Pleistocene occupation of New Guinea's highland and subalpine environments

Andrew S. Fairbairn, Geoffrey S. Hope and Glenn R. Summerhayes

Abstract

New Guinea's mountains provide an important case study for understanding early modern human environmental adaptability and early developments leading to agriculture. Evidence is presented showing that human colonization pre-dated 35ka (ka = thousands of uncalibrated radiocarbon years before present) and was accompanied by landscape modification using fire. Sorties into the subalpine zone may have occurred before the Late Glacial Maximum (LGM), and perhaps contributed to megafaunal extinction. Humans persisted in the intermontane valleys through the LGM and expanded rapidly into the subalpine on climatic warming, when burning and clearance may have retarded vegetation re-colonization. Plant food use dates from at least 31ka, confirming that some of New Guinea's distinctive agricultural practices date to the earliest millennia of human presence.

Keywords

Mountains; archaeology; archaeobotany; palynology; extinction; Late Glacial Maximum.

Introduction

The vast island of New Guinea, split between Papua New Guinea (PNG) and Indonesia, has a high mountainous spine rising above 4000m along its length and to over 5000m at Mt Jaya (Fig. 1). Archaeological research suggests that New Guinea was colonized by at least 40–50ka, when sea level was 200m lower than today (Fig. 1) and New Guinea formed the northern part of Sahul, the single prehistoric landmass containing Australia and New Guinea. In this account we discuss published and new evidence for the Pleistocene occupation of the highland (700–3000m) and subalpine (3000–4000m) zones of New Guinea's mountains, focusing on developing human-environment relations between *c*. 40 and 10ka. Most archaeological research has understandably focused on the prehistory of the intermontane valleys at *c*. 1400–1800m altitude in which independent agriculture

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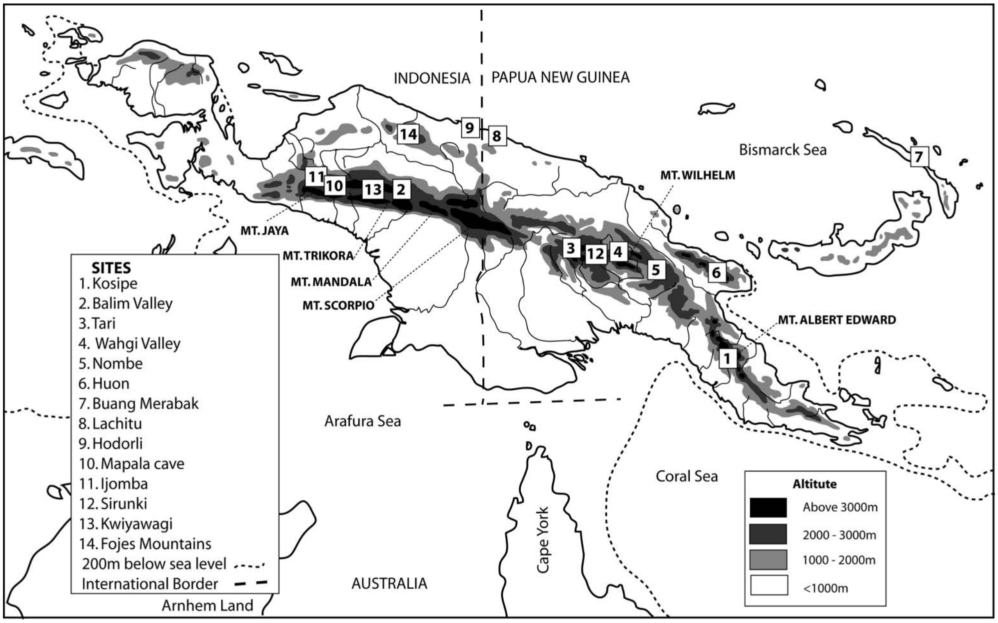

Figure 1 New Guinea showing the location of key sites mentioned in the text.

developed during the Holocene (Denham et al. 2003). The twentieth-century European discovery of these densely populated valleys with warlike societies based on intensive root cropping and pig rearing (Sillitoe et al. 2002) greatly influenced Western conceptions of New Guinea's mountain people. Yet anthropology records societies that have adapted to New Guinea's montane environments in a wide variety of ways and, at the same altitudinal zone as highland agriculturalists, other groups are found with sparse populations reliant on hunting and gathering/tending plants of uncertain domestic status. Occupation and economic exploitation also extended well above the intermontane valleys for settlement, hunting and communication, the latter using mountain passes as high as 4600m on Mt Carstenz (Hope and Hope 1976a). Sparse archaeological research makes montane New Guinea's early prehistory a difficult subject area, but its importance goes well beyond regional archaeological discourses, providing key information about the adaptive ability of early modern humans. This is because human colonization of Sahul required the earliest known open ocean crossings and expansion into the highlands confronted newcomers with totally unfamiliar biota in a range of environments influenced by extreme climatic gradients.

