



IAIN DAVIDSON

FIRST PEOPLE BECOMING AUSTRALIAN

ABSTRACT: This paper discusses the initial colonization of Sahul, including Australia, by focusing on the questions of who? when?, how?, and why? After reviewing the archaeological record of the first settlers, it argues that the colonization process was a dynamic one, replete with both continuities and discontinuities. A comparison of this record to ethnographic data indicates both that the first Australians lived very different lifeways and, more importantly, that the crucial issue in understanding both the Australian archaeological and ethnographic records is understanding the changing people in a changing environment.

KEY WORDS: Colonization – Australia – Sahul – Dynamic adaptations – Culture change

INTRODUCTION

At the time of the invasion of Australia by non-Aboriginal people 200 years ago, the human population was small, once estimated at 300,000 (Smith 1980), now generally acknowledged to be closer to 1 million (White, Mulvaney 1987). Why the population should have been so small is still largely unexplained (see Beaton 1991). It is widely accepted that all of these people were fisher-gatherer-hunters and it used to be widely believed that humans have been fisher-gatherer-hunters for 99% of their existence. This combination of views, when they coincided, was partly responsible for a belief that fisher-gatherer-hunters were unchanging: a view explicitly advanced about Australia (Horton 1981, Pulleine 1928) that had an important effect on understanding the Aboriginal past. If fisher-gatherer-hunters were unchanging and the inhabitants of Australia were all fisher-gatherer-hunters, then ethnography might be taken as a picture of the past.

The simplistic view of the predatory past of humans has been challenged for many years, resulting in new emphasis on the role of females in hominid and human evolution, stressing the role of gathering, and recognizing scavenging as an alternative source of meat for much of the period before agriculture. Attention may now shift to

the recognition that the fisher-gatherer-hunter way of life had an origin as pronounced as the much more frequently discussed origin of agriculture (Davidson 1996, Foley 1988). The history of how the first Australians came to be Australian Aborigines, is therefore not only of local importance, but one of the stories of how the fisher-gatherer-hunter way of life came about anywhere in the world.

UNEASY TENSION WITH ETHNOGRAPHY

That early writers should have failed to distinguish between the realities of the lives of living Aborigines and the nature of the human past in Australia is not perhaps surprising, particularly given the importance that living Aborigines have had in the intellectual history of interpretation of the past of other countries (e.g. Clark 1967). The sterility of this approach to interpreting history outside Australia for understanding anything within it is illustrated by the legacy of the nineteenth century. Sollas (1915), attempting to interpret the archaeological discoveries of the Mousterian in Europe, described the more fully documented Tasmanians as "modern representatives" of such an evolutionary stage, and he similarly matched the early

Upper Paleolithic with living Australians. The essential intellectual underpinning of such a framework was that the "modern representatives" should be "an unchanging people living in an unchanging environment" (Pulleine 1928). When Hale and Tindale (1930) showed through excavation that the past in Australia was different from the present the dominant interpretative mode provided no methodology for interpreting the evidence in behavioural terms (Davidson 1983).

Researchers in the 1960s showed the Pleistocene antiquity of Australian colonization (Mulvaney, Joyce 1965), collected data on the behaviour of modern Australian Aborigines with a view to interpreting the prehistory of Australia (Gould 1980) or Europe (Hayden 1979), and established the nature of environmental change during the period of human occupation of Australia (Bowler *et al.* 1970). The last of these studies, by showing historic use of the now-dry Lake Mungo at times when it was one of a number of large fresh-water lakes, destroyed forever the label of an unchanging people in an unchanging environment. Despite this, Jones (1975) interpreted the fragmentary evidence to suggest that the "distinctive Australian economy was already in train and that the major adaptations to the continent had been made" by 30 thousand years ago, seeming to imply the more remarkable proposition of an unchanging people in a changing environment.

The argument being put forward in this paper is that the crucial issue is understanding the changing people in a changing environment. That they might have adopted a single "distinctive Australian economy", despite demonstrable environmental variation across Australia as well as environmental change through time in all regions, was an astonishing claim that seems to have derived from a failure to understand that prehistoric economy is a relationship between people and their resources (Davidson 1981). If the appearance of resource exploitation stayed the same while the resources changed, the economy had, in reality, changed markedly. The problem arises from a failure to view the ethnography as an account of relationships, as a source of explanatory methods (middle range theory) for interpreting the archaeological record, rather than as a description or an explanation of past. This is particularly important if we view the archaeological record as resulting from the process that led to the situations ethnographers (incompletely) describe. The phenomena of ethnography cannot be an explanation of their own origins.

Lourandos (1983) recognized the complexity of the social arrangements described in nineteenth century accounts of Aborigines, saw the need to provide an account of the emergence of that complexity and assumed that social forces would be a sufficient explanation of the process. While the introduction of social forces as an explanatory mechanism was clearly an important development at a broad scale of interpretation, a narrower focus required a demonstration of the way particular aspects of the archaeological record might be interpreted

to contribute to that view of social change, but Lourandos failed to define the subtle interactions between the archaeological evidence and the interpretation. Not surprisingly, when the archaeological record is examined at a finer scale, the process of change seems more complex than Lourandos assumed (Bird, Frankel 1991a, 1991b). This problem of scale seriously affects the way we view the process of becoming Australian Aborigines.

SCALES OF ANALYSIS AND INTERPRETATION

The Europeanness (non-Aboriginality) of Aboriginality

The first issue of scale is the question of Aboriginality: what is it we are seeking to describe as the end of the process of becoming? I will address this near the end of the paper in considering the "who" question. What needs to be said here is that the notion of Aboriginality is not, in the first place, a notion well-known to any of the people of Australia before the non-Aboriginal invasion, but one that arises from the politics of that colonization (Davidson 1991, see also Attwood 1989). In 1788, the various Aboriginal societies were distinguished from each other by diversity in kinship regulations (Radcliffe-Brown 1930–31), language (McConvell 1990), art style (Layton 1992), material culture (Anon 1981), initiation practices (Tindale 1974), burial practices (Pardoe 1988, 1995) and many other details. The Aborigines of Tasmania were separated from those of the rest of Australia for 11 thousand years (Porch, Allen 1995), and their common (self-) identification as Aborigines owes as much to their two islands being part of the nation-state of Australia, and their common history of mistreatment by the invaders, as to their common ancestry. There are now some elements of a shared sense of Aboriginality among people ironically united by not being non-Aboriginal people.

The situation is quite different in Papua New Guinea where isolation from Australia occurred only 8000 years ago, 3000 years later than for Tasmania, but where much of the island did not suffer so badly from the early stages of colonialism. There is no question of a common identity with Australian Aborigines, though the ultimate origins of the Papuans may be from common ancestry. The issue, therefore, is not about the emergence of the common social identity of Australian Aborigines, nor even of individual Aboriginal societies as recognized by their particular conjunctions of kinship regulations, language, art style, material culture, initiation practises, or burial practices, but about the emergence of the ecological adaptations (which may include such diverse traits) that were fundamental to the survival of people in different parts of the region.

The nature of archaeology and time

The next issue of scale concerns the nature of human adaptations (Dodson, Fullagar, Head 1992) and how the

interpretation of them is derived from the imperfections of the archaeological record and the practices of archaeologists in revealing it.

