Symbolic Revolutions and the Australian Archaeological Record

Adam Brumm & Mark W. Moore

Australia was colonized by at least 40,000 bp and scientists agree that the continent was only ever occupied by anatomically and behaviourally modern humans. Australia thus offers an alternative early record for the archaeological expression of behavioural modernity. This review finds that the pattern of change in the Australian archaeological sequence bears remarkable similarity to the pattern from the Lower to Upper Palaeolithic in the Old World, a finding that is inconsistent with the 'symbolic revolution' model of the origin of modern behaviour. This highlights the need for archaeologists to rethink the implications of the various criteria and scales of analysis used to identify modern human behaviour.

> … here you have fully modern man, sitting at the head of 40,000 years of occupation of modern man, making stone tools that could come out of the African or European Lower Palaeolithic … it leaves us a little baffled (Gowlett 1987, 215).

It is now commonplace to assign the origins of modern human cultural behaviour to the 'symbolic revolution' of the Middle to Upper Palaeolithic transition between 50,000–40,000 years ago. As a phase of unprecedented human creativity and geographical exploration, the symbolic revolution is thought to be the last in a series of major events in an otherwise prolonged period of human evolutionary equilibrium (Klein & Edgar 2002). This key time period in our history is thought to mark the origins of syntax and grammatically complex language and the 'dawn' of human culture (e.g. Bar-Yosef 1998; 2002; Byers 1994; Davidson & Noble 1989; Gamble 1999; Klein 1989; 1992; 1998; 2000; Klein & Edgar 2002; Kuhn & Stiner 1998; Leary & Buttermore 2003; Mellars 1989a,b; 1996; 1998; Mithen 1996; Noble & Davidson 1996; Shea 2003; Skoyles & Sagan 2002; Stringer & Gamble 1993; Tattersall 1998; Wynn & Coolidge 2004).

The concept of a symbolic revolution is based largely on European and/or African evidence and rarely considers the Australian archaeological record (Gowlett 1987, 214). Research conducted in the last 20 years has demonstrated that the Australian region was colonized by at least 40,000 bp (Allen 1998; Allen & Holdaway 1998; Allen & O'Connell 2003; O'Connell & Allen 1998), and perhaps as early as 60,000 bp (Roberts *et al.* 1990; 1993; 1994; 1998a,b; Thorne *et al.* 1999), but at present estimation probably around 50,000 years ago (Gillespie 2002; however see Allen & O'Connell 2003). Specialists universally agree that this colonization was by anatomically modern humans (see Foley & Lahr 1997; Lahr & Foley 1994; Stringer 2001) and one of the earliest reported dates for Australian occupation is directly associated with modern human remains (Bowler *et al.* 2003). But were these earlier colonizers behaviourally modern? Again, most experts believe that this was so. An implication of this position is that the earliest colonizers of Australia participated in the symbolic revolution prior to arriving on Australian shores. Hence Australia contains an alternative archaeological record of early, behaviourally modern humans to the European and African records currently dominating the debate.

In the first part of this article we will review the early Australian Pleistocene archaeological record, focusing in particular on the evidence used in other parts of the world as hallmarks of the symbolic revolution. We will argue that this evidence in Australia is patchy and that many of the hallmarks do not emerge until the middle to late Holocene. The evidence for symbolic activity in the Australian Pleistocene most closely resembles the European and African Lower and Middle Palaeolithic.

Cambridge Archaeological Journal 15:2, 157–75
doi:10.1017/S0959774305000089 Printed in the United Kingdom.

Identifying modern human behaviour in the archaeological record

A range of archaeologically-visible human behaviours have been put forward as proxy measures of behavioural modernity (d'Errico 2003; d'Errico *et al*. 2003; Henshilwood & Marean 2003; Klein 1992; 2000; McBrearty & Brooks 2000; White 1982). These proxy measures include the systematic manufacture of tools from raw materials other than stone, meat procurement through hunting rather than scavenging, exploitation of extremely-difficult environments such as arid and arctic zones, use of seasonally-punctuated food resources, long-distance exchange of raw materials, enlargement of geographic range, increase in artefact diversity, application of highly-standardized stone-tool manufacturing techniques, and technological sophistication in subsistence procurement (Henshilwood & Marean 2003). According to this reasoning, such proxy measures demonstrate the presence of modern human behaviour. Henshilwood & Marean argue that the 'trait-list' mentality has developed within a 'strict empiricist paradigm that is characterized by an inductivist/observational research protocol where structure or pattern in data forms an intrinsic part of the model, and the significance of the pattern is arrived at intuitively' (2003, 635). In other words, the use of these criteria is empirically derived and under-theorized. Indeed, many — if not most — of these proxy measures can be explained more parsimoniously in other ways. Thus it seems most of the categories mentioned above may be inadequate indicators of modern human behaviour.

Henshilwood & Marean (2003, 635) characterize modern human behaviour as

> mediated by socially constructed patterns of symbolic thinking, actions and communication that allow for material and information exchange and cultural continuity between and across generations and contemporaneous communities.

This is similar to Wadley's (2001) 'symbolic storage' argument: hominins were behaviourally modern as soon as they began to store symbolic information outside the brain.

> The four types of symbolic storage described here — art, personal ornamentation, style in lithics and the formal use of space — need not be linked in a package for modern symbolic behaviour to be recognized. Any of these behaviours alone is sufficient to confirm cultural modernity. Once people begin to store symbolism outside their brains they are modern ... (Wadley 2001, 210).

Although this seems to replace one set of proxies for another set structured around 'symbolic storage', the key difference is the underpinning argument that, at its most essential, modern human behaviour involves abstract thinking that is socially constructed and mediated. As Henshilwood & Marean (2003, 635) write: '… aspects of the trait list dealing with the recognition of symbolic behaviour may be on the right track'.

This established, however, there is disagreement over how common a proxy for symbolic storage must be in the archaeological record before it can be considered evidence for behavioural modernity. On the one hand, Wadley claims that the existence of a symbolic storage device is by itself sufficient proof of modernity, and that 'the frequencies of different classes of symbolic storage are irrelevant' (Wadley 2001, 210). 'Long range' advocates (after Bednarik 2003a) have argued, therefore, that geographically- and chronologically-isolated examples of symbolic storage demonstrate that hominins were behaviourally modern by the Middle Pleistocene — either wholly (Bednarik 1992; 1995a,b; 1997a; 2001; 2003a,b,c; Wurz 1999; amongst others); or partially (Clark 1999; Deacon 1997; Foley & Lahr 1997; Marwick 2003; McBrearty & Brooks 2000; Ronen 1998) — as reviewed below. On the other hand, 'short range' advocates believe that isolated examples of symbolic storage are not by themselves sufficient to indicate behavioural modernity because there is no evidence for convention from some form of repetition (Davidson 2002). Furthermore, such repetition must be chronologically and geographically restricted. From this perspective, the pace at which evidently symbolic conventions were deposited in the archaeological record is crucially important to pinpoint the emergence of modern human behaviour.