Vegetation and climate

New Guinea's mountains form a steep east-west barrier, dissected by deep valley systems (Fig. 1), with a cool, moist and thermally equable climate. Local variations in climate punctuate regional temperature and rainfall gradients. Frost is common above *c.* 2500m, providing an effective barrier to root cropping. Temperature declines with increasing altitude, for example reaching an average of 19°C at *c*. 1580m in the Wahgi Valley (Hughes et al. 1991), 8°C at 3480m and 6°C at 4380m on Mt Wilhelm (Hnatiuk et al. 1976). Precipitation is generally high with annual rainfall from the same locations of 2700mm, 3450mm and 2900mm.

Five broad vegetation types are found (Table 1) varying in composition, physiognomy (structure) and altitude, depending on changing climate and landform. Floristically diverse broadleaf forests cover the highlands from 700 to 3000m. Oaks (*Lithocarpus* and *Castanopsis*) are key elements of the lower-lying forests with southern beech (*Nothofagus*) and Gymnosperms (e.g. *Dacrydium*, *Podocarpus* and *Papuacedrus*) important in the mid and upper zones. Alluvial swamps and bogs are found extensively in some intermontane valley floors and vegetation everywhere is modified by human activity, perhaps most obviously in gardens, but also forming widespread grasslands dominated by species of *Miscanthus* and *Imperata*. The subalpine zone is characterized by low-growing, floristically poor forests, rich in shrubs (e.g. Ericaceae) and tree-ferns (e.g. *Cythaea*), with grasslands at higher altitudes and extensive bogs. Above the tree line at *c*. 3800m, the alpine zone contains low-growing grassland with shrubs such as *Leucopogon*, which give way to glacial environments above 4600m.

Chronology, rate and direction of colonization

Humans appeared in Sahul by at least 40–50ka (O'Connor and Chappell 2003; O'Connell and Allen 2004). Among the key evidence in New Guinea are luminescence dates of >44ka for occupation on the raised coral terraces of the Huon peninsula (Fig. 1) and evidence of expansion into the Bismarck Archipelago by *c*. 40ka at the cave of Buang Merabak (O'Connell and Allen 2004). AMS dates from recent excavations by the authors at Kosipe Mission in the Papuan highlands (1950m: see Fig. 2) provide a *terminus ante quem* of 35,049 ± 670 BP (Wk-17901) for human habitation, based on dates from hearths

Table 1 Major vegetation types of New Guinea's mountain landscape zones following terminology used in the text, with modern altitudinal range and key plant taxa

Zone	*Vegetation type*	*Alt. range (m)*	*Vegetation structure*	*Key plants*
Alpine	Alpine	>3800	Grassland	*Festuca*, *Poa*, *Leucopogon*
Subalpine	Subalpine	3000–4000	Forest/shrub grassland	Ericaceae, *Dacrycarpus*, *Cyathea*, *Poa*
Highland	Upper montane	2700–3200	Moss/cloud forests	*Dacrycarpus*, *Papuacedrus*, *Amaracarpus*
	Mid-montane	1500–3000	Forests	*Nothofagus*, *Weinmannia*, *Dacrydium*
	Lower montane	700–2000	Forests	*Lithocarpus*, *Castanopsis*, *Araucaria*

