Summary

The western half of New Guinea, the Indonesian province of Papua, is a much understudied area in many respects, but in particular in relation to its past. In 1995, as part of the Dutch-Indonesian ISIR project, two cave sites were investigated archaeologically, providing some of the first insights into the prehistory of this part of New Guinea.

The Ayamaru Plateau, surrounding the three connected Ayamaru Lakes, lies at c. 350 m above sea level in the centre of the Bird's Head Peninsula. Kria Cave and Toé Cave are located to the northeast and the southwest of the lakes, respectively, and contain overlapping occupation sequences from sub-modern times extending back to c. 26,000 BP, i.e. well before the Last Glacial Maximum. The abundant faunal remains and stone artefacts recovered from both sites provided an opportunity to document long-term environmental and settlement trends, as well as more detailed temporal and spatial patterns in human activity on the Ayamaru Plateau, particularly during the Holocene period.

The study concentrated on three aspects:

1. a detailed analysis of the stratigraphy and chronology of the sites to establish a basis for the interpretation of temporal and spatial patterning in the excavated material (Chapters 3 and 4);
2. a description and analysis of two major artefact classes, namely the stone and bone artefacts (Chapters 5 and 6); and
3. an in-depth investigation of the faunal remains focussing on three issues, namely a) the food resources used by the cave occupants (Chapter 7); b) the effects of their hunting behaviour on populations of their main prey item, Dorcopsis muelleri, a wallaby locally known as Djief (Chapter 8); and c) the nature of environmental change on the Ayamaru Plateau since the Last Glacial Maximum (Chapter 9).

For both sites the excavated material was subjected to detailed taphonomic analyses to understand the circumstances of preservation, the pattern of distribution of the cultural materials, and the stratigraphy and chronology of the deposit. Kria Cave is stratigraphically intact and shows five distinct units, which for the most part differ in the relative quantities of cultural material. The surficial unit also contains qualitatively different kinds of material, including pottery and the remains of an introduced animal, the pig. Human occupation of this site commenced around 8000 BP. Kria Cave was probably abandoned around 4000 BP and then revisited at lower intensity and perhaps for different kinds of activities, including human interment, over the last few millennia.

Toé Cave, with a sloping bedrock floor, has a more complex stratigraphy due to local slumping and erosion of the deposit. However, detailed analysis of bone and stone, along with a more intensive programme of dating using AMS combined with amino acid racemisation of cassowary eggshell, has demonstrated that the Toé Cave deposit is essentially intact. Two major units are distinguished, a late Pleistocene unit and a Holocene unit, that differ primarily in faunal composition, and additionally in the preservational state of chert and bone. Toé Cave was first occupied around 26,000 BP, and was visited on an occasional basis from that time through into recent millennia.

Large quantities of chert artefacts were found in both sites. The stone-working technology, based on a few simple core types, remained relatively stable throughout the entire 26,000-year period covered by the sites. However, the intensity of chert
reduction differs markedly between sites and between time periods. During the late Pleistocene, artefacts were mainly brought to Toé Cave ready made; there is some evidence that they were used and maintained on site, but there is little indication of active stone-working. In contrast, the Holocene period in Toé Cave saw a change to active stone-working on site; the assemblage is comprised of abundant debitage, including large block- and flake-cores, as well as retouched flakes, resharpening flakes and waste material. The function of Toé Cave evidently changed over time, from a 'transit' site where casual tool maintenance occurred during the late Pleistocene, to a place where significant stone tool production occurred. While chert is potentially available anywhere in the limestone of the Ayamaru Plateau, a source located somewhere close to Toé Cave may have been the reason why it was visited throughout the Holocene. Stone implements were clearly also manufactured during contemporary times at Kria Cave, but the assemblage contains virtually no cores and, with only a few exceptions, the debitage is relatively small. This suggests that the chert reduction process at Kria was more thorough and economic, such that whatever stone material was brought into the cave was thoroughly recycled with larger pieces perhaps taken away for use elsewhere. Good quality chert may have been more readily available in the vicinity of Kria Cave, leading to high costs of transport and an overall more thrifty approach to this resource.

Bone artefacts are abundant in Kria Cave but extremely rare in Toé. Besides some utilised wallaby incisors, there are large quantities of artefacts made of fragments of bone. The latter fall into two distinct classes: bipoined specimens made of splinters of cortical bone, and unipoints made of fragments of small, slender shaft bones. These categories are also distinct in their pattern of usewear. Analysis of usewear and damage to these artefacts suggests that the bipoints were most likely hafted, and may have been used as borer. The unipoints were probably used for a variety of tasks in various ways, but were perhaps most often hand-held. The Kria bone points appear to have been manufactured, used and repaired on site. The absence of such artefacts in Toé further points to differences in the pattern of use of the two caves during the Holocene period: Kria seems to have been a focus for more intensive activity involving the manufacture, use and maintenance of bone and stone tools, while Toé appears to have been visited less frequently and perhaps with more specific purpose - to consume the yield of a hunting trip, or to flake some of the locally available chert, perhaps with a view to transporting selected pieces away to more distant parts of the group's territory.

In contrast to what has long been assumed in regard to lowland tropical rainforests, the consequences of the last Ice Age were strongly felt on the Ayamaru Plateau. The mammal and bird communities were significantly altered during Last Glacial Maximum times, with the descent of a suite of montane species down to lowland elevations, creating a for New Guinea undocumented 'mixed' assemblage of montane and lowland species. The vegetation at this time probably consisted of rainforest with floristic and structural similarities to modern lower montane forests. The montane species presumably began to withdraw or decline as temperatures rose under post-glacial climatic conditions. However, some species persisted in the area until 6000 BP, probably surviving in remnant patches of cooler, mossy forest. Flooding of the Arafura Shelf and the shallow bays south and southwest of the Bird's Head may have generated persistent cloud cover over the Ayamaru Plateau that may have led to locally depressed temperatures until mid-Holocene times.