Given this context, what is the current evidence for the appearance of symbolic behaviour? A host of claims for symbol use among Lower and Middle Palaeolithic hominins have been made (e.g. Bednarik 1997a; 2003a,b; 1994; 1995b; 2001, 549; d'Errico *et al*. 2003; d'Errico & Nowell 2000; d'Errico & Soressi 2002; Freeman 1983; Goren-Inbar & Peltz 1995; Hovers *et al*. 1997; Mania & Mania 1988; Marshack 1990; 1996, 54–5; 1997a,b; Marquet & Lorblanchet 2003; Stepanchuk 1993, 34; see also Bahn & Vertut 1997, 23–6). Most of these artefacts are dismissed by 'short-range' proponents as products of natural agency, such as carnivore chewing and gnawing, inadequate excavation methodology, intrusion from younger levels, utilitarian hominin activities (e.g. Chase & Dibble 1987; 1992; Chase & Nowell 1998; Davidson 1992; Mithen 1996; see also reviews by d'Errico & Nowell 2000; Duff *et al.* 1992), or else as flukes — evidence of a 'running ahead

of time' in behavioural capacities (Vishnyatsky 1994). Such objections have caused consternation among the 'long-range' camp:

> The currently still dominant short-range model, which perceives the use of symbolism, language, and palaeoart to be limited to the last quarter of the Late Pleistocene, survives by rejecting every instance of earlier evidence of this kind or by explaining it away ... (Bednarik 2003b, 412).

The position of the 'short-range' school requires the origins of symbol use to be manifested in a rapid efflorescence or 'explosion' in human creativity, both spatially and chronologically. A pattern that matches this prediction occurs during the Middle–Upper Palaeolithic transition in Europe and the Middle–Late Stone Age transition in sub-Saharan Africa (e.g. Bar-Yosef 1998; Gamble 1999; Klein 1992; Klein & Edgar 2002; Kuhn & Stiner 1998; Lewis-Williams 2002; Mellars 1989a,b; 1996; Mithen 1996; Noble & Davidson 1996; White 1989). The phenomenon is referred to as the 'symbolic' or 'creative explosion' (Mellars 1998; Pfeiffer 1982) or the 'cultural' or 'human revolution' (Klein & Edgar 2002; Mellars & Stringer 1989). We refer to it here as the symbolic revolution (cf. Knight *et al.* 1995).

The phenomenon underpinning the definition of the symbolic revolution is the dramatic shift in the tempo of change starting with the appearance of unambiguous evidence for repeated patterning in symbol use. This includes:

- the drilled and ground ostrich eggshell beads from Enkapune Ya Muto rockshelter (Twilight Cave) in the central Rift Valley of Kenya, east Africa, *c.* 40,000 years ago (Ambrose 1998a; Klein & Edgar 2002, 11–15);
- numerous small mollusc shells, perforated for use as beads or pendants, from the site of Ksar 'Akil (Lebanon) in the eastern Mediterranean basin of the northern Levant and Üçağızlı Cave in Turkey, dated to between *c.* 41,000 and 39,000 bp (Güleç *et al.* 2002; Kuhn *et al.* 2001);
- thousands of diverse ivory, stone and marine shell body ornaments (pierced, ground and polished beads and pendants) from basal Aurignacian deposits in Europe (*c.* 40,000 bp) (White 1989);
- and the appearance of naturalistic paintings and carvings (i.e. parietal art at Grotte Chauvet and the Swabian ivory figurines from Hohle Fels, Hohlenstein-Stadel and Vogelherd) in western Europe between *c.* 36,000–30,000 years ago (Conard 2003; Dowson & Porr 2001; Lewis-Williams 2002; but see Pettitt & Bahn 2003).

Furthermore, it is argued that the symbolic revolution saw the first entanglement of material culture with complex socio-symbolic as well as practical concerns. Thus for the first time in prehistory, artefacts became invested with abstract meanings and symbolic values (Mithen 1996). Tools were no longer manufactured with just pragmatic considerations in mind (e.g. see Bisson 2001), a phenomenon reflected in the archaeological record by increased standardization and regional stylistic variability in Upper Palaeolithic tool types (Chase 2003; Stiner 2002; Stringer & Gamble 1993; Dickson & Gang 2002).

As a final consideration, we should emphasize that researchers who object to the 'short-range' model do not necessarily support a 'gradualist' theory of neurobiological evolution. This would be to simplify grossly the complex arguments made by a range of different researchers. Like a number of archaeologists before us, we have, for heuristic purposes, constructed a sharp and admittedly rather simplistic division between the arguments of 'short-range' and 'long-range' proponents.

In summary, then, the dominant 'short range' school sees the symbolic revolution *c.* 50,000–40,000 years ago as the first unambiguous evidence for modern human behaviour. This is preceded by geographically- and chronologically-sporadic occurrences of symbolic behaviour most of which is challenged on methodological or theoretical grounds.

The symbolic revolution and Australian evidence

Pleistocene evidence

According to Davidson & Noble (1992; see also Coolidge & Wynn 2001), fully-modern language-mediated symbolic behaviour was required to colonize Australia because of the degree of planning and time depth of intentionality necessary to construct seaworthy watercraft, outfit them with food and provisions, and then sail them at least 90–100 km over the horizon to an unseen land. Such a scenario is consistent with both the 'long-range' and 'short-range' arguments for the emergence of modern human behaviour, as both of these models argue for behavioural modernity at or prior to the period of Australian colonization.

As reviewed above, the nature of the expression of modernity predicted by the two models is quite different. The 'short-range' model argues that modernity is reflected by the symbolic revolution, and — if we accept Davidson & Noble's argument that the colonizers of Australia were behaviourally modern — this revolution must have occurred before the colonization of Australia. If this is the case, unambiguous mate-

Table 1. *Archaeological evidence for external symbolic storage in Pleistocene Australia.*

Feature	Age	Site location and object description	Reference
Art	17 kya?	Kimberley, WA OSL dates obtained from sand grains contained in a mudwasp nest overlying a 'Bradshaw' painting indicate a post-terminal Pleistocene (25–17 kya) age for this complex figurative art.	Roberts *et al.* 1997
	13 kya	Early Man rockshelter, QLD Deeply-weathered geometric and track motif engravings on a rock wall surface. A minimum radiocarbon age estimate of 13,200±170 bp was obtained from stratified deposits covering the engraved wall panel.	Rosenfeld *et al.* 1981; Rosenfeld 1993
	12 kya	Sandy Creek 1, QLD A fragment of sandstone with part of a deeply-pecked motif was recovered from excavated deposits with a minimum age of 12,620±370 radiocarbon years (calibrated age 14,400 years BP) (Morwood *et al.* 1995, 78–9). As Cole *et al.* (1995, 153) note: 'The fragment is too small for recognition of the motif, but is almost certainly from the engraved panel [exposed on rear wall of shelter], which has exfoliated sections'.	Morwood *et al.* 1995
	10 kya	Judd's Cavern, TAS AMS dates of 10,730±810 bp and 9240±820 bp were obtained for human blood protein extracted from two samples of pigment on the limestone rock wall surface of Judd's Cavern. The samples were not taken directly from any discernable painted motifs.	Loy *et al.* 1990
Personal ornaments (beads and pendants)	40–30 kya	Riwi, WA Fragments of *Dentalium* sp. shells with use-wear at their openings suggestive of their use as beads.	Balme 2000
	32 kya	Mandu Mandu, WA Six small complete *Conus* shells with apex perforated and internal structure broken to form a hollowed-out shell with round hole at the top. Microwear analysis indicate worn notches at shell openings implying they were threaded as beads onto string. Sixteen fragments of modified *Conus* shell were recovered from the same sediments.	Morse 1993
	19–12.7 kya	Devil's Lair, WA Three ground bone beads made on the various limb-bones of macropods. Manufactured by cutting the (more or less naturally-perforated) shafts into short segments and grinding them smooth on abrasive stone.	Dortch 1979a
	14 kya	Devil's Lair, WA A deliberately-perforated but otherwise unmodified stone (marl) object with wear patterns suggestive of its use as a pendant.	Dortch 1980; Bednarik 1997b
	<25–17 kya	Carpenter's Gap, WA <10 *Dentalium* sp. shells (whole and fragmented) with use-wear at their openings suggestive of their use as beads.	O'Connor 1995
Style in lithics (edge-ground axes)	60–55 kya?	Nauwalabila I, NT Eight pieces of heavily-weathered porphyritic dolerite hornfels recovered from basal deposits; two are roughly lenticular-shaped, suggesting these objects may have been complete stone axes. The 60–55 kya OSL dates for Nauwalabila I have been contested (see Allen 1998; Allen & Holdaway 1998; Allen & O'Connell 2003; O'Connell & Allen 1998). Standard radiocarbon chronology suggests axe technology at this site may be closer to 40 kya or younger.	Jones & Johnson 1985, 216–18, Roberts *et al.* 1990; 1994
	16–15 kya	Nauwalabila I, NT 350 small (max. length *c.* 15–30 mm; maximum width *c.* 10–20 mm) flat flakes of porphyritic dolerite and other volcanic rocks, as well as some schist and hornfels. Most likely removed from edge of ground stone axes during reworking. 39 of these flakes feature ground facets on dorsal surface.	Jones & Johnson 1985, 216–18
	32 kya	Laura, QLD Single small quartzite ground stone axe.	Morwood & Trezise 1989, 77
	>28 kya	Widgingarri 1, WA Four edge-ground flakes of basalt.	O'Connor 1999
	25–10 kya	Malangangerr, Nawamoyn and Jimeri II, NT 20 heavily-weathered (mostly bifacially-flaked, lenticular-shaped) porphyritic dolerite, schist and quartzite edge-ground stone axes found across three sites at Alligator River. Five axes from Malangangerr and Nawamoyn are 'waisted' or grooved, indicating modification for hafting. Five of the axes from Nawomoyn were found clustered together in a recess at the rear of the shelter, possibly indicating deliberate caching.	Schrire 1982