Sources: Paijmans 1976; Johns 1982

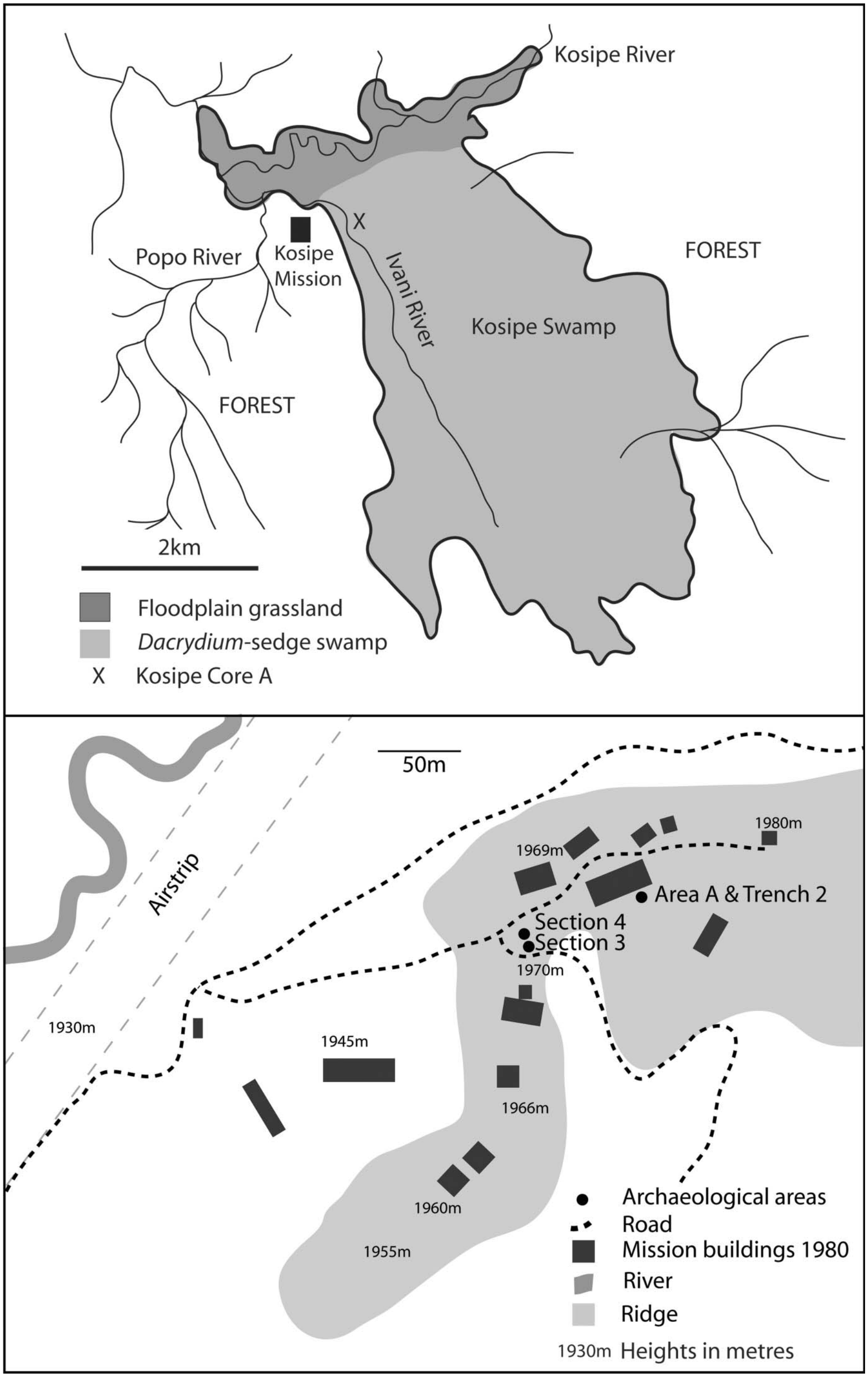

Figure 2 Sites in the Kosipe valley (upper, after Hope 1982) with detail of the Kosipe Mission (lower).

associated with stone tools. A cluster of new dates at *c*. 30–32ka and those published earlier (White et al. 1970) suggest that Kosipe was regularly visited before 35ka until about 16ka and then through the Holocene. Occupied from *c*. 25ka, Nombe rockshelter (*c*. 1720m) has the only other contemporary occupation, which lasted into the Holocene (Mountain 1993; Evans and Mountain 2005). 'Generalized correlation' has been used to estimate the solar age of these sites at *c*. 30,000 cal. BP (see Evans and Mountain 2005); a similar estimation would put Kosipe's earliest occupation at *c*. 40,000 cal. BP. Taken at face value the dates suggest a temporal lag in expansion to the montane zone from the lowlands of *c*. 5000 years, whether compared directly to the Buang Merabak radiocarbon dates or the >44ka Huon date, assuming that the 35ka Kosipe radiocarbon dates represent *c*. 40,000 solar years. Subalpine occupation is less well known, but appears to have lagged significantly behind the highlands. Data from Nombe suggest hunters exploited animals from higher altitude environments after 25ka, though this may reflect closer proximity of natural grasslands and the large fauna they sustained. Microcharcoal records from Ijomba and Laravita Tarn (see below) provide the earliest strong evidence of a subalpine presence.

Can we say anything about the initial direction and extent of the Pleistocene human presence? The most parsimonious colonization route is from the south and Australia contained contemporary or earlier populations in its tropical woodlands (Kershaw et al. 2002). Early occupation is known to the north, in both the Huon and Bismarck Archipelago, but direct colonization by that route would have required crossing the high passes. An alternative is colonization from the north via circumnavigation of Papuan lowlands. The paucity of Pleistocene sites, the chronological unevenness of fire records and clear absence of firing in some areas before 20ka suggest that the earliest occupation in the highlands was relatively sparse, sporadic and uneven. Human impact and disturbance clearly increased after *c*. 20ka and increased in intensity towards the terminal Pleistocene, perhaps reflecting increasing populations and the early stages of independent agricultural development (Haberle et al. 2001; Haberle 2003; Denham et al. 2003). Before this, some locations, such as Kosipe, were repeatedly visited from the earliest times; other areas saw habitation only later, such as Nombe and probably Tari (see below). Kosipe's abridged archaeological record, with superimposed and temporally distinct patches of fireplaces, tools and food residues is suggestive of a temporary encampment, perhaps reflecting a population with high residential mobility (see Denham and Barton 2006), as suggested for the early phase at Nombe (Mountain 1993).