What "adaptation" is, and how it is to be recognized is a complex problem (Kirch 1980, O'Brien, Holland 1992, Rindos 1989, Rindos, Webb 1992). The concern here is quite fundamentally biological and not (particularly) concerned with the much more difficult issues of the appropriateness of biological and specifically evolutionary models for the study of particular "cultural" expressions. The issue in the process of colonization is about interactions between behaviour and environmental conditions that allowed people to enter a region, and interactions that not only allowed them to enter but to reproduce in ways that allowed their offspring to reproduce. Thus the distinction that needs to be made is one between the archaeological signatures of ephemeral events and of more permanent abilities to survive.

That the archaeological record is not a complete record of all hominid and human behaviour is one of the central understandings of archaeological interpretation. But the imperfections of the record sometimes are ignored, and sometimes cannot be distinguished from gaps in evidence caused by no evidence being left. There are no easy solutions to the dilemma this poses. Nevertheless, there are some reasonable assumptions about plausible interpretation.

First, there would be little variation in the archaeological record if all people always made the right choices – this is not an option by which evolution of human behaviour seems likely, dependent as evolution is on the generation of new variation and selection from among those variations. Second, by the same token, selection has always taken place (and continues to). The only way to reduce the effects of natural selection is by acting on information about the likely selective pressures. Available information now is far better than it has ever been in the past, yet our vulnerability to natural selection can be shown by the present uncertainty about the reality of the "global warming" or its consequences. By comparison with any argument about the past, the information is copious but we are unsure whether the warming exists, how strong its local effects will be if it does, and we are unable to avoid these effects supposing some of the analyses are correct. How did people cope with the past variation of climate (Bender *et al.* 1994, Taylor *et al.* 1993) far greater in amplitude and frequency than that predicted from global warming, and with related – and unrelated (Kershaw, Martin, McEwen, Mason 1994) – environment change, in the period since first colonization?

The Australian climate is one of extremes, particularly in its variability. There are, as in all places, variations at several different scales. While there is a pattern of seasonal variation superimposed on the pattern of longer term climatic changes, there are also marked variations between extreme events (Gale, Bainbridge 1994) that typically have immediate effects at a finer time scale than seasonal

variations. Such events may be devastating not only through their extreme expressions, but through the unpredictability of their occurrence. The effects of some of the extreme variations (particularly drought, flood and bushfire) seem likely at one time or another to have constituted major hazards to local or regional populations. The sedimentary sequence in Central Australia indicates several "superflood" events including ones dated at 450, 700 and 850 radiocarbon years ago (Pickup 1991). The 700 year old event coincided with stream channels in one part of the region that were 3–6 km wide. The direct effects of such events on human populations might well have been devastating, the indirect effects through the destruction of resources may have been equally so. It is the extreme minima of resource availability that must be examined in understanding the limits on population numbers, not the average or maximum conditions (Vayda, McCay 1975). Discontinuity might, therefore, be a reasonable prior expectation in interpreting the history of human occupation of any region (Davidson 1990).

One reason why evidence of discontinuity has been slow in coming has been the practices of archaeologists (Frankel 1988), particularly that of using small numbers of radiocarbon determinations together with age-depth curves to produce estimates of the boundary ages of excavation units (David, Chant 1995). Here, interpolation between determinations from different stratigraphic units runs the danger of masking discontinuity resulting from either lack of occupation or lack of sediment (due to erosion or absence of deposition). Added to this is the accumulating evidence that some stratigraphic sequences (especially in the sandstone rock-shelters that dominate excavated sequences in Australia) are not divided neatly into chronologically discrete layers, but that materials have moved, for whatever reason, between units that might have been regarded as showing strong stratigraphic integrity (Richardson 1992). At the broad scale the effect is not critical; at a smaller scale it is crucial to the possibility of interpreting the nature of the behaviour involved in a human presence in a particular region.

The nature of archaeology and space

Australian archaeology also has serious problems about the relations between the recovered archaeological record and the spatial scale of human use of sites. Australian archaeologists are beginning to become aware of this, though the problem is no more severe than it is in other parts of the world. The problem is well understood by examining two of the few published examples of modern plans of Aboriginal campsites. *Figure 1* shows: a) the plans of a portion of a camp of the Alyawara people of arid Central Australia (O'Connell 1987); and, b) of a family camp complex of the Anbarra people on the tropical coast of Arnhem Land (Jones 1980). The figure also shows, for comparison: c) the plan of artifact density from mechanical excavation of a site at Rouse Hill, west of Sydney, and an

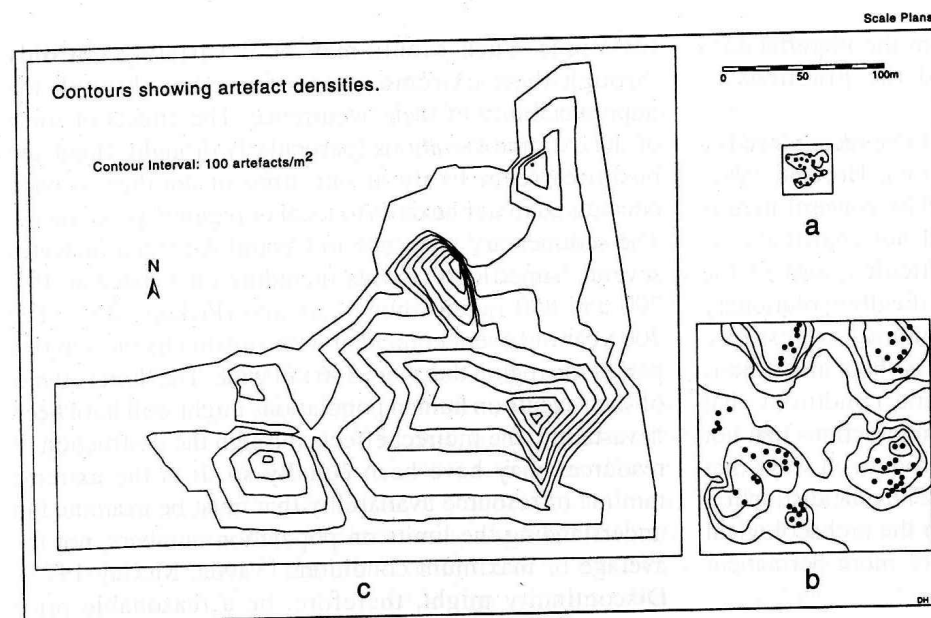


FIGURE 1. a) Plan of three huts at a family camp complex of the Anbarra people on the tropical coast of Arnhem Land (Jones 1980); b) plan of a portion of a camp of the Alyawara people of arid central Australia (O'Connell 1987); and, c) plan of artifact density from excavations at a site at Rouse Hill, west of Sydney. Positions of hearths are shown as black dots. The excavated area of Cuckadoo 1 rock-shelter was about the same area as one of the hearths at the scale of representation on these plans.

indication of the excavated area of Cuckadoo 1 rock-shelter. Over long periods of occupation, shifts in the locus of activities could easily show up, in the excavation areas we traditionally examine, as apparently intermittent presence or absence of occupation. Moreover, the areal scale of camps may itself be an indicator of the nature of occupation (Gargett, Hayden 1991), difficult to discern through a sampling strategy involving excavation of small proportions of sites of the scale of the Cuckadoo 1 excavations.

It is clear that there are problems of sampling at the scale of most archaeological excavations. One study (James, Davidson 1994) considered the representativeness of different sized samples of the surface assemblage we collected from a rock-shelter 45 m by 7 m. This showed that even when considering the simplest possible description of the artifact assemblage (the number of artifact classes from among the categories flake, flaked piece, retouched flake and core), we would have needed to excavate 12% of the site to recover all artifact classes from two raw materials. Few excavations of open sites or rock-shelters have had the luxury of this degree of sampling.