Throughout the Holocene period, the fauna in both caves is dominated by the remains of one species, Dorcopsis muelleri, a medium-sized forest wallaby, known locally as D. m. megapodes, a relative of the cassowary and the megapode. The remains from Kria Cave are of a variety of age, suggesting a varying mix of age groups, and there is no evidence of the widespread use of bird bones. The absence of such activity is likely due to the more frequent visits to Kria Cave during the Holocene, where the site was occupied for the construction of stone implements and the hunting of wallabies. The Ashmore River was not being used for transportation purposes, and the faunal remains from Kria Cave suggest that the site was not being used for a variety of other activities, such as the construction of tools or the hunting of various species, as is the case in Toé Cave.
During the late Pleistocene, there is some indication of a change to a more intensive debitage, with thinner flakes and more, from a Late Glacial to a Holocene, to a potentially larger resource located throughout the period only a few centimeters deep. Stone material does not appear to have been available in sufficient quantities to support a more thrifty lifestyle.

Besides some observed fragments of stone, there are splinters of wood and bone. These artifacts and damage to the site have been interpreted as evidence of wallaby hunting. The presence of these bones in the Kria Cave and the Holocene period suggests that intensive hunting involving the pursuit of prey to have been a common activity. The bones were consumed as part of the food supply, perhaps with a focus on this area's territory.

The presence of lowland rainforests, particularly on the Ayamaru Plateau. The transition from a forest to lowland rainforest was a gradual process involving the expansion of montane rainforest with time. However, the montane rainforest did not disappear entirely, and it remains under post-glacial climate conditions. The Arafura Mountains have generated a heavily depressed landscape.

Pottery and remains of pig, presumably indicative of a new lifestyle based on agriculture, were found only in the uppermost levels of both sites. A pig bone from Kria Cave is radiocarbon dated to a minimum age of 1840 ± 40 BP with an inferred upper range of c. 4000 BP. However, there are some indications for somewhat earlier changes in land use patterns on the Ayamaru Plateau, perhaps dating back to c. 5000 years. In particular, the wallaby remains in Kria Cave from this time on show a slight shift toward a larger proportion of younger, though already mature, animals and a slight increase in bone fragmentation. These changes suggest that the Dorcopsis population had declined below the carrying capacity of the environment and that wallaby carcasses were being exploited more fully for nutritional content than in earlier times. Why this decline might have occurred cannot be determined with certainty, but the two most likely causes are an increased rate of culling of Dorcopsis and the initiation of a more intensive hunting strategy.

Other animals, including echidnas, pythons, cuscuses, cassowaries, megapodes, and a variety of smaller mammals, were caught occasionally as well. Fish, cassowary and megapode eggs, and molluscs further supplemented the diet. Plant remains are scarce in both sites, hence the vegetable component of the diet is virtually unknown. However, carbonised fruits, possibly of the Elaeocarpaceae family, and Celtis and banana seeds, were recovered in small quantities. No evidence was found for the prehistoric production of sago, although this cannot be ruled out.

The prolonged hunting of Dorcopsis on the Ayamaru Plateau during the Holocene period raises questions regarding the sustainable exploitation of one particular prey animal, especially in a tropical environment. Analysis of the age profile of wallaby remains from Kria Cave shows that predominantly mature to senescent animals were consumed at the site. As is evident from ethnographies of hunting-gathering populations in rainforest environments, hunters can rarely afford to be selective in their pursuit of prey; therefore, the Kria Dorcopsis age profile is taken as indicative of the demographic character of the Dorcopsis population during this period. An age profile dominated by mature to aged individuals is characteristic of a population close to the carrying capacity of its environment. This implies that hunting pressure on Dorcopsis was low, a conclusion that is supported by calculations of the minimum number of wallabies (MNI) represented within the faunal assemblage during the period of occupation of the cave. The Dorcopsis sample from the Holocene unit of Toé Cave features an even older age profile and still lower MNI. This unit also produced more abundant remains of disturbance-intolerant animals such as echidnas and treecassowary, and it seems likely that the area to the south of the lakes was used less intensively than the area around Kria Cave to the northeast.

The various lines of evidence all point to the fact that human populations were very low through the area and throughout much of the period of occupation of the caves. Various factors might have worked together to keep human population densities low, such as the naturally low carrying capacity of the Plateau environment, limited carbohydrate resources prior to the advent of extensive agriculture, and a high prevalence of disease and inter-group conflict. Human remains from the upper unit in Kria Cave with signs of childhood illness or starvation and a possible violent death bears testimony to the harshness of life in lowland New Guinea, even during the recent past. However, lowland rainforest has been present on the Ayamaru Plateau throughout the occupation period. The archaeological sites thus provide further evidence, contra Headland & Bailey (1991), that lowland tropical rainforest can be successfully inhabited for extended periods without access to cultivated plants and domesticated animals.

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extensive modification of its habitat, perhaps as a consequence of limited gardening activities. Interestingly, those changes in age profile are registered only on the northeastern side of the lakes. A short pollen sequence from the western lake basin, provided by Dam (Delft University of Technology, Netherlands) and Van der Kaars (Monash University, Melbourne), also shows evidence of limited forest disturbance back at least to 4000 BP, with no major change in the intensity of disturbance during successive millennia. These indications for small-scale gardening activity are significantly later than the earliest evidence of plant cultivation in New Guinea, but are consistent with the timing of widespread adoption of agriculture across the region.