Environment of first colonization

What plant communities met the first colonists as they ascended from the costal lowlands? Vegetation reconstructions for the period 48–26ka can be made based on long pollen records at Tari (Haberle 1998), Sirunki (Walker and Flenley 1979), Lake Hordorli (Hope 1996) and Kosipe (Hope 1982, unpublished), as well as those from northern Australia (Kershaw et al. 2002). Climate in the main highland valleys was perhaps 4°C cooler than today, as they were densely covered in *Nothofagus* forests to *c*. 2500m, a vegetation type today found at higher elevations. The position of the alpine tree line is unknown but may have been 2700–3000m while glaciers were probably present above 4200m.

Subalpine shrub grasslands seem to have occupied the zone now taken by subalpine forest (Hope 1996). The lower boundary to mixed lower montane forest is also not well known but may have lain below 1400m. Although the highland sites are uniformly moist, it is likely that the lowlands were somewhat drier than today. Savannah may have extended closer to the foot of the mountains and a zone of dry-season forest typified by deciduous trees was probably well developed in the foothills.

Vegetation change and fire

Humans have had a significant impact on montane vegetation through clearance, burning, translocation of plants and cultivation, and altering populations of grazers/browsers through hunting and pig rearing. Fire is a major human influence on New Guinea's montane zone, used to clear and maintain both gardens and grassland areas. Microcharcoal accumulation at Kosipe from core A, located 1km from the Mission site in Kosipe Swamp (Fig. 2), shows phases of forest burning and clearance before 36ka (36,500 ± 400 BP (OZE-451)) (Fig. 3). A similar record has been found >33ka at Wamena in the Balim (Hope 1998) (see Fig. 4). Records of vegetation burning pre-date 30ka at Kosipe and the Balim, but were these related to human or natural causes? The highland zone is analytically useful when trying to disentangle fire causality in Sahul. In the lowlands, fire may have affected New Guinea's savannah and large swathes of Australia naturally before human occupation. Claims that humans were responsible for landscape burning before 40ka (e.g. Turney et al. 2001) and in doing so were responsible for animal extinctions in Australia (Miller et al. 2005) are compelling, but remain fringed with doubt. Early fires at Kosipe Swamp occurred in a moist mid to upper montane *Nothofagus* and *Elaeocarpus* forest of limited combustibility and unlikely to have supported natural fires. Recent studies of microcharcoal, pollen and phytolith data (festucoid grasses) from nearby terrestrial sediments also indicate that the forest was being burnt and that clearings were being maintained within it. Vegetation burning does not correspond with any major climatic events, but the new Kosipe dates show that humans were present during the early phase of firing and, in the absence of any other feasible cause, we are left in little doubt that humans were responsible for vegetation burning before 35ka.

While evidence from Kosipe and the Balim shows pre-30ka fires, other sites, such as Haea Swamp and Lake Hordorli, record no fires at all for several millennia with a sudden appearance at *c*. 20ka (Fig. 4), probably indicating the appearance of humans in the area (Haberle et al. 2001). The Tari pollen record is of great importance for understanding long-term sequences of vegetation change as it is the only one that preserves a continuous sequence from before 28ka through to the present (Haberle 1998). It shows that, at *c*. 21,000 BP, in forests dominated by *Nothofagus*, *Castanopsis* and Myrtaceae, burning led to the creation of a grassland and forest mosaic. Although there is no direct archaeological evidence for a local human presence, the vegetation change and increase in burning is unprecedented and is considered to be a consequence of the arrival of humans in the region (ibid.). Increasing vegetation disturbance and burning is also evidenced in the Wahgi Valley from *c*. 20,000 BP through to the Holocene and has been identified as the Pleistocene genesis of a unique Holocene agricultural landscape (Haberle 2003).