rial manifestations of the symbolic revolution must be present in the Australian archaeological record from the earliest occupation. In contrast, the 'long-range' model does not perceive behavioural modernity as a packaged event, and is therefore not contingent on chronologically- and geographically-linked manifestations of modernity.

Which pattern best reflects the Australian archaeological record? The Pleistocene antiquity of human occupation in Australia was only demonstrated archaeologically in the early 1960s, at Kenniff Cave in central Queensland (Mulvaney 1962). Despite this late start, by the time of their 1993 review of Australian Pleistocene sites Smith & Sharp (1993, 57) could point out that '[t]he quality of the archaeological record for the late Pleistocene is now at least as good as that for the Holocene period'. By the early 1990s, at least 154 Pleistocene sites had been recorded in greater Australia, the majority of which dated to between *c.* 20,000 and 10,000 bp (Smith & Sharp 1993). Over half of these depositional contexts comprise rockshelters and caves (53 per cent), while the others include stratified deposits in alluvial terraces (9 per cent), lunettes (9 per cent), coastal sand dunes (4 per cent), wetlands (4 per cent), and other open sites (16 per cent). Smith & Sharp (1993, 46) note that '[t]he latter includes sites in sandsheets, palaeosols, source-bordering dunes or continental linear dunes, as well as dated hearths on deflation surfaces'. A separate study would be necessary to compile an adequate picture of the number of Pleistocene sites that have been recorded in the ten years since Smith & Sharp's review, a task that is beyond the scope of this article.

Figure 1. *Map of Australia showing locations discussed in the text.*

Figure 2. *Shell beads from Mandu Mandu, Western Australia. (Courtesy of the Western Australia Museum.)*

Table 1 presents an up-to-date list of the earliest archaeological evidence in Pleistocene Australia for modern human behaviour according to Wadley's (2001) categories of external symbolic storage: art, body ornamentation, and style in lithics. Table 2 sorts Smith & Sharp's Pleistocene sites into a series of time slices and tabulates the number of sites with evidence for external symbolic storage.

There can be little doubt that symbols were in use during early stages of the occupation of Australia, evidenced by the 22 whole and fragmented perforated *Conus* shell beads from Mandu Mandu

in Western Australia (Figs. 1 & 2), dated to 32,000 bp (Morse 1993). In addition to these, a few fragments of *Dentalium* sp. shells with smoothing at their openings suggesting their use as beads have been recovered from 40,000- to 30,000-year-old sediments at the site of Riwi in the Kimberley (Balme 2000). Despite the absence of a systematic analysis of use-wear on the Riwi shells, their small size and the fact that they were found over 300 km from the Pleistocene coastline provides reasonable evidence for their nonutilitarian function. Interestingly, O'Connor & Chappell (2003) have argued that marine shellfish species (*Melo* sp. (baler shell), *Pinctada* sp. (pearl shell), *Dentalium* and *Conus* recovered from the oldest Pleistocene Australian sites are more likely to have been used as symbolic resources (i.e. shell beads, prestige goods) than dietary items. As they point out, the earliest Pleistocene use of shell seems to be primarily symbolic; it is not until some 30,000–25,000 years after initial colonization of Australia that shellfish and other coastal resources appear to become important in Aboriginal foraging economies. In addition to the Mandu Mandu and Riwi shell beads, three bone beads (Dortch 1979a) and a perforated stone object, possibly worn as a pendant (Dortch 1980; see also Bednarik 1997b), were recovered from Pleistocene deposits at Devil's Lair in Western Australia. Individual dates for each of these symbolic objects in the deposits at Devil's Lair range from *c.* 19,000 to 12,000 bp (Table 3).

Edge-ground axes — lithic objects with 'imposed form' and the potential for stylistic variability (Fig. 3) — are at least 30,000 years old in Pleistocene northern Australia, and possibly as old as 60,000–55,000 years, although the latter dates are controversial. Apart from rare stone axes, however, there is little evidence for regionally distinctive and stylistically complex Pleistocene stone artefact assemblages in Australia (Holdaway 1995), and certainly none akin to the blade-based industries associated with the symbolic revolution in Late Stone Age Africa (e.g. Ambrose 1998a; Clark 1999) or Upper Palaeolithic Europe (Gamble 1999; Stringer & Gamble 1993) (Fig. 3). Chase (2003, 25, his italics) defines style as a '*given pattern or a set of patterns consisting of overdetermination of form that are, in one way or another, associated with a given group of people bounded both ethnically and temporally*'. Because systematic stylistic variation in stone artefacts is determined by cultural standards — and cultures are mutable and differ regionally — then as Chase points out, there should be marked spatial and chronological disjunctions in style in the archaeological record; adjacent regions or time periods should be marked by different styles of stone artefacts.

It would be difficult to argue that stone artefacts from the Pleistocene period exhibit discontinuous regional or temporal stylistic variability. Edge-ground stone axes are a possible exception, but these objects are unfortunately so rare (and mostly represented by small flakes, fragments or heavily-weathered specimens) that a systematic analysis of stylistic variation amongst Pleistocene stone axes is not possible at present. Isolated backed artefacts may date to the terminal Pleistocene in southeast Australia (Hiscock 2002; Hiscock & Attenbrow 1996; McNiven 2000) but they do not become widespread until at least the middle Holocene. Indeed, Foley & Lahr's (1997) classification of Australian Pleistocene assemblages as 'Mode 3' seems optimistic. An equally-strong case can be made that most of the stone technology is 'Mode 1' in character although the vague definition of technological 'modes' clouds the issue.