In addition, archaeologists might be sampling different phenomena at different scales; an excavation trench might cut through shifting occupation across the surface of the site; a site might be abandoned for a time while an adjacent one was used; one region may have had different patterns of discontinuous use from another. Whilst any or all of these may be true for any apparent discontinuity, the fundamental issue is what the starting assumptions are. If we assume continuous occupation, we may be tempted to explain away the absence of evidence. If, as here, we assume discontinuity, the evidence hints at broader patterns that may be masked by the use of the continuity assumption.

With these cautions in mind, we may proceed to a consideration of the basic features of current knowledge and thinking about the processes of adaptation to the Australian continent – a perilous process, given that the scale at which these features can be considered is broad, while we recognize the need for consideration at a fine scale (Dodson, Fullagar, Head 1992).

HOW

The first Australians undoubtedly entered Australia across the sea, probably from the region now called Indonesia. Then, depending on the precise date of initial colonization, much of Indonesia was joined to mainland south-east Asia during glacial period low sea-levels. This extended continent is now known (by archaeologists and some paleogeographers) as Sunda. The same low sea-levels exposed a continental shelf that joined mainland Australia to Tasmania in the south and Papua New Guinea in the north. This paleocontinent is called Sahul (by the same specialists) (Ballard 1993). Between Sunda and Sahul lie the islands of Wallacea, always separated by sea from both Sunda and Sahul, a barrier of different degrees to faunal migration in either direction (Bellwood 1985). To the north-east lie the islands of the Bismarck Archipelago, close to the shores of Sahul but similarly separated from it. The first colonists of Sahul and the Bismarcks necessarily made sea-voyages (Irwin 1992).

Given that the monkeys, apes and non-human hominids (*Homo erectus*) of Sunda did not make the crossing to Sahul, it is generally agreed that neither being washed adrift on rafts of vegetation, nor an accident involving a pregnant woman on a log were sufficient for the initial movement. Instead, what made humans distinct from the other primates was their ability to conceive of and construct a raft or boat.

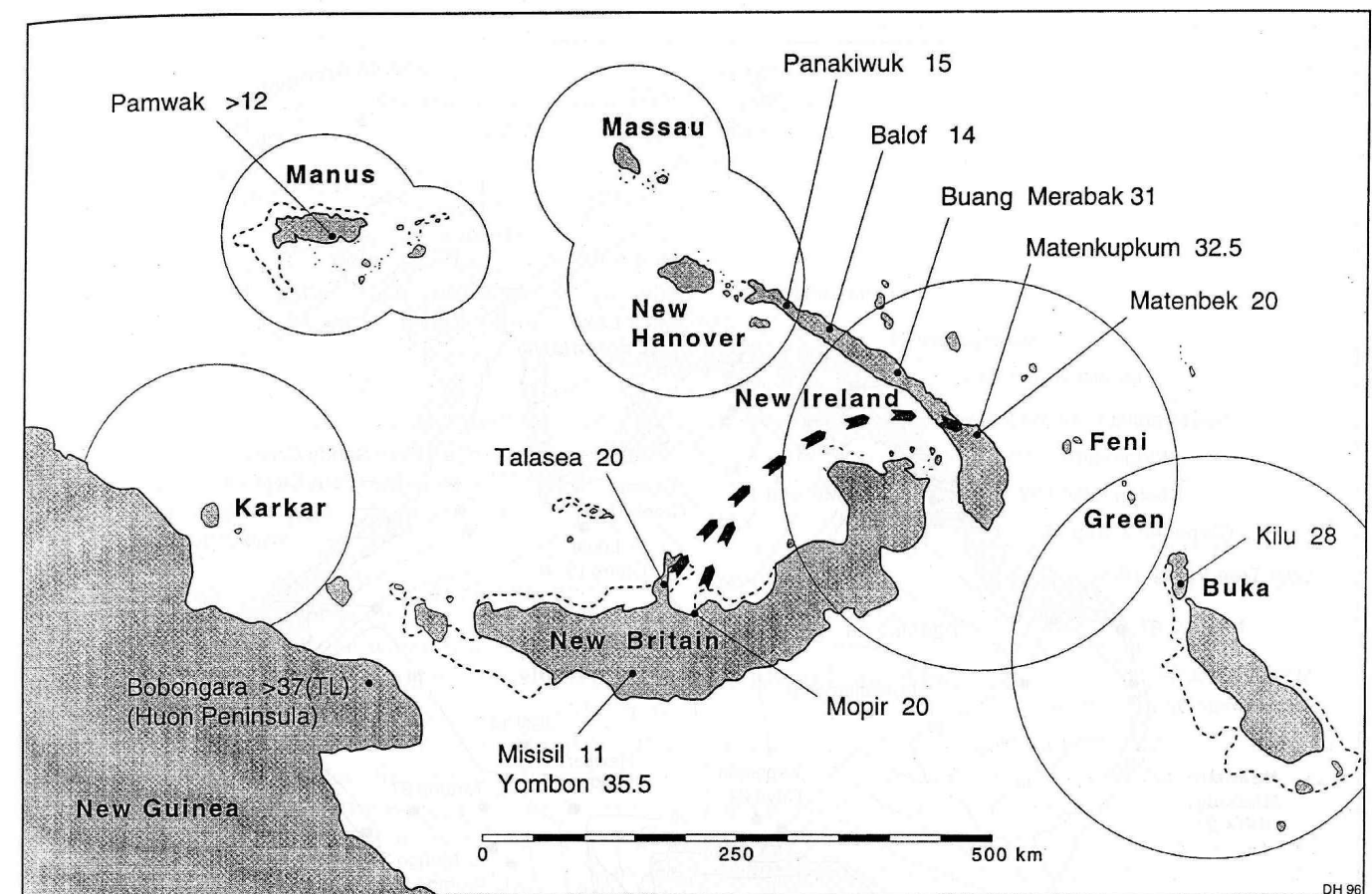


FIGURE 2. Early sites to the north east of Sahul indicating zones of intervisibility for sea crossings (from Irwin 1992). An intermediate stage was necessary for a sighted crossing to Buka, but none was possible for the first colonization of Manus. Also shown are the early sites inferred for the obsidian sources of Mopir and Talasea which supplied raw material to Matenkupkum and Matenbek (arrows) (Summerhayes and Allen 1993).

Davidson and Noble (1992a) showed that the same language-dependent abilities as those needed to build a boat are indicated by the early archaeological record of Australia in the form of stone axes (Schrire 1982) and bone points (Webb, Allen 1990) – tools with imposed form – objects of adornment (Morse 1993), and the use of ochre (Jones, Johnson 1985) for some unknown purpose. The first human inhabitants of Australia, the ancestors of the Aborigines, were amongst the first users of language in the world, and the abilities language conferred (e.g. imposing form on artifacts, forward planning) were essential for providing the means by which they made the sea voyage to Australia.