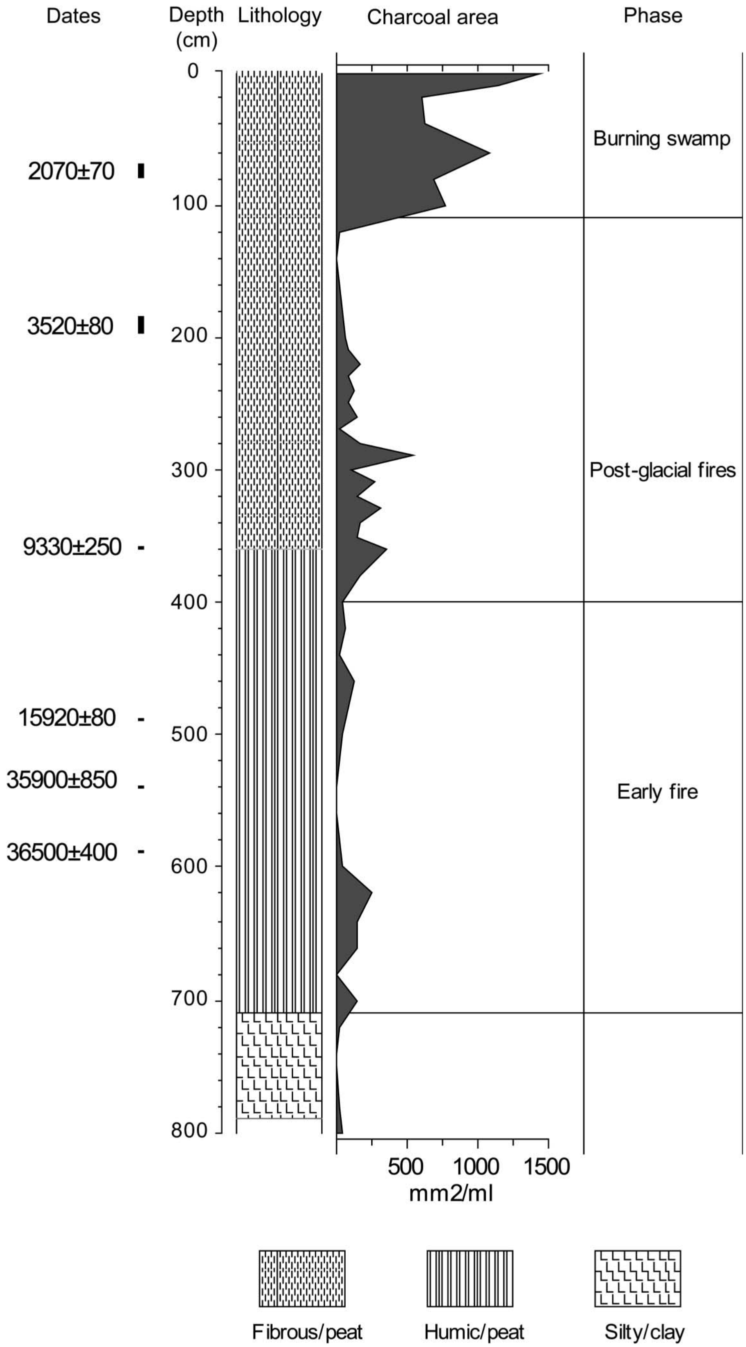

Figure 3 Microcharcoal influx at Kosipe.

Several palaeoecological records show that fire appeared in the subalpine with post-glacial warming. For example, at Lake Habbema, north of Mt Trikora, fire and open grasslands were present by the start of the Holocene, and pollen diagrams

