification of new assemblages of plant remains (the valuable but limited achievement of much recent research in parenchyma, phytolith, and starch-grain analysis) to reveal new insights into how the plants were used. In recent years, archaeobotanists have increasingly tried to elicit direct evidence of how plants were cultivated and processed, notably through ecological and ethnographic studies of cereals and their associated weed floras, an approach pioneered by Gordon Hillman (1981; 1984) and Glynis Jones (1984; 1987). More recently still, some archaeo- and ethno-botanists have sought insights into the domestication process from the varied ethnographically recorded roles of plants in human social relations, as gifts, festal foods, territorial markers, symbols of group identity, and in other ways (see, e.g., Dietler & Hayden 2001; Hastorf 1998; 2004; Ingold 1996; Rival 1998). This emphasis on the multi-faceted social functions of plants in human affairs increases our awareness of the complexities of early plant use, but it also makes it even more difficult to link the usually exiguous archaeobotanical evidence directly to the ethnographic record.

This task is even more challenging in archaeological studies of the role of plants in the lives of former foragers than in those of past agriculturalists, because most archaeological investigations of hunter-fisher-gatherers are concerned with more distant (Palaeolithic and Mesolithic) time periods than studies of (Neolithic and later) farmers. The examples presented here that combine ethnohistorical, ethnobotanical, and archaeological study of recent foragers in the Queensland rain forest and Torres Strait Islands demonstrate how much more feasible and productive it is to investigate past forager subsistence when the time gap between ethnographically observed and archaeologically inferred subsistence practices is measured in centuries rather than millennia. But, despite the greater difficulty inherent in investigating plant use by people who lived many millennia ago, by combining the use of new analytical techniques with more refined models of plant-people interaction based on ethnographic and ecological data, we can expect to achieve great gains in our understanding of the myriad ways in which humans have procured and produced food from plants, in the tropics and elsewhere.

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Interaction des connaissances ethnographiques et archéologiques dans l’étude des modes de subsistance passés dans les régions tropicales

Résumé

Une grande partie de nos connaissances ou croyances actuelles sur la manière dont les humains se procu-raient et produisaient leur nourriture dans le passé provient d’indices ethnographiques et historiques liés aux pratiques de subsistance des cueilleurs et des agriculteurs. Il est souvent difficile, voire impossible, de corrêler directement les indices archéologiques aux observations ethnohistoriques, bien que ces deux source de données très différentes soient potentiellement complémentaires, ainsi que le met aujourd’hui en lumière l’usage de nouvelles techniques telles que l’analyse des parenchymes, des phytolithes et des grains d’amidon, qui permet d’identifier les résidus organiques fragmentaires et amorphes retrouvés dans les fouilles archéologiques, ou encore la spectrométrie de masse par accélérateur au radiocarbone qui rend possible la datation de très petits échantillons tels que des graines isolées. Les méthodes eth-noarchéologiques plus classiques, qui consistent à comparer les indices de structures liées à la subsistance retrouvés sur le terrain avec les informations tirées des sources ethnographiques et historiques, continu-ent cependant à apporter une contribution précieuse à l’étude de la production et de l’obtention de nour-riture dans le passé. Nous donnons ici des exemples de l’interaction entre les données archéobotaniques et ethnohistoriques, en examinant (a) des applications récentes des nouvelles techniques d’analyse dans l’étude historique de la culture des racines et tubercules dans les régions tropicales d’Amérique, d’Afrique et d’Asie du Sud-Est, et (b) l’utilisation de méthode plus conventionnelles pour étudier la subsistance des anciens chasseurs nomades du nord-est tropical de l’Australie.

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