The network of marine voyages

Irwin (1992) has shown that the navigational issues involved in getting to Australia, Papua New Guinea and the Bismarck Archipelago and Buka were not great once a sea-worthy raft or boat could be constructed. In favour of the argument that sea voyages were deliberate rather than accidental is the evidence for the early extension of movement not only from Wallacea to Sahul, but off the continent again in the north east to the islands of the Bismarck Archipelago and Buka (Figure 2) (Allen, Gosden

1991). Irwin's analysis of inter-island visibility shows that, unlike the initial voyages out of Wallacea, early movement did not involve setting out to land that could not be seen (though in the case of getting to Buka there must have been an intermediate step). Where unseen shores were reached, as in Manus, the present evidence suggests that the movement took place rather late. This would suggest that the use of boats was general, but intrepid voyages of exploration were not the norm. On this account, the first people were probably using boats for some defined purpose (such as fishing) but the first voyage(s) to get to Sahul were possibly accidental.

A marine source of subsistence is given support by the large quantities of shellfish remains in the site of Matenkupkum (Gosden, Robertson 1991), and fish (including sharks) later at Balof (White, Flannery, O'Brien, Hancock, Pavlish 1991). Further evidence that the sea voyages were purposeful comes from the continued movement of flaked stone across sea barriers between the islands of the Bismarck Archipelago from 20 ka (Summerhayes, Allen 1993) with introduction of animals at similar dates (Gosden 1995, Gosden, Robertson 1991, Marshall, Allen 1991, White *et al.* 1991). This pattern of systematic sea voyages stands in contrast with the other early evidence from the Mediterranean region (Australia's

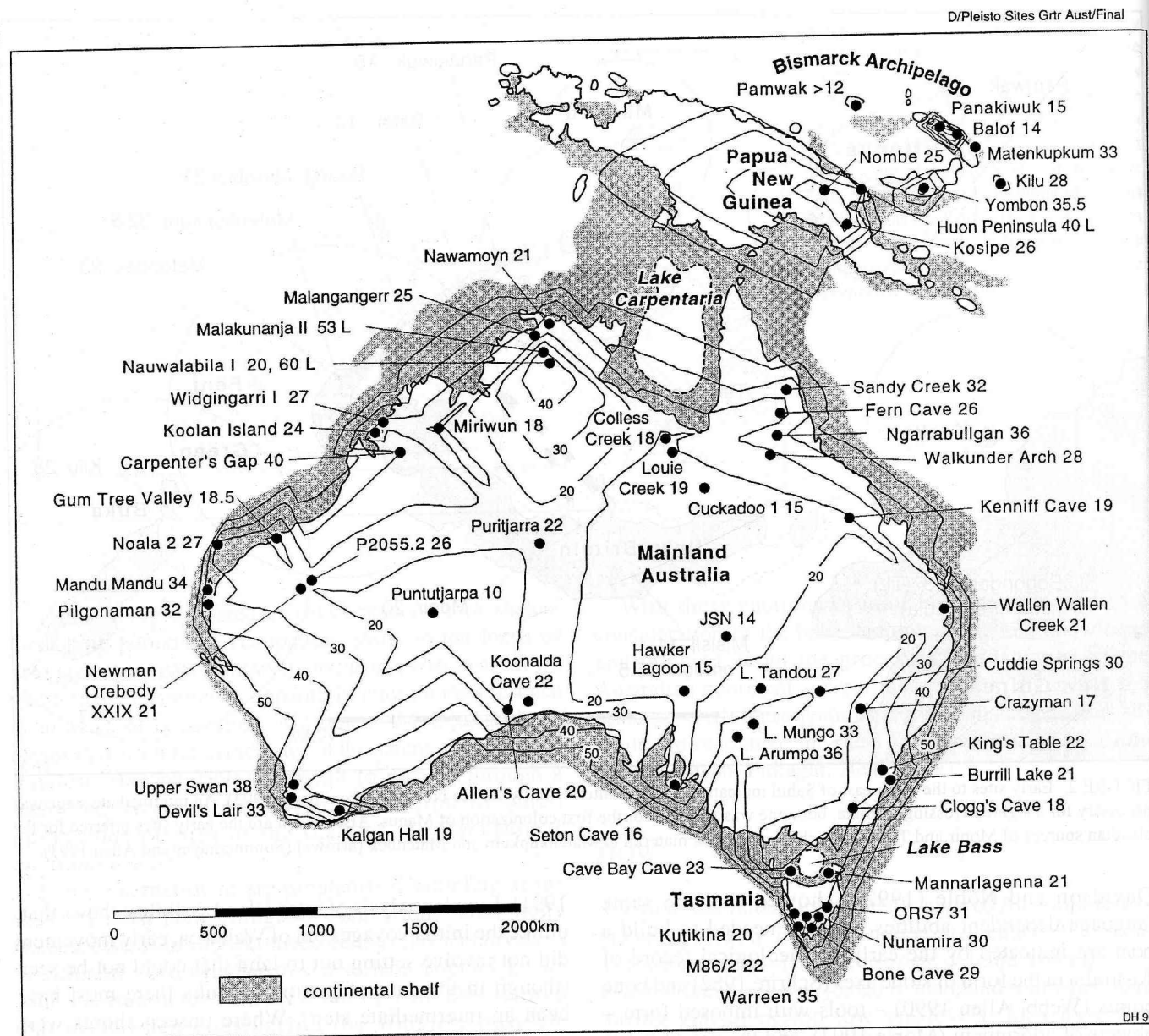


FIGURE 3. Distribution of early sites in Sahul, the Bismarck Archipelago and Buka. The number after the name is the oldest date in radiocarbon years (uncalibrated). Three dates are indicated as luminescence dates (L).

antipodes) where the islands, several of them visible from the mainland, were not occupied until 11 ka (Cherry 1990). The "Argonauts of the Western Pacific" (Malinowski 1922) have a longer history of using boats than anyone else.

New language and the resources of a new continent

The way these first people adapted to the new conditions they found in Australia was probably determined, at least in part, by the novel abilities that followed their use of language. In terms of the use of information to mitigate selective pressures from the environment, the first colonists needed to gather information about sets of resources that were entirely new, and had unfamiliar variability in spatial and temporal availability. In dealing with these novelties,

they also had, in the potential to construct a new language with new arbitrary meanings and new conventions appropriate to their new circumstances, a new means of doing so. The potential for error in information gathering seems very high.

In other parts of the world, if colonization took place it did not involve movement into regions with such markedly different resource distributions. The equivalent period in Europe, and possibly Africa, seems to have been one in which fundamental issues of relationships among people and their environments were worked out through the new means of symbolic communication (Davidson 1996).

Unlike the first human inhabitants of Europe (who displaced the Neanderthals), the first Australians, in crossing a water barrier from a Laurasian continent to a

Gondwanan one, moved into an environment quite unfamiliar to them in geology, climate, water availability, plants (despite some similarities of plant species [Golson 1971] but not their distributions) and animals. And there were no other hominids (such as Neanderthals) with similar physiological and behavioural requirements for them to learn from.

Bowdler's (1977) suggestion that initial colonization of Australia proceeded around the coastlines and up the reliable waterways depended on the assumption that initial colonists would continue to concentrate on fish and shellfish, those resources assumed to be most familiar from their homelands. The evidence at the time this view was advanced suggested otherwise, with the major constraint on settlement being the availability of water. Typically in any Australian environment, where water is available there will also be fish. This is not true at the site of Koonalda (Wright 1971), more than 150 km into the desert at the time of its occupation at the height of the last glacial period where there is a freshwater water reservoir within the limestone cave away from the light necessary for plant or animal life to exist. This early occupation of the most arid lands could never have been construed to fit a coastal colonization model. Since then the pattern of discovery of early dates (Figure 3) and careful consideration of appropriate models (Rindos, Webb 1992) has made the fishing model seem more inadequate. It may, nevertheless be a clue to the reasons for initial colonization.