Table 2. *Counts of Australian Pleistocene sites by date range and counts of Pleistocene sites with archaeological evidence for external symbolic storage.*

Date range	No. of Pleistocene sites recorded (after Smith & Sharp 1993)	No. of sites with evidence for symbolic storage (art, bodily ornaments, style in lithics) (see Table 1)
60–51 kya	2	1?
50–41 kya	2	–
40–31 kya	18	3
30–21 kya	31	4
20–10 kya	96	8

Table 3. *Dates for Pleistocene symbolic objects from Devil's Lair, Western Australia (courtesy of Joe Dortch).*

Item	Layer and trench provenance	Layer age estimate, years BP (Turney *et al.* 2001; Dortch 2000; and previous dating cf. Dortch 1979b)	Sample numbers
Perforated marl object	O in Trench 87 (Dortch 1980)	13,975±450	GX7249
Bone bead B3654	U and V mixed in Trench 9	Layer V: 19,160±380 17,370±290	 SUA 976 SUA 1248
Bone bead B1556	Hearth 1 in Trench 6	12,660±240	Wk 5494
Bone bead B1898	1st orange brown earthy layer in Trench 5	Age at base of layer: 19,000±250	SUA 101

Although not without ambiguity (see below), apparent symbol use is indicated by the so-called Bradshaw figures in the rock art of the Kimberley district of Western Australia (Morwood 2002). In Australia, like elsewhere in the world, rock art is notoriously difficult to date, whether by absolute or relative methods (see Ward & Tuniz 2000; Bednarik 1993; Franklin 1996; Rosenfeld 1993; Watchman 1993a). Optical dating of quartz sands from mudwasp nests overlying rock paintings in western Arnhem Land highlights the problems inherent in dating rock art to the Pleistocene by superimposition of subject matter alone (Roberts *et al.* 2003). Some supposed images of extinct Pleistocene megafauna, such as the *Palorchestes* (a large marsupial which became extinct *c.* 18,000 bp) painting at Deaf Adder Creek in Arnhem Land (Chaloupka 1993, 100; see also Murray & Chaloupka 1984) may actually date to the Holocene (Roberts *et al.* 2003; see also Ouzman *et al.* 2002). It is also often claimed that the Koonalda Cave 'flint mine' and similar underground limestone caves on the southern coast of Australia contain 20,000-year-old rock markings (e.g. Bahn & Vertut 1997, 38–9; Flood 1996). The antiquity of this 'art' is not, however, as securely established as often assumed (Rosenfeld 1993).

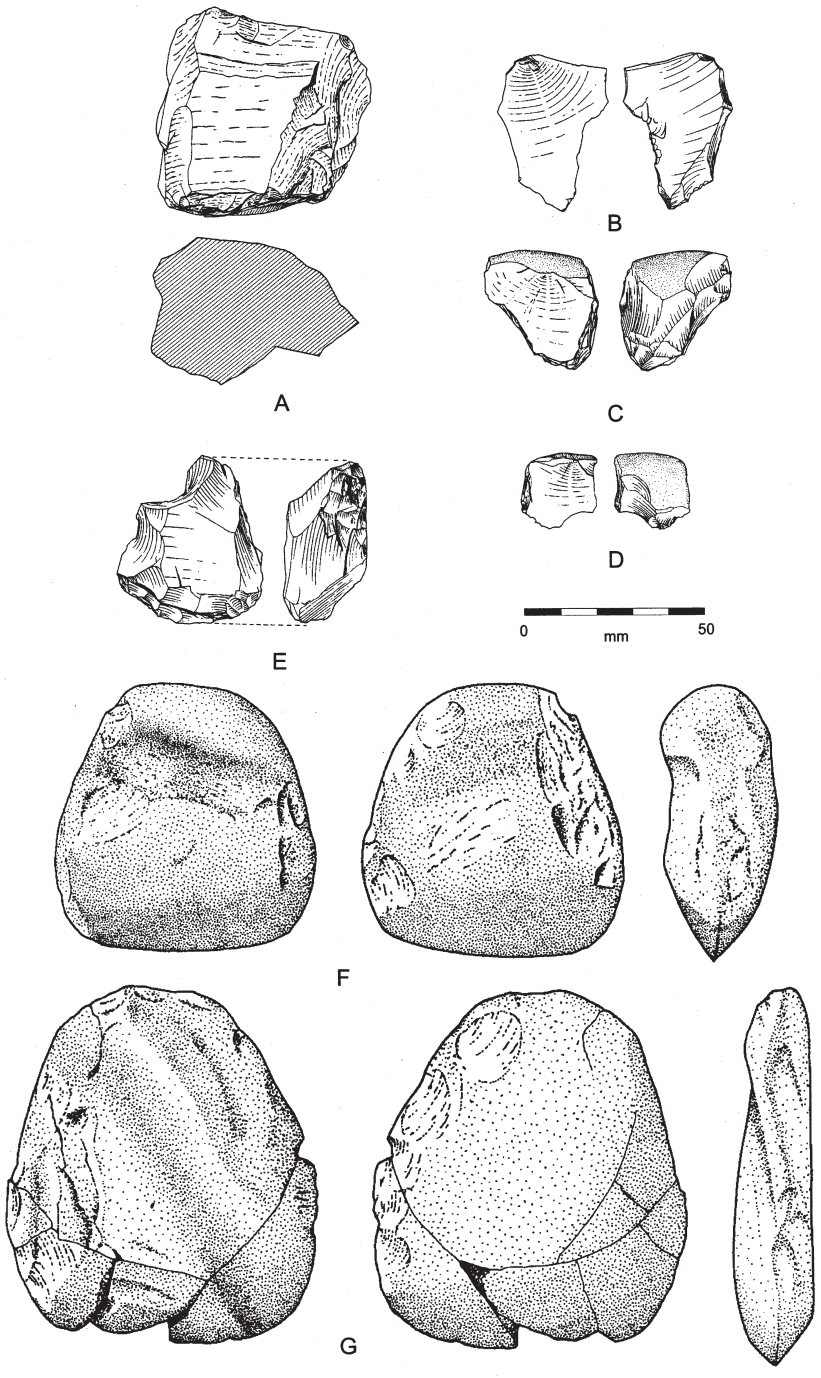


Figure 3. *Australian Pleistocene stone artefacts: A) core; B) utilized flake; C–E) retouched flakes; F–G) edge-ground stone axes. A–E) Newamoyn, Northern Territory; F–G) Malangangerr, Northern Territory. (After Schrire 1982.)*

Other more science-based techniques for the direct dating of rock art imply the production of art in Australia as early as 25,000 to 20,000 bp, but can be similarly ambiguous. For example, Watchman (1993b) has obtained AMS dates of 24,600±220 years BP from carbon-bearing substances in a rock-wall lamination at an equivalent stratigraphic position to an adjacent residual layer of pigment at Laura South, Cape York Peninsula. As Franklin (1996, 147) stresses, however, the fact it was necessary to correlate the dated sample stratigraphically with that obtained from an adjacent crust causes problems. She infers that 'it is possible that the haematite may be natural, rather than an artifactual, layer' (Franklin 1996, 147). In a more recent study, Watchman *et al.* (1999) obtained 16 AMS age determinations from extremely small samples of oxalate-carbon in 0.25-mm-thick crustal layers overly-

ing three pecked cupules at Jinmium rockshelter, in the Keep River region of northwest Australia. This study suggests the three cupules were last retouched between 11,000–1430 years ago, with one cupule returning a minimum age estimate of 11,050±650 bp. This early date is problematic, however, as 'a disparity is apparent between the thickness of the crust and its age when compared with the other crusts in the Keep River region' (Watchman *et al.* 1999, 7). These authors suggest that a mid-Holocene age for the cupule might be more plausible.