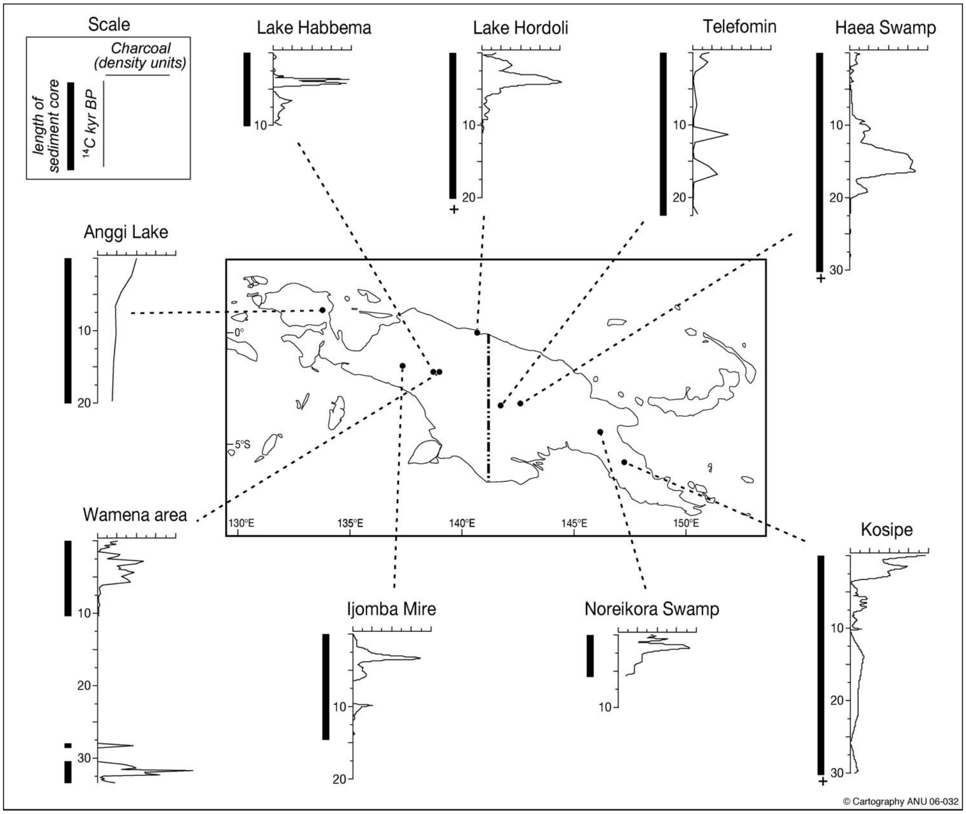

Figure 4 Microcharcoal records from highland and subalpine New Guinea (after Haberle et al. 2001).

(Hope unpublished) show continuing disturbance to the present day. Ijomba, on Mt Jaya, sees firing at 11.5ka that reaches a peak in the mid-Holocene. Laravita Tarn, at 3680m on Mt Albert Edward, shows burning in alpine grasslands at 11ka followed by limited development of subalpine forest after 10ka which was removed by burning after *c.* 7ka (Hope unpublished data). Once again, humans are the only viable cause for such widespread and continuous burning. Evidence suggests that exploitation of the subalpine occurred as soon as occupation was viable following glacial retreat. The Laravita sequence may even indicate that post-glacial vegetation re-colonization was impeded by human action, as seen in other parts of the world (Roberts 2002). Records are, however, mixed as some subalpine areas experienced clearance only within the last millennium, associated with rising limits to agriculture (Corlett 1984) and some areas appear to have been largely ignored – a core from a glacial pond at 3540m on remote Mt Scorpio showed only one fire event in a 12,500 year record (Hope 1980).

Plant-based subsistence

New Guinea's mountains have a dearth of wild plant food resources. One exception is the tree-crop *Pandanus*, several species of which are cultivated and grow wild between *c*. 1800m and 3100m (Bourke 1996) and produce a seasonal bounty of nutritious seeds (see Powell in Paijmans 1976: 116–17). Other edible nut trees, mostly occurring today below 2000m, include several *Elaeocarpus* species and the widespread *Castanopsis* and *Lithocarpus* acorn-bearing species. In the subalpine zone there are no staple plant resources, although fruits such as *Astelia alpina*, *Podocarpus amarus* or *Rubus* spp. are reasonably common. Fern shoots and some sedge and *Potentilla* spp. root stocks are eaten by pigs in the subalpine but are not recorded as human food today, although they may have been eaten in the past.

The character and development of Pleistocene plant-based subsistence activities has been starved of archaeological evidence. Peter White first suggested that seasonal settlement at Kosipe was attracted by the abundance of wild edible *Pandanus* in the area (White et al. 1970), a suggestion supported by abundant archaeological *Pandanus* remains directly dated to 30,575 ± 399 BP (Wk-17261) and 30,727 ± 395 BP (Wk-18233). Single-seeded *Pandanus* drupe fragments closely resemble *P. brosimos* and *P. iwen*. *Pandanus* remains post-date the earliest signs of a human presence and further work is required to establish if its use was a late and potentially local development or accompanied colonists and thus involved transfer of gathering knowledge from lowlands area where *Pandanus* is common (Haberle 1995). The Kosipe data confirm the potential importance of *Pandanus* as an early food resource, extend greatly direct evidence for the antiquity of its use (Denham 2005), and suggest that some of New Guinea's distinctive highland agricultural practices derive from the early millennia of human colonization. When combined with the presence of waisted axes, which may have been used to clear vegetation (Groube 1989), and traces of vegetation clearing and firing (see above), it is tempting to envisage a *Pandanus* management system similar to that seen today.