WHY

"Why?" questions are always difficult to answer in history. The motives for the first movements of people from south east Asia to Australia will never be known, and "because it was there" does not seem a satisfactory assertion, given that the journey involved visits to unseen shores. Nor does it seem likely that we can resolve the question of whether the earliest voyages were accidental or intentional, though the fact that the first voyages were, indeed, the first suggests strongly that intention cannot have been highly informed. The only issue that might be addressed is: why were people messing about in boats, as their primate predecessors (including *Homo erectus*) had not been?

Balme (1983) showed that the archaeological sites of western NSW preserved good evidence of fishing, using nets and traps, that could be directly dated to 27 ka (Balme 1995, Balme, Hope 1990). She hints that the first inhabitants of Australia were using boats because they were fishing off the shores of Sunda. Unfortunately, the record of the behaviour of those people in Sunda is sparse, to the point that there may be no archaeological evidence earlier than the colonization of Australia (Bowdler 1993), given that Indonesian *Homo erectus* left their bodies with no evidence of their behaviour.

The motives for further exploration of the continent may

more reasonably be attributed, at the individual level, to simple curiosity. At a broader scale there are important questions of population growth, the ability to obtain appropriate resources especially water and plant foods, and the ability to avoid the worst hazards of the Australian environment.

WHEN

Extreme claims have been made for colonization before or during the time of the last interglacial on the basis of evidence of vegetation changes or charcoal in pollen cores (Singh, Geissler 1985). There is, currently, no archaeological evidence that would justify claims this old, and it seems more appropriate for palynologists to look to their models for interpretation rather than require archaeologists to double or triple (at least) the accepted dates for first human occupation of Australia.

Arnhem Land dates

The application of thermoluminescence dating and related techniques to archaeological sites in Australia has had the apparent effect of extending the chronology of human occupation from a comfortable 40 thousand years (Allen 1989), pushing up against the limit of radiocarbon dating, to a controversial 60 thousand years by luminescence methods (Allen 1994, Roberts, Jones, Smith 1990, 1993, 1994) (see Figure 3 for distribution of early dates through the continent). Comparison of the frequency distribution of radiocarbon determinations for archaeological and geological studies (Allen, Holdaway 1995) shows that there are no determinations as old as 41 thousand radiocarbon years for archaeological sites, but many for geological sites. In addition, there are hardly any cases of sites where radiocarbon dates close to the radiocarbon limit are obtained from stratigraphic situations more recent than undated archaeological deposits. The conclusion is that the early luminescence dates are difficult to interpret in relation to the established radiocarbon chronology.

At least part of this controversy is due to the application of different dating methods with different assumptions (Davidson 1989a). The well-known pattern of variation between radiocarbon dates and dates from historical or tree-ring sources has a relationship with variations in the earth's magnetic field (which are known to have been considerable) at times beyond the capacity of historical or tree-ring sources to provide corrective calibration (Barbetti 1980, Barbetti, Flude 1979). Some, but not all, of the discrepancy between these dating methods seems likely to be due to this, given that luminescence dates are unaffected by geomagnetism. Other interpretations are possible, such as vertical movement of artifacts (Hiscock 1990) and the issue does not yet seem capable of resolution. Sadly, the supposedly oldest artifacts in Australia have not yet been published.

Tasmanian dates

The uncertainty about the earliest date of colonization makes the determination of rates of colonization particularly perilous. If the luminescence dates compare without complication to radiocarbon years, then the rate of colonization was very slow, in the order of 25 thousand years from Arnhem Land (Nauwalabila and Malakunanja II: see Figure 3) to Tasmania (Warreen), but then it also seems to have taken 20 thousand years for the much shorter distances from Arnhem Land to the Kimberley (Carpenter's Gap) or Cape York Peninsula (Ngarrabullgan). Accepting first landfall at a short period before 40 thousand radiocarbon years ago would involve very rapid movement to Tasmania at the other end of the continent where an earliest date of 35 thousand radiocarbon years ago has been recorded. The rate of colonization seems as quick as in the scenario of most rapid colonization proposed by Birdsell (1957) in his purely theoretical simulations of the demographic conditions for colonizing all of Australia. Rindos and Webb (1992) argued that such rapid colonization could result from "optimal maladaptation" in which people not well adjusted to the vicissitudes of a poorly known and stochastically varying environment died out or moved on rather than staying to find ways of coping with resource variation.

The excavations of the cave sites of the cool temperate rainforests of southern Tasmania have provided a greater number of radiocarbon determinations than any other research in Australia. Individual sites show peaks and troughs in occupation (Cosgrove 1995), a pattern that is repeated on a regional scale. Analysis of 103 radiocarbon determinations from 12 sites has shown that occupation may not have been continuous, rather there were several pulses of occupation that may coincide with particularly warmer and wetter climate (Holdaway, Porch 1995). This is consistent with predictions from an understanding of the stochasticity of Australian environments, and an approach to adaptation that emphasizes the importance of extreme environmental events rather than the comfortable conditions between.

WHERE

The nature of the Australian environment

The Australian environment is one of the most arid, yet Sahul has tropical rainforests to the north in Papua New Guinea, various patches of rainforest along the east coast, and significant cool temperate rainforests in Tasmania. While much of eastern and northern Australia has open forest (particularly in the eastern part) or woodland, 70% of the modern land surface of Australia can be classified as arid (Edwards, O'Connell 1995). This region is dominated by uncoordinated drainage patterns (actual drainage is a rare event) with a vegetation of shrubs and

hummock grassland (*spinifex*). Rainfall is predominantly in summer in the northern and north-eastern regions, with winter rainfall in the extreme south-west and some parts of the south east. Elsewhere there is equal probability of rainfall at any time, with extremely erratic patterns over the arid zone.

Attempts to simulate the spatial pattern of climatic parameters at this coarse scale for the period of human occupation (Bowler 1982, Nix, Kalma 1972) suggest that 30–50 thousand years ago the arid core was less severe, but that by 18 ka the arid zone had expanded to reach the shores of the Gulf of Carpentaria, then occupied by a huge freshwater lake (see Figure 3). The pattern of variation since the Last Glacial maximum is better known (Harrison, Dodson 1993), and allows explanation in terms of general synoptic conditions. Conditions were wetter in Tasmania by 12 ka and by 10 ka in coastal south east Australia. Although the analysis of radiocarbon dates from Tasmania shows that peaks of occupation, during the otherwise arid glacial period, seemed to coincide with wetter conditions, the change at the end of the glacial led to the expansion of rainforests and the abandonment of the cave sites of southern Tasmania (Cosgrove, Allen, Marshall 1994).

Added to this pattern of coarse variation of environment in Australia are significant variations at a finer scale. In broad terms, patterns of rainfall variation are closely related to the patterns of aridity. Only the tropical north in Arnhem Land and the temperate south-east and south-west have a variability of mean annual rainfall of less than 20%, and for most of the continent mean annual rainfall variability is more than 10% greater than world mean variability (Leeper 1970). This coarse pattern of variation is made up of stochastic variation on much shorter time scales. There is some evidence that such hazards had destructive effects on Aboriginal people during the time of historical records (see Davidson 1990: 52).