Campbell (2000; see also Cole 2000) also recently reported on the results of AMS dating of micro-stratigraphic layers of pigment intercalated with crust deposits on the walls of Walkunder Arch Cave near Chillagoe in North Queensland. Although none of the dated samples come from discernable imagery, he claims to have discovered micro-stratified 'evidence of painting episodes at about 28 ka, 16 ka and 10.4 ka b.p.' (2000, 80). Despite the purported reliability of these rock-surface accretion age-estimates, however, Campbell (2000, 81) cautions that 'nearly all results of this sort so far are problematic, because it is seldom clear whether carbon from different laminations and/or from different sources has been mixed either in the past or by the sampling procedures, or possibly by both'. Finally, two AMS dates (10,250±170 bp; 10,410±170 bp) were obtained from a compact inner layer of calcium carbonate overlying manganese-rich varnish on a rock engraving at the Eight Mile Creek area about 80 km north of Broken Hill, western New South Wales (Dragovich 1986). The main varnish, and possibly the engravings, is inferred to have a minimum age of at least 10,000 years. In light of Dorn's (1996) uncertainties over his own 40,000-year-old dates obtained from manganiferous rock varnish formed over petroglyphs in the Olary Province of South Australia (see Nobbs & Dorn 1993), the Eight Mile Creek dates — and for that matter other attempts at direct-dating varnish layers on rock engravings — are considered somewhat dubious by most specialists (but see Dragovich 1993; 2000).

Other attempts at direct dating Australian rock art to the Pleistocene have been similarly problematic. At Judd's Cavern in southwest Tasmania, and Laurie Creek in the Northern Territory, Loy *et al.* (1990) conducted AMS dating of human blood protein extracted from patches and smears of pigmented substances on limestone and sandstone rock wall surfaces. Dates of 10,730±810 bp and 9240±820 bp were obtained for two samples from the Judd's Cavern site; at Laurie Creek, one haemoglobin sample returned an age of 20,320+3100/–2300 bp (Loy *et al.* 1990). Since the time of Loy and colleague's published research, however, one of the scientists on the team has rejected the initial results of *c.* 20,000 bp for the 'art' at Laurie Creek (Nelson 1993). Nelson (1993, 894) claimed not only that the dated sample came from a potentially *natural* red mineral 'skin' with no associated paintings, but that the 'material dated was not proteinaceous, and therefore not a remnant of human blood'. Despite these reservations Loy (1994, 148) has defended the original Laurie Creek date, stating that the 'combination of microstratigraphic, chemical, isotopic and immunological data give consistent and compelling evidence for the presence of human activity directly associated with the dated sample'. Since then, Gillespie's (1997a, 436) study has concluded that the *c.* 20,000 bp Laurie Creek date should be rejected. Again highlighting the absence of significant protein content in the dated sample, Gillespie (1997a, 436) concluded that 'human or other blood has not been radiocarbon dated at this site'.

The Bradshaw figures are the earliest *discernable* motifs to have been directly dated (but see ongoing work by Roberts *et al.* 2003). These anthropomorphic images have been OSL dated to more than *c.* 16,400 bp (Roberts *et al.* 1997). Despite this apparent level of certainty, Watchman *et al.*'s (1997) study, which involved AMS radicarbon dating of accretionary deposits containing oxalates, diatoms and algal remains overlying and within some Bradshaw paintings, contradicts this isolated date. Watchman *et al.*'s work implies that the Bradshaw art tradition may actually date to around the middle Holocene or later, perhaps 4000 to 1000 bp. This would seem to be a remarkably long time period for a complex figurative painting style to persist without demonstrable change, casting a certain level of doubt over Roberts *et al.*'s (1997) isolated Pleistocene date. In any case, although thousands of Bradshaw figures have been recorded at hundreds of sites in the Kimberley (Walsh 1994), a Pleistocene date has been returned for only one of these paintings. It is therefore quite difficult to determine the nature and extent of the rock-painting tradition within the Pleistocene period. As Rosenfeld (1993, 77) concludes from a careful assessment of the chronological data for rock art and markings in Australia 'an age greater than the terminal Pleistocene cannot at present be upheld for any referential rock art'. Despite several attempts at direct dating of pigments, this situation has changed little in the subsequent ten years of research.

As is often pointed out there is much circumstantial evidence for Pleistocene art production. For example, faceted pieces of haematite and red ochre, some with wear patterns indicating their use as

'crayons', have been found in the earliest occupation deposits at Malakunanja II and Nauwalabila I in northwest Arnhem Land, sites which may be as old as 60,000–55,000 bp (Roberts *et al.* 1990; 1994). Nearly 200 ochre pieces were recorded at Puritjarra rockshelter in Central Australia, indicating the systematic collection and processing of colourants in this region as early as 32,000 bp (Smith *et al.* 1998). Pink staining in sediments surrounding a 46,000- to 40,000-year-old (Bowler *et al.* 2003; but see Thorne *et al.* 1999) human skeleton at Lake Mungo in the Willandra Lakes region in southeastern Australia suggest that this person was sprinkled with powdered red ochre prior to burial (Bowler & Thorne 1976). Similarly, O'Connor & Fankhauser (2001) report on a piece of detached roof panel sprayed with ochre recovered from *c.* 40,000-year-old occupation deposits at Carpenter's Gap site in the Kimberley (no imagery was discernable on this piece). In spite of persistent evidence for the early use of colourants in Australia, in the absence of discernable rock paintings directly dated to the upper late Pleistocene or other securely-established artistic uses of pigments from the time of initial colonization, it remains ambiguous whether the oldest Australian ochres were used for symbolic referencing (art, body decoration), or some other utilitarian purpose. At this stage, the early use of ochre does not provide clear evidence for external symbolic storage.

There are other possible examples of external symbolic storage in Pleistocene Australia, but these too are ambiguous. For example, the apparently deliberate placement of Lake Mungo 3's hands in a clasped position prior to burial (Bowler & Thorne 1976) could have been intended to convey some form of symbolic information. So too might the practice of artificially deforming Aboriginal crania at *c.* 13,000-year-old Pleistocene sites in the Murray River Valley (Brown 1981). Another possible example is the engraved *Diprotodon optatum* tooth reported from the Spring Creek region in northeast New South Wales (Vanderwal & Fullagar 1989). The megafaunal assemblage at Spring Creek has been dated to 19,800±390 bp. Although the 28 roughly parallel grooves visible on the tooth surface resemble those produced by carnivore gnawing, microscopic analysis points to their probable production with a stone implement (Vanderwal & Fullagar 1989). The authors speculate that the engravings may be 'tally marks for an ephemeral activity, or perhaps doodles while passing away time' (Vanderwal & Fullagar 1989, 16). Although the grooves do not seem to be natural, they may well be some sort of utilitarian cut marks. Symbolic treatment of the dead has been suggested for a 46,000- to 40,000-year-old ochred skeleton known as Lake Mungo 3 (Bowler & Thorne 1976; Bowler *et al.* 2003; but cf. Thorne *et al.*'s 1999 much older dates), and for a 25,000- or 17,000-year-old cremated and smashed skeleton known as Lake Mungo 1 (Bowler *et al.* 1972; see Gillespie 1997b; 1998 for dating discrepancies). Similar finds have been made, however, among early hominins argued by 'short-range' proponents to be behaviourally and cognitively *non*-modern (e.g. Bisson 2001; Mithen 1996; Wynn & Coolidge 2004). For example, ochre sprinkled on human corpses may reflect some form of non-symbolic utilitarian activity, not ritual treatment (Bahn & Vertut 1997, 85).