Hunting and extinctions

Hunting is a key economic and social activity that almost certainly accompanied the first colonists, and which, before the introduction of pig, provided the only source of animal nutrition. Early hunters may have exploited a strange fauna, which included several large and now extinct mammals (Flannery et al. 2002). New Guinea seems always to have lacked some families of marsupials found in Australia, but has a rich possum and rodent fauna, of which the folivorous possums (e.g. *Pseudocheirus cupreus*) and large rats (e.g. *Mallomys rothschildii*) are commonly hunted today. The large monotreme *Zaglossus bruijnii* is reasonably common up to the subalpine, but hunting pressures have caused local extinction. Small kangaroos are found in forests and subalpine grasslands, with rodents particularly common in the subalpine. Birds are quite common throughout the discussed range, from larger species such as cassowary and ground pigeons to small frugivorous birds and grassland specialists such as quail. Larger mammalian predators, other than introduced dogs, are lacking, their niche being filled by pythons and large birds of prey.

Direct zooarchaeological data of the details of hunting behaviour are scant. The best early evidence comes from Nombe (Mountain 1993), used as a temporary shelter from *c*. 25ka from which time large mammals were targeted. By 14.5ka there was a shift towards targeting small and medium animals which coincided with more intensive occupation of the shelter. Now extinct species were hunted before 14.5ka and hunting appears to have extended into the upper montane forest and subalpine grassland zones, which would have lain close to the site during the cold of the Last Glacial Maximum (LGM). Burnt animal bone fragments from a charcoal lens dated to 25,217 ± 293 BP (Wk-17898) at Kosipe were beyond identification but also suggest hunting.

Few other direct archaeological data concerning animal exploitation are available before the LGM. While the recovered fossil and zooarchaeological data are very sparse, there has clearly been attrition of the native fauna during the Pleistocene, in many cases linked to human activity. The age and scale of human impact continues to be debated, but the methods of human impact seem clear: reduction of animal numbers by hunting and change of environment by burning and clearing. New Guinea's pre-human montane fauna is known from several fossil sites in the central highlands that contain bones of extinct taxa, such as large kangaroos (*Protemnodon* spp.) and diprotodontids (e.g. *Hulitherium thomasettii*) (Menzies and Ballard 1994; Flannery 1995). The sites are poorly dated but megafauna were possibly present until *c.* 35ka. No settlement evidence is forthcoming from this region contemporary with the last megafauna, and, while Kosipe lies at some remove from the central highlands, its new dates suggest that contemporary human occupation was feasible.

Kelangurr Cave (2850m asl), New Guinea's highest altitude megafaunal site, near Kwiyawagi on the West Balim River, has the earliest evidence linking humans and animal extinction. Among the fauna that accumulated until *c.* 30ka were the now extinct diprotodontid marsupial *Maokopia ronaldii* and the thickset kangaroo *Thylogale hopeii*, both adapted to the subalpine grasslands. The remains have no association with human artefacts (Hope et al. 1993). However, human intervention via landscape burning is apparent from around 33ka in the same catchment (Balim Valley) as the fossils (Hope 1998). A stronger case for human interaction is seen at Nombe, where now extinct megafauna occur just before human appearance at *c.* 25ka (Flannery et al. 1983). Other animals disappear from the Nombe sequence over the following millennia, including the marsupial wolf (*Thylacinus cyanocephalus*) (Mountain 1993). Evidence of human impact and animal extinction continues to accelerate into the Holocene, for example at Mapala rockshelter (3960m asl) (Hope and Hope 1976a), where hunting from 5.5ka resulted in the extinction of a small wallaby (*Thylogale christensenii*). Extinction of the same animal is dated to *c.* 3.5ka at another high altitude (3650m asl) rockshelter near Kwiyawagi. Hunting pressure on small kangaroo and folivorous rodents allowed the copper ringtail possum (*Pseudocheirus cupreus*) to expand into the subalpine niche (Hope et al. 1993).

These Late Pleistocene and Holocene extinctions post-date the development of large human populations at lower altitudes and were almost certainly the result of human action. While direct evidence for human impact is weak, disappearance of the larger subalpine fauna occurred well before the climate warmed after 14ka, at which time forest limits rose and the mountain grasslands diminished. These expanded grasslands should have been favourable to the grassland adapted fauna, but the larger grazers failed to survive. Hence a non-climatic cause must have been involved and human hunting or disturbance is plausible.

Humans and the LGM

The LGM was a period of climatic deterioration that saw depression of the tree line below 2500m at Sirunki from *c.* 26,000–17,000 BP, after which the climate ameliorated and the tree line ascended the mountains again (Walker and Flenley 1979). Prentice et al. (2005) report evidence for a glacial advance early in the period and a later advance around 17ka, followed by a full retreat by 15ka. At maximum, ice covered about 2200km^2 and alpine grasslands about 50,000km^2 of the island's spine. At Kosipe, the swamp record shows that subalpine herbs were present between 30 and 15ka, perhaps representing minor development of a frost-hardy herb field at the LGM. Lower down at 1200–1800m in the Wahgi, Tari and Telefomin valleys, vegetation was less radically affected and a forest of beech (*Nothofagus*) remained through the LGM (Hope and Haberle 2005).