Dates for colonization of different environments

One of the first syntheses of the newly emerging evidence of Australian prehistory was a demonstration that people reached all environments relatively quickly (Jones 1968). Even with the extended time-scale that has emerged since then, the process seems to be rapid, but there is an emerging picture of differential rates of colonization, with competing views about the reasons for those rates (O'Connor, Veth, Hubbard 1993, Ross, Donnelly, Wasson 1992, Smith 1989, 1993, Veth 1989, 1995). Whether the first date of colonization proves ultimately to be 60 thousand years or closer to 40 thousand (whatever method is used to determine it), it is now clear that Tasmania at the other end of the continent was reached by 35 thousand radiocarbon years ago. The colonization of the south-west, the north-east, the inland lakes of western New South Wales, and the islands of the Bismarck Archipelago and Buka was achieved by similar dates. The site of Yombon in New Britain seems to show that people had moved into

rainforests by 35 thousand radiocarbon years ago (Pavlidis, Gosden 1994), though the issue remains of how successful they were there.

Veth (1989) proposed that the desert regions of central Australia posed a particular set of problems, and that the barrier deserts were only colonized after the arid period of the last glacial maximum. He showed, too, that the early dates for the arid zone clustered around regions he called "islands in the interior". These were primarily the upland regions which seem to act as biogeographic refuges during periods of environmental stress. In particular, the upland relief provides focused run-off so that, unlike other arid regions, there is relatively predictable water supply, promoting floral and faunal diversity.

The pattern Veth discerned seems to be extended to regions outside the arid zone, with early sites also concentrated around the uplands in the tropical north of the Kimberley, Arnhem Land and Cape York Peninsula, in the south west of Western Australia, south east Australia and Tasmania, and the Central Queensland Highlands. It also seems to be true in the heart of the arid zone at the early site of Puritjarra (Smith 1989). Whilst this pattern may indicate targeting of biogeographic diversity, it could also indicate that these are suitable contexts in which to find archaeological sites; the same relief that concentrates run-off providing cliffs in which to locate rock-shelters with accumulating sediment.

Some indication of the perils of this bias are provided by the significant group of early sites that lie away from these refuges: the sites on the ancestral channels of the River Darling, and the inland lakes of western NSW (Balme 1995, Balme, Hope 1990, Bowler *et al.* 1970). Here, the altered hydrological regimes of the Last Glacial aridity produced stream channels and freshwater lakes where now there are none. Archaeological evidence is abundant in the source bordering dunes and lunettes, where middens were rapidly covered with aeolian sediments, and now can be discovered in erosional contexts created by the activities of modern pastoralists. The apparently discontinuous dates for human use of these sites cluster around 35 ka, 24 ka, 13 ka, 7 ka and less than 100 years, and can be accounted for by an understanding of the variations in the past hydrological regimes of the site environments (Balme, Hope 1990).

Discontinuous occupation of regions

As shown by the example from the old water sources of western NSW, there is evidence for discontinuous occupation of regions, though some part of the phenomenon can be accounted for by taphonomic factors. The existence of many other examples may be a result of the pervasiveness of the taphonomic uncertainty, or it may be part of a pattern of discontinuous use of regions such as might reasonably be expected.

In island Melanesia, the pattern of occupation does not seem to be continuous, with Matenkupkum and Panakiwuk,

in southern New Ireland, apparently abandoned in the early Holocene (Gosden, Robertson 1991, Marshall, Allen 1991), and the Yombon rainforest sites in New Britain occupied at about 35 ka and again at 4 ka (Pavlidis, Gosden 1994). In two northern regions of western Australia, Pleistocene sites show abandonment during the height of the arid period of the last glacial maximum, while further south this was a period of occupational intensity, followed by abandonment of sites until relatively recent dates (O'Connor, Veth, Hubbard 1993). A survey of dated sequences from northern Australian rock-shelters shows that the numbers of rock-shelters with incomplete stratigraphic records increase steadily from 30 ka to 9 ka, and declines thereafter (Smith, Sharp 1993). A similar pattern is shown in the very different environmental conditions of Tasmania, where occupation of several caves in the region now covered by cool temperate rainforest appears to have been intermittent from first occupation about 38 thousand years ago through to the end of the Pleistocene (Holdaway, Porch 1995). My own excavations at Cuckadoo 1, on the edge of the arid zone in Queensland, might be interpreted to show big gaps in the sequence of sediment deposition in the rock-shelter, notably between 12 ka and 6 ka (Davidson, Sutton, Gale 1993).

As the Western Australian examples show, only rarely might the discontinuities at the narrow scale in one region correspond with those in another, providing an impression of continuity if the evidence is considered at a broad scale. Even so, there may be suggestion that occupation was not continuous at the broad scale: consideration of the frequency distribution of all archaeological dates from Australia (Allen, Holdaway 1995) shows a marked absence of determinations around 29–30 ka. This does not seem likely to be due to extrinsic factors (such as the bunching of dates that can occur in later periods due to the "wiggles" in the calibration curve) as no such absence is visible in the geological dates for the same period.

These examples suggest that there is evidence for discontinuous occupation of environments from the tropical rainforests through the Australian arid zone to the Tasmanian temperate rainforests, and some hint that there may be sufficient coincidence at times for this pattern to be more general.

First humans and environmental change in Australia

There are two major controversies about a human role in environmental change in Australian prehistory. First, what was the role of burning in vegetation change, and specifically, when may the Aboriginal practice of systematic burning have begun? Can this be detected from the evidence of charcoal particles and vegetation changes observed in pollen diagrams and does it constitute sufficient evidence for early colonization of Australia? Second, did humans, through such habitat modification or through direct predation, have a role in the extinction of the large bodied animals that seem to have been present at the time

of first colonization? Both of these issues relate to the question of adaptation. Firing, whilst destructive in many ways, also provided a modified environment which favoured human occupation (Latz 1995); supposing humans obtained food from the megafauna, new predation strategies would have been required upon their extinction.

The burning question

The original claim that large numbers of charcoal particles and associated vegetation changes in a pollen core at Lake George (near Canberra) indicated anthropogenic changes to natural fire regimes at 125 ka (Singh, Geissler 1985) collapsed in the face of uncertainty about dating (Wright 1986), the mechanism and scale of incorporation of charcoal particles into the pollen-bearing sediments (Clark 1983) and absence of any other evidence for human presence at those dates (Allen 1989, Allen, Holdaway 1995, Roberts, Jones, Smith 1990, 1993, 1994, White, O'Connell 1982). Similar claims have been made more recently, based on evidence from a core from the Great Barrier Reef (Kershaw, McKenzie, McMinn 1993). These have been criticized on several grounds (White 1994) and might perhaps be disregarded until such time as archaeological evidence from within or without Australia makes them worthy of investigation. Poverty of paleoecological interpretation is a poor reason for writing histories based entirely on circumstantial evidence.

Head (1994) argues that the circumstances of ethnographic (i.e. modern) use of fire to "clean up" the country in northern Australia have existed for the last 3000 years. Any claim for the use of the practice at earlier dates is speculative, and depends on determining the appropriate signature of firing in the different climatic conditions of those earlier periods.

Extinction of the megafauna

The other ecological topic is also the subject of actively continuing dispute: the extinction of giant mammals (some perhaps more than 1000 kg in weight), birds (some up to 100 kg) and reptiles (all more than 50 kg) that may have survived until some time (perhaps shortly) after the arrival of the first people of Australia. At various times the extinction of these animals has been blamed on the direct or indirect actions of people sooner or later after they arrived, or on one or other sorts of environmental change (see review by Flannery [1990] and comments by other authors). Recently doubts have been expressed about the dating of some of the supposed survivals of the extinct species to human times (White, Flannery 1995), whilst at the same time good evidence is emerging for close association of artifacts and megafauna (Furby *et al.* 1993). White and Flannery (1995) conclude that the present evidence shows:

1. No sites with undoubted evidence for human accumulation of bones less than 35 thousand radiocarbon years old have many bones of extinct animals.