In summary, then, the overall impression is that symbolic evidence is present in the Australian Pleistocene archaeological record, but it occurs in geographically- and chronologically-isolated patterns. The Mandu Mandu beads — perhaps the best evidence for Pleistocene symbol use recovered to date — are separated from other contenders (fragments of *Dentalium* sp. shell beads at Riwi and Carpenter's Gap in the Kimberley) by perhaps 8000 years and 1500 km. The only other beads or ornaments known for the Pleistocene period come from Devil's Lair — and they appear far to the south and many thousands of years later at around 19,000 bp. Stone axes, which are at best ambiguous indicators of cultural symbolism, occur over some 30,000 years and 3000 km of northern Australia. With the possible exception of the Mandu Mandu beads, most of this evidence can be challenged on methodological or theoretical grounds. Although there is ochre use from the very beginning of human occupation of Australia, no rock art with discernable imagery has been convincingly dated to before the terminal Pleistocene. Evidence for symbolling in the material remains from Pleistocene Australia is strikingly similar to the Middle Pleistocene Old World in terms of geographical and chronological disparity and interpretive ambiguity.

The Australian Holocene record

As decades of archaeological research have revealed, Aboriginal social and economic systems appear to have 'intensified' and become more complex in the last 7000 years, but particularly during the middle to late Holocene (Allen & O'Connell 1995; Beaton 1985; Lourandos 1983; 1997; Lourandos & Ross 1994). Fishing technologies like rock walls, weirs, shell hooks and other equipment, as well as complex technologies for processing toxic plants appear towards the late Holocene, suggesting increased diet breadth and an intensification of marine and plant food resource extraction (Evans & Jones 1997). Along with and possibly closely related to economic intensification

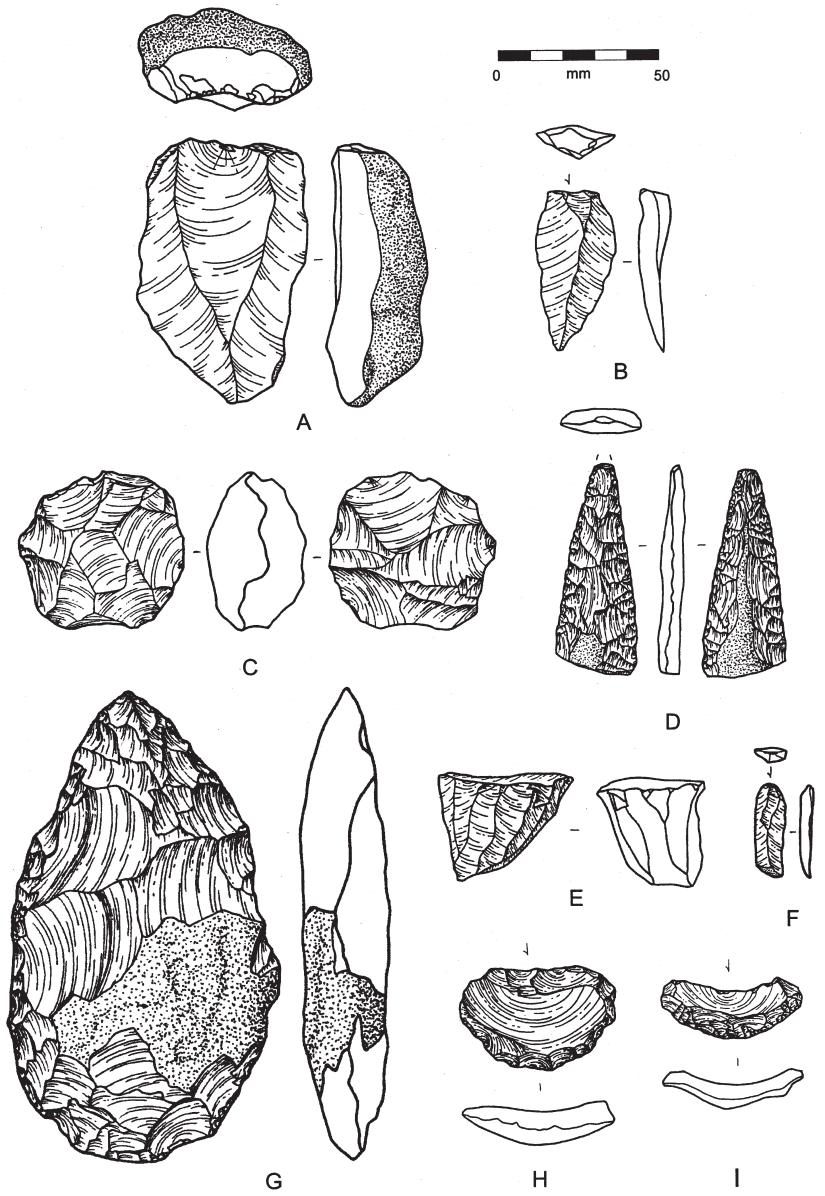


Figure 4. *Australian Holocene stone artefacts from Camooweal, Queensland: A) macroblade core; B) macroblade; C) bifacial radial core; D) bifacial point; E) microblade core; F) microblade; G) large biface; H) Tula adze; I) Tula adze slug.*

there appears to have been a marked increase in site usage and population density, synchronous with a growth in the size and frequency of social aggregation (Lourandos 1997). Long-distance exchange networks circulating such articles as stone artefacts, ochre and pearl shell throughout the Australian continent (see McBryde 1987) date to the middle to late Holocene, with the most extensive trading networks emerging only within the last millennium or so (Davidson *et al.* in press; Hiscock 1988; Tibbett 2002). Stone technology increases in complexity, a process which includes the emergence of Levallois-like stone-reduction methods around 6000 years ago (Dortch 1977; Dortch & Bordes 1977; Moore 2003a). Blade-based lithic industries and backed artefacts become well established at about the same time (Figs. 4 & 5). Ground-edge axes become widespread in the middle Holocene after a Late Pleistocene hiatus (Morwood & Hobbs 1995), and distinctive tools like large bifaces (Moore 2003b), bifacially-flaked points (Akerman & Bindon 1995), and tula adzes (Moore 2004) emerge in the Holocene.

In addition to the economic and technological transformations, there is also evidence for major changes and developments in artistic practices and religious systems beginning around 6000–4000 years ago (Chaloupka 1993; David 2002; Taçon & Brockwell 1995; Taçon & Chippindale 2002; Taçon *et al.* 1996). With the exception of Bradshaw figures in the Kimberley, which *may* date to at least 17,000 bp, complex figurative paintings such as the 'Yam Period' tradition of Arnhem Land, the 'Wandjina' tradition of the Kimberley, and the 'Quinkan' tradition from Cape York, do not become widespread in northern Australia until at least the middle Holocene (Morwood 2002; Taçon & Brockwell 1995). There is also evidence for the development of ethnographically-documented patterns of social organization, complex kin classificatory systems and long-term symbolic attachments to landscape (Layton 1997; but see Rosenfeld & Smith 2002), as well as the dissemination of the dominant language structure, Pama-Nyungan (Evans & Jones 1997), all within the last 5000 years.

Complex ritualistic burials with rich grave-good assemblages, namely elaborately-decorated clothing and jewellery implying social differentiation based on status — often found in large cemetery grounds (e.g. Haglund 1976; Pretty 1977; see Pardoe 1988) — appear for the first time in the Holocene period. Spectacular grave goods are found, including 327 pierced kangaroo and wallaby incisors (jewellery components)

with a double inhumation at Cooma, New South Wales, dated to 7000 bp (Feary 1996); the 178 pierced and ground Tasmanian devil teeth (jewellery components) from the Lake Nitchie burial in New South Wales, also dated to around 7000 bp (Macintosh 1971); and the dozens of notched mammal incisor pendant ornaments (possibly arranged as parallel strands in a headband) and a coiled reptile vertebrae necklace from 4000-year-old paired burials at Roonka Flat, South Australia (Pretty 1977). No grave goods have been recovered from Pleistocene burials.