Though evidence is sparse, it is clear that occupation continued throughout the LGM at Nombe (Evans and Mountain 2005) and in the intermontane valleys at Telefomin (1430m) (Hope 1983) and Tari (Haberle 1998). It is probable that the limit of regular human habitation was pushed below 2500m, but this remains speculative. Current data are too poor to know whether higher altitude sites such as Kosipe were abandoned during this period. Several highland sites become occupied soon after LGM (Denham 2005) and evidence discussed above suggests that human impact in the subalpine zone post-dates the LGM. An earlier occupation of this zone is suggested on the basis of the disappearing megafauna, but, since the timings of the extinctions and extent of human presence are unknown, it is unclear whether the large marsupials had already succumbed by the time the LGM arrived.

Discussion

Though there are gaping holes in the archaeological and palaeoenvironmental records, research indicates a sustained human presence in the highland zone of New Guinea before 35ka. Rapid colonization from the lowlands suggests that adaptation to montane conditions was not a significant problem for early Sahul populations. If microcharcoal evidence is accepted as indicative of human activity – and we see no plausible alternative – humans were present and actively managing environments across New Guinea during the Pleistocene, even at the higher altitudes. Disappearance of grassland-adapted faunas is a pointer to pre-LGM use of the subalpine, but this remains to be archaeologically verified. Settlement continuity is suggested in the highland zone, with populations in higher altitudes withdrawing below 2000m during the LGM. The end of LGM conditions saw increasing exploitation of the subalpine areas towards the end of the Pleistocene, probably for hunting and communication as in the present day, and there is clear evidence of sustained human impact on some high altitude locations from that time. Indeed, vegetation in some areas of the high-altitude zone may have been affected from the start of the Postglacial by burning in an upward extension of intensive landscape management which appears by 20ka and had its roots in the earliest phase of highland occupation.

The antiquity of human presence and environmental impact in the region is striking. In few other areas of the world can be demonstrated such an early signal of deliberate human landscape modification and early impact on fauna, though more evidence is required to prove the latter. Evidence suggests that humans came to the highlands with the knowledge and technology to open up its forests by burning and probably the use of axes. This implies the population could plan and initiate actions with full knowledge of their probable environmental outcomes. It also suggests that early modern humans could actively adapt new and unfamiliar environments to their purposes from at least 35ka as well as modify their behaviour to those environments. Hominids have been able to control fire for several hundred thousand years (Goren-Inbar et al. 2004), though the earliest claims of deliberate use of fire as a landscape modification tool before their appearance in Sahul remain weak (McBrearty and Brooks 2000; Rolland 2004). The Kosipe evidence provides, at before 35ka, the earliest strong evidence for deliberate landscape modification by humans. Nowhere else can such close spatial and temporal evidence be found of a contemporary presence of both fire-affected vegetation and human activity at this date in an environment where natural fire is unlikely.

Vegetation burning and evidence of early *Pandanus* use at Kosipe also indicate that some of New Guinea's modern agricultural practices had ancient antecedents. The data push back the threshold of pre-agricultural plant use, by 10–15,000 years, confirming longstanding suspicions of the importance of *Pandanus* to early settlers. Confirmation of early plant-food management, the most probable reason for burning, requires further supporting data, but the Kosipe data do make such management plausible from the start of human presence in highland Sahul, as suggested by several accounts (e.g. Groube 1989; Denham and Barton 2006). *Pandanus* seeds would have provided a predictable and storable seasonal crop, perhaps used in permanent settlement or, more plausibly, occupation with high residential mobility (e.g. Evans and Mountain 2005; Denham and Barton 2006). *Pandanus* utilization by mobile groups would have allowed more frequent use of a wider altitudinal range than available to agriculturalists. Development of garden crops may have radically altered occupation patterns and landscape use, marginalizing the subalpine and upper montane zones where field crops could not grow, and conceptually separating those areas from the more amenable lower altitude slopes.

Unfortunately the patchiness of the data prevents an integrated understanding of changing occupation and landscape use of any single region over the timescale covered here. Archaeological and palaeoecological records of highland and subapline New Guinea remain relatively sparse and further research is necessary to test the speculative interpretations discussed here. In particular, the higher altitude areas have yet to be systematically explored, despite the widespread occurrence of rockshelters in many mountain areas; the question of the early use of these areas postulated thirty years ago (Hope and Hope 1976b) remains to be tested. Exploitation of both the major mountain zones described here has important bearing on understanding human adaptability globally and the local development of agriculture. However, the relatively high altitude of Kosipe emphasizes the point that pre-agricultural strategies were not tied to any particular altitudinal range, so that records of early settlement may very well be found away from the modern major centres of population.

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