2. Where bones of extinct animals are present in such sites they either derive from older deposits or are from only one of the herbivores (*Sthenurus*) or from carnivores (*Thylacoleo* or *Sarcophilus*).
3. Where bones of many extinct animals are present, they either have no evidence of human presence, or have a conjunction of artifacts and bones that may be purely depositional.

Under these circumstances, any argument for a direct human role in the extinction of the megafauna seems premature. Arguments for an indirect cause, particularly through habitat modification by means of fire, depend on the establishment of dates for the survival of living megafauna (not just their bones) and for the Aboriginal practice of burning the landscape. Two of the extinctions from the mainland of Australia, of the carnivores *Sarcophilus* (surviving in Tasmania as the Tasmanian Devil) and *Thylacinus* (the Tasmanian Tiger), seem to have occurred after the introduction between 4 ka and 3 ka, presumably by people, of the dingo (Gollan 1984).

WHAT

Imposed form and the origins of art

The use of boats to get to Australia, and beyond to the Bismarck Archipelago and Buka, required the imposition of form on a combination of materials: a novelty in hominid evolution that is taken by some to mark the emergence of modern human behaviour (Davidson, Noble 1992a, Mellars 1989a). In several parts of the world, the emergence of modern human behaviour appears to be marked by the production of three-dimension modelling (Vogelherd and Hohlenstein-Stadel), engraving (La Ferrassie) or painting (Grotte Chauvet). In the early stages in Europe and Australia there seems to be a consistent pattern (Davidson 1996) of marking people (Morse 1993, White 1989), followed by marking of places in increasingly specific ways (Clottes *et al.* 1992, Rosenfeld 1993). The dates for this marking are changing rapidly at one of the cutting edges of archaeological science: direct AMS radiocarbon dating of tiny samples of paintings or engravings or of mineral skins covering them (Watchman 1993b).

In Europe, an apparent pattern (Davidson 1996) of early marking of places with relatively undiagnostic hand-stencils (at ca 28 ka) followed by very specific marking with symbolic animal figures (at ca 19 ka) (Clottes *et al.* 1992) seems to be confounded by much earlier dates for symbolic representations of animals at Grotte Chauvet at 35 ka (Clottes *et al.* 1995). In Australia, claims for engraved surfaces at 40 ka (Nobbs, Dorn 1993) remain controversial (Watchman 1992). Taçon (1994) has suggested that these undiagnostic marks may have been made in imitation of marks visible in the landscape as footprints or ripples caused by raindrops. Controversial claims for paint on rock as early as 25 ka in south-east Cape York Peninsula

(Watchman 1993a) are given credence by new dates for paint on rock from Walkunder Arch cave at 28 ka (Campbell 1996). The discovery of both these examples beneath opaque mineral coatings of the rock prevents any judgement about the nature of the paintings. While expectations of old dates for painting and engraving abound in Australia (Flood 1995), a rigorous assessment of the evidence suggests little sign of the marking of places with symbols earlier than about 13 ka (Rosenfeld 1993).

I have suggested (Davidson 1996) that this indicates a process that began with personal marking and ended with the marking of places as part of the way in which the corporate identity of groups was worked out in relation to the places they used. There are emerging signs that the end product of this was a regionalization of art styles that may have encompassed quite specific marking of relatively small regions (Taçon 1994), perhaps early in the Holocene (Taçon, Brockwell 1995), perhaps as late as 3.5 ka (David, Chant 1995) or later (Taçon 1993).

Plant use

The great distinction of Australian prehistory is that agriculture never emerged in mainland Australia, while only 400 km away in the highlands of New Guinea, it may have emerged as early as anywhere in the world (Hope, Golson 1995). Speculation about the reasons for this is varied (White 1971, Yen 1995) and includes attempts to show that Aboriginal resource management strategies have had much in common with agricultural practices (Balme, Beck 1996, Hynes, Chase 1982, Kimber 1984). Another approach suggests that the marking of places was part of the working out of collective relationships with resources so distinctive of fisher-gatherer-hunter economies in both Europe and Australia (Davidson 1989b, 1996).

The overwhelming evidence from detailed studies in both Australia (Gott 1982, O'Connell, Latz, Barnett 1983, Veth, Walsh 1988) and New Guinea (Powell 1982, Rhoads 1982) is that plant foods were traditionally important and that much knowledge is retained despite some replacement with carbohydrate sources more easily obtained by purchase (Altman 1984). How this situation arose in history is much less certain, given that the calculations of optimal foraging suggest that many plant foods were low ranked (O'Connell, Hawkes 1981). Where plant foods required special processing using grindstones (Balme 1991, Smith 1986) or other means (Beaton 1982, Beck 1992), the costs of making them available as food were high, and other food sources might reasonably be preferred to them.

In adopting a perspective derived from these energetic considerations, Edwards and O'Connell (1995) shift the focus from the frequently ill-defined associations of agriculture to a broad spectrum revolution which involved the "regular use of resources that require heavy investments in processing, such as tree and grass seeds". In this focus, Australians participated in the same process as others

around the world, but the dates, at least in the arid zone, were later than elsewhere.

But agriculture has two characteristics that seem to be mostly absent from the Australian situation: food storage and the protection of crops. Storage presented problems of rights to share in and share out the resource, while protection is necessary both for the store and for a standing crop if it is to acquire value through storage. Although there is argument about the nature of rights in property in Aboriginal Australia, the essential issue is that such rights do not seem to have been transferable by any means other than through social relationships. They were, therefore, collective not individual rights. Ingold (1980, 1987) argues that it is this dichotomy in appropriation of resources that is the real distinction between agricultural and non-agricultural societies.

Ceremonies

What may be true is that Australians used social relationships as a means of storage through the ceremonial life of groups with different conditions of resource availability, with the effect of pooling some of the risks of the Australian environment. This argument is familiar outside Australia through Gamble's (1982) use of descriptions by Strehlow (1970), as interpreted by Yengoyan (1968). The archaeology of the emergence of this ceremonial tradition is poorly developed. Several features are involved: people must be assembled in considerable numbers, requiring a secure food and water supply; the people will usually gather together from different regions; and, some other indicator that this was not merely convergence on a good food and water supply was probably present.

Early ceremonial behaviour is probably indicated by the Mungo I burial (Bowler *et al.* 1970) in which the fully fleshed body was partly burned, the burnt skeleton smashed and the broken bones gathered together and buried. At 26 thousand radiocarbon years, this is one of the earliest unmistakable burials (in the world) and through the repeated treatment of the body might easily be said to involve ritual or ceremony. Supposing this interpretation to be true, it is still the case that there is no necessary relationship between this form of ceremonial and the ecologically functional ceremonies that gathered people together from diverse regions.

Gould (1980) produced explicit argument about this in suggesting that the movement of stone raw materials he called exotic to the region of the site of Puntutjarpa were righteous rocks carried for their religious significance. Gould himself documents the movement of these artifacts as hafted wood-working tools carried by people in their normal movements about the region, so that no such non-utilitarian explanation is necessary (Davidson 1988). Nevertheless, a huge range of goods (including axes, the narcotic pituri, grindstones, ochre, shells, woven bags, gum for hafting, spears, boomerangs, shields and ceremonies)

were exchanged over extensive regions as late as the 19th century (McBryde 1987, Mulvaney 1976). Such exchanges involved ceremony, and brought people together from different tribal territories (Thomson 1949), but the archaeology of this is complex.