The cultural efflorescence of the middle to late Holocene period in Australia is marked by the emergence of unambiguous material consequences of symbolling occurring as a chronologically- and geographically-linked 'package'. The evidence appears as a mosaic of local and regional patterns, but linkages tend to be readily identifiable in the Holocene record such as the roughly coeval appearance of complex figurative rock-art traditions in different parts of northern, southern and central Australia. What is most striking is that in its spatial and chronological linkages and the tempo of economic, technological, social, ritual and artistic change, these changes have all the hallmarks of the symbolic revolution in the Old World.

Figure 5. *Australian Holocene backed microlith from Willaura, Victoria. (Scale 20 mm.)*

Discussion

We have argued that Pleistocene Australia is marked by chronologically- and geographically-isolated examples of symbolism followed by a Holocene explosion of chronologically- and geographically-linked examples of symbolism. We contend that this pattern is not unlike the Old World pattern of a few isolated examples of symbolism followed by an explosion of linked examples of symbolism. What are the implications for this?

A strict application of the 'short-range' model would suggest that the first colonizers of Australia were not behaviourally modern. This is because the 'short-range' model requires modern human behaviour to be manifested in a repetitive package of symbolic traces in the archaeological record. If such a package is not readily apparent — as with the Middle Pleistocene archaeological record in the Old World and, as we have argued above, with the Pleistocene archaeological record of Australia — then, according to the 'short-range' model, modern human behaviour did not exist. In accordance with this model, the marked contrast between the Pleistocene and Holocene archaeological records of Australia indicate that the symbolic revolution did not take place in this continent until perhaps as late as 6000 or 7000 years ago. The patchiness of symbolic behaviour in the early Australian record might be explained away as the result of a 'running ahead of time' in hominin behaviour (e.g. Vishnyatsky 1994), or something else altogether. While some authors argue for a very late emergence of fully modern human behaviour in Old World contexts (e.g. Humphrey 1998; Watkins 2000; 2001), this is a position we feel few Australian researchers would accept.

On the other hand, if one accepts that the first colonizers were behaviourally modern — and this is the opinion of most Australian researchers — then the criteria used by the 'short-range' camp to identify modern human behaviour in the Old World is undermined. The Australian record demonstrates that fully modern symbolling humans did not necessarily produce a repetitive package of symbolic traces. This in turn supports Wadley's (2001) position that a single case of symbolic storage may be sufficient for identifying modern human behaviour. The 32,000-year-old Mandu Mandu shell beads are perhaps the least ambiguous evidence for symbolic storage recovered to date from the Australian Pleistocene; they can, by themselves, confirm Davidson & Noble's (1992) contention that the first colonizers of Australia were behaviourally modern. Furthermore, if modern

symbolic behaviour in early Australia produced a patchy archaeological record, there is no clear reason for rejecting the 'modernity' of the Middle Pleistocene record of the Old World solely on the basis of its patchy distribution.

We suggest that the Holocene Australian example could indicate that the rapid pace of change during the symbolic revolution in Africa and Europe roughly 50,000–40,000 years ago has little to do with the emergence of modern human behaviour and more to do with social, demographic, or other causes. It is possible, for example, that these changes simply reflect the reaching of an organizational threshold, that regional populations had reached a level at which new channels of information transmission became necessary to alleviate conflict and establish boundaries (Kuhn & Stiner 1998, 157).

Stiner (2002) suggests that a link exists between population density and social complexity amongst modern hunter-forager groups. Extrapolating into prehistory, she argues that the appearance of regionally distinctive and often elaborately decorated hunting technologies, as well as other visual signs of social identity (i.e. beads, pendants and other ornaments) at the Middle to Upper Palaeolithic transition, could indicate the emergence of cooperative networks over which food resources could be more effectively pooled between human groups of increased population size.

Shennan (2001) — although he takes a somewhat different tack on this problem — draws a similar conclusion, making the argument that cultural innovation leads to major increases in combined mean fitness only amongst groups with large populations; such as those inferred for Late Stone Age Africa (Ambrose 1998a,b), and Upper Palaeolithic Europe (Stiner *et al.* 2000; Wall & Przeworski 2000). Thus symbols may have been in use before the Late Pleistocene but, owing to low population densities, cultural change and innovation may have been unattractive from an adaptive perspective.

This hypothesis is lent added support by White's socio-demographic argument, which suggests that prior to the Upper Palaeolithic the rarity of perforated objects in Europe may simply result from the 'absence of the social, ideational, and technological context for use, rather than the inability to make or conceive of holes' (White 1989, 380; see also Ambrose 1998a). Elsewhere, White (1982) has argued that social relations were totally restructured during the Middle to Upper Palaeolithic transition. To support this, White points to evidence for greater population density, increased frequency of social aggregation, a greater stylistic component to lithics, greater emphasis on the working of antler and bone (with corresponding imposition of form according to stylistic variables), a shift towards uneconomical hunting of antler-bearing herd species, the use of ornaments, and the exchange of exotic materials over long distances. White's (1982) argument suggests that before the Middle to Upper Palaeolithic transition the sheer geographical isolation of very low-density hominin groups, who rarely if ever came into contact, may have obviated the need for such key symbolic 'inventions' (see Chase 1994, 628).

This argument anticipates Cullen's (1996) 'forest metaphor' of cultural transmission in the Lower and Middle Palaeolithic. Cullen implies that from their geographic isolation, limited social networks, and potentially less well-developed early hominin linguistic systems, individual hominins and their cultures may be thought of as isolated trees in a vast savanna landscape. Under such conditions, the formation of social networks for the interchange of symbols between isolated trees (or cultures) is more difficult to achieve than it is in forest environments where trees are packed tightly together. The latter, he argues, is a suitable metaphor for extensive social interaction in the Late Pleistocene. Any decoupling of the individual capacity for culture and the explosion of certain kinds of cultural phenomena in the Upper Palaeolithic can be represented in terms of the degree to which fully-evolved trees are grouped together in such a way as to provide an interlocking canopy (Cullen 1996, 425).

In Cullen's estimation, there may have been significant constraints facing the spatial and chronological distribution of symbols amongst early hominins living in small and isolated communities, where opportunities for information exchange were limited. He concludes: 'When new ideas appeared in one community there may have been very few opportunities for that idea to have been taught to individuals of other communities some distance away' (Cullen 1996, 425).

These observations turn on how 'patchiness' is defined. Bednarik (1992; 2003a) argues that taphonomic factors must be considered in assessing the Middle Pleistocene record of symbolling, as older assemblages are more likely to represent a biased data set than younger assemblages. What appears to be 'patchy' evidence may be an illusion created by the destruction of the archaeological record through time. According to this logic, the scanty evidence for symbol use in the early Old World and Australian archaeological records provides us with but a glimpse of a once much richer and more varied symbolic life. Moreover, the pace of spatial and chronological change may be biased in earlier periods because there are such huge

gaps in the information data base. While this factor may have affected the Australian Pleistocene record (Frankel 1993) — particularly with regard to any sites located on the submerged continental shelf — it is also apparent that the majority of rockshelters, caves and sand horizons with Pleistocene occupation also contain clear and unambiguous evidence for symbolling in later archaeological deposits and Holocene-age rock art on the shelter walls. In any case, while a taphonomic argument might be marshalled to salvage the 'short-range' model, the above discussion highlights the need for a more rigorous definition of criteria for identifying symbolic 'packaging' in the archaeological record.