Ground-edged axes have been found in northern Australia at 20 ka (Schrire 1982), rather earlier than elsewhere in the world. Argument about the antiquity of trade rests on finds such as fragments of ground-edged axes from Graman in northern NSW 200 km from their source and dated to 3820 radiocarbon years B.P. (McBryde 1974). Whether this involves trade is unknown. Research near Mt Isa, the source of the most widely distributed axes, shows that the distribution of materials is complex. My excavations at Cuckadoo 1 revealed fragments from Mt Isa axes 150 km from source later than 1000 radiocarbon years ago; in a nearby rock hole, Mt Isa axes were cached, and we also found Mt Isa axes and axe fragments on open sites. In the same region there are local quarries with shorter distance movement of axes (Davidson, Cook, Fischer 1992). The nature of the evidence from such more detailed studies shows that interpretation is not simple, and depends very much on the scale of analysis and the quantity of evidence obtained at different scales. We cannot, yet, be sure of the involvement of ceremony at any particular period.

Similar caution must be expressed about claims for the involvement of ceremony in the exploitation of particular food resources: cycads (Beaton 1982), eels (Lourandos 1980) or moths (Flood 1980). Plausible arguments can be constructed, but little convincing evidence offered, that these were either ceremonial foods or the staples that supported the large aggregations of people involved. The presence of large numbers of grindstones might be taken as a sign of such large aggregations (Morwood 1990), but for an inference of ceremony something else is needed.

Some solace might be had in the consideration of art, especially given the detailed documentation of the way in which art can be used in the spiritual life associated with ceremony (Morphy 1991). In several regions of Australia there are sets of motifs that are different from those in other regions (Layton 1992); these might be taken as indicators of the spatial extent of regions that were linked by a common tradition. Moreover, it seems to be the case that within the bounded motif sets there are rarer motifs that suggest links to regions with different dominant motif groups. Again the link to ceremony is plausible, but difficult to substantiate. Dating is also difficult, given that most dates produced hitherto have been unrelated to particular motifs. Nevertheless, AMS dating offers the possibility in the near future that bounded motif sets can be dated. Then, perhaps, integration of the different threads of evidence can provide a whole cloth of an Aboriginal way of life.

Perhaps the best candidate for special gatherings is the evidence that there were burial grounds, with so many burials that they must be regarded as cemeteries (Pardoe 1988). These occur, particularly, along the River Murray

but also elsewhere (Haglund 1976), at various times after 13 ka, and often in the sandy lunettes beside freshwater lakes. It is still unclear how the contiguity was achieved without grave markers. The concentration of burials at many sites can be distinguished from the haphazard disposal of more than 100 bodies over a 25 thousand year period around Lake Mungo without any such concentration (Webb 1989). The precise circumstances of the practice are still unknown: were the dead carried to cemeteries; do the cemeteries occur primarily in places of rich resources and easily dug soil; are the cemeteries the result of deaths during aggregations of people such as occur during ceremonies?

WHICH

The interpretation of cemeteries may be as problematical as the interpretation of the skeletal remains they contain. It was of some comfort when it seemed clear that there were morphological links between early Australian skull morphology and the morphology of Indonesian *Homo erectus*, but the situation is far from clear now. The problem was caused by the discovery of the Mungo female, certainly as gracile as modern female Aborigines, dated to 26 ka, and the simultaneous discovery of a series of robust skulls, exceeding modern male robustness, dated at about 10 ka (Brown 1987).

At various times the variation in the physique of Australian Aborigines, either from fossils or from modern regional variation, has been ascribed to the historical introduction of one (Brown 1987), two (Thorne 1977) or three (Birdsell 1967) separate groups. Clearly this conflict of interpretation represents a difficulty for any non-specialists who seek to understand what really happened. In reality, the evidence for repeated deliberate sea-voyaging makes it much more likely that there were many introductions of people, but as all came from the same region it is highly likely that there were basic similarities of skeletal morphology whenever they arrived.

Much more important is the consideration of the assumptions involved in deciding how morphological variation is to be interpreted. Pardoe (1991) has argued persuasively that the naming of specimens as belonging to one or other particular populations forces the explanation of variation into consideration of different regional ancestral populations. Instead he proposes that it might be more valuable to consider changes in variable populations as a result of environmental and other selection. This seems a valuable corrective to the excesses of the multiregional hypothesis (Frayer *et al.* 1993) which saw the Australians derived from Indonesian *Homo erectus*. Brown (1992) and others (Storm 1995) have shown that the connection to Indonesian *Homo erectus* is weak, and the multi regional hypothesis now seems implausible on several grounds (Groves 1992, Groves, Lahr 1994, Rogers 1995, Rouhani 1989).

WHO ARE THE AUSTRALIAN ABORIGINES?

It would have been convenient to begin this paper by defining Australian Aborigines in ways that might show what it is the first Australians have become, or to end it by showing how archaeological evidence has demonstrated the distinctive adaptations of different Aboriginal groups. But this is difficult because of the imprecision of the archaeological interpretations, the political nature of definition and the intangible nature of many of the criteria of recognition. The first people on the continent used boats, got food from fish and shell-fish, moved stone raw materials and animals in their boats; moved into the full range of environments of the continent and coped or did not cope with variations in them; modified their environments through the use of fire, later and probably not sooner; marked their presence on the landscape and probably thus symbolized the nature of their relationship with land; introduced a range of plant and other foods into their diets; and got together on ceremonial occasions. Much less can be said of the prehistoric emergence of specific kinship organization or other non-material defining characteristics of Australian Aborigines.

In Australian law, identification of Aboriginality is socially defined and limited to those who identify themselves and each other as Aboriginal. It is a risky venture for any non-Aboriginal person to attempt to contribute to a discussion of the nature of that self-identification. It seems from the available evidence, that physical anthropology may be an unreliable guide, and definition in terms of the use of Aboriginal languages denies identification to many who have been denied the opportunity to acquire them by circumstances beyond their control. The use of particular items such as boomerangs or beads as a criterion ignores the past and present evidence for changes in material culture.

In the end, we can say rather little with any precision about the process of becoming of the Australian Aborigines. The first people in Australia were very different in their behaviour from the Aborigines as recorded in ethnographies as recent as the 1960s, because they were amongst the first language users and because they had to discover all the resources of Australia before they could use them. It is probably impossible to determine when the particular mix of material evidence and distinctive adaptations to environment first allowed any individual group to define its identity in relation to any other group in terms that would have been familiar 200 years ago. Moreover, we should not favour that particular time as a moment to define Aboriginality. The identity of any Aboriginal group was constantly being redefined through the negotiation of relationships within and between groups. The final negotiation (so far) is through the representation of Australian Aboriginal identity following the non-Aboriginal colonization. We can never know how the identities of different Aboriginal groups would have appeared if they had not come into bloody conflict

with the wider world outside Australia: they would certainly have continued to change on smaller and larger scales.

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Iain Davidson
Department of Archaeology
and Palaeoanthropology
University of New England
Armidale NSW 2351
AUSTRALIA
Tel.: (02) 6773 2441
Fax: (02) 6773 2526
E-mail: iain.davidson@une.edu.au