Conclusion

The Australian archaeological record is rarely considered in debates regarding the nature and emergence of early symbolic behaviour (but see Holdaway & Cosgrove 1997); this article has attempted to redress this imbalance. As we have discussed, before the rapid, continent-wide cultural changes of the middle to late Holocene period, the tempo of cultural change in Australia was slow and sporadic and the distribution of symbolic activity was patchy in time and space. We believe there are broad similarities between patterning in the Pleistocene and Holocene Australian archaeological record and patterning in the Middle and Upper Palaeolithic archaeological records of Africa and Europe, similarities that cannot be comfortably ignored. Applying the archaeological signature of modern human behaviour advocated by 'short-range' proponents to Pleistocene Australia indicates that the ancestors of Aboriginal people were not behaviourally modern until relatively recently, perhaps only the last 7000 years. If one rejects this conclusion — as we do — problems are raised with both the logic and validity of the 'short-range' model of modern behavioural origins.

Clearly this issue cannot be resolved with any sense of finality here. We suggest, however, that the isolated evidence for symbolic behaviour by early but behaviourally modern Australians reflects a similar pattern to the isolated evidence for symbolic behaviour in the Middle Pleistocene archaeological record of the Old World. This comparison may allow us to compile a more meaningful picture of symbol use amongst early hominins — one in which the capacity to behave like we do was not necessarily absent amongst these hominin ancestors and close relatives. In other words, the Australian example effectively highlights that the absence of evidence for repeated patterning in symbolic behaviour cannot by itself be taken as evidence for the absence of behavioural modernity among past people. It seems there is an urgent need for archaeologists to test carefully the implications of the various criteria and scales of analysis used to deny the behavioural capacities of some past humans.

Acknowledgements

We would like to acknowledge the comments and assistance provided by Eleni Asouti, Darren Boyd, Ross Chadwick, Iain Davidson, Joe Dortch, Kate Morse, Sue O'Connor, Paul Taçon, Randall White, and an anonymous reviewer. We are solely responsible for the views expressed in this paper.

Adam Brumm
Department of Archaeology and Natural History
Research School of Pacific and Asian Studies
Australian National University
Canberra, ACT 0200
Australia
Email: adam.brumm@anu.edu.au

Mark W. Moore
Department of Archaeology and Palaeoanthropology
School of Human and Environmental Studies
University of New England
Armidale, NSW 2351
Australia
Email: mmoore5@une.edu.au

References

Akerman, K. & P. Bindon, 1995. Dentate and related stone biface points from northern Australia. *The Beagle, Records of the Museums and Art Galleries of the Northern Territory* 12, 89–99.

Allen, J., 1998. Radiocarbon determinations, luminescence dating and Australian archaeology, in *Archaeology of Aboriginal Australia: a Reader*, ed. T. Murray. St Leonards: Allen & Unwin, 13–18.

Allen, J. & S. Holdaway, 1998. The contamination of Pleistocene radiocarbon determinations in Australia, in *Archaeology of Aboriginal Australia: a Reader*, ed. T. Murray. St Leonards: Allen & Unwin, 26–40.

Allen, J. & J.F. O'Connell, 1995. Introduction, in *Transitions*: *Pleistocene to Holocene in Australia and Papua New Guinea*, eds. J. Allen & J.F. O'Connell. *Antiquity* special number 265, vii–ix.

Allen, J. & J.F. O'Connell, 2003. The long and the short of it: archaeological approaches to determining when humans first colonised Australia and New Guinea. *Australian Archaeology* 57, 5–19.

Ambrose, S.H., 1998a. Chronology of the Later Stone Age and food production in East Africa. *Journal of Archaeological Science* 25, 377–92.

Ambrose, S.H., 1998b. Late Pleistocene human population bottlenecks, volcanic winter, and differentiation of modern humans. *Journal of Human Evolution* 34, 623–51.

Bahn, P.G. & J. Vertut, 1997. *Journey Through the Ice Age*. London: Weidenfeld & Nicolson.

Balme, J., 2000. Excavations revealing 40,000 years of occupation at Mimbi Caves in South Central Kimberley. *Australian Archaeology* 51, 1–5.

Bar-Yosef, O., 1998. On the nature of transitions: the Middle to Upper Palaeolithic and the Neolithic Revolution. *Cambridge Archaeological Journal* 8(2), 141–63.

Bar-Yosef, O., 2002. The Upper Palaeolithic revolution. *Annual Review of Anthropology* 31, 363–93.

Beaton, J.M., 1985. Evidence for a coastal occupation timelag at Princess Charlotte Bay (North Queensland) and implications for coastal colonization and population growth theories for Aboriginal Australia. *Archaeology in Oceania* 20, 1–20.

Bednarik, R.G., 1992. Palaeoart and archaeological myths. *Cambridge Archaeological Journal* 2(1), 27–57.

Bednarik, R.G., 1993. The calibrated dating of petroglyphs. *The Artefact* 16, 32–8.

Bednarik, R.G., 1994. The Pleistocene art of Asia. *Journal of World Prehistory* 8(4), 351–75.

Bednarik, R.G., 1995a. A taphonomy of palaeoart. *Antiquity* 68, 68–74.

Bednarik, R.G., 1995b. Concept-mediated marking in the Lower Palaeolithic. *Current Anthropology* 36, 605–34.

Bednarik, R.G., 1997a. The role of Pleistocene beads in documenting hominid cognition. *Rock Art Research* 14(1), 27–41.

Bednarik, R.G., 1997b. Pleistocene stone pendant from Western Australia. *Australian Archaeology* 45, 32–4.

Bednarik, R.G., 2001. The oldest known rock art in the world. *Anthropologie* 39(2–3), 89–97.

Bednarik, R.G., 2003a. The earliest evidence of palaeoart. *Rock Art Research* 20(2), 89–135.

Bednarik, R.G., 2003b. A figurine from the African Acheulian. *Current Anthropology* 44(3), 405–13.

Bednarik, R.G., 2003c. Seafaring in the Pleistocene. *Cambridge Archaeological Journal* 13(1), 41–66.

Bisson, M.S., 2001. Interview with a Neanderthal: an experimental approach for reconstructing scraper production rules, and their implications for imposed form in Middle Palaeolithic tools. *Cambridge Archaeological Journal* 11(2), 165–84.

Bowler, J.M. & A.G. Thorne, 1976. Human remains from Lake Mungo: discovery and excavation of Lake Mungo III, in *The Origin of the Australians*, eds. R.L. Kirk & A.G. Thorne. Canberra: Australian Institute of Aboriginal Studies, 127–38.

Bowler, J.M, A.G. Thorne & H.A. Polach, 1972. Pleistocene man in Australia: age and significance of the Mungo skeleton. *Nature* 240, 48–50.

Bowler, J.M., H. Johnstone, J.M. Olley, J.R. Prescott, R.G. Roberts, W. Shawcross & N. Spooner, 2003. New ages for human occupation and climatic change at Lake Mungo, Australia. *Nature* 421, 837–40.

Brown, P., 1981. Artificial cranial deformation: a component in the variation in Pleistocene Australian Aboriginal crania. *Archaeology in Oceania* 16, 156–67.

Byers, A.M., 1994. Symboling and the Middle–Upper Palaeolithic transition: a theoretical and methodological critique. *Current Anthropology* 35(4), 369–99.

Campbell, J.B., 2000. The Chillagoe and Laura laser-AMS dating project, in *Advances in Dating Australian Rock-Markings: Papers from the First Australian Rock-Picture Dating Workshop*, eds. G.K. Ward & C. Tuniz. (Occasional Publication 10.) Melbourne: Australian Rock Art Research Association, 80–83.

Chaloupka, G., 1993. *Journey in Time, the World's Longest Continuing Art Tradition: the 50,000-year Story of the Australian Aboriginal Rock Art of Arnhem Land*. Chatswood: Reed.

Chase, P., 1994. On symbols and the Palaeolithic. *Current Anthropology* 35(5), 627–9.

Chase, P., 2003. Stone Tool 'Style' and the Evolutionary Origins of Symbolism. Paper presented at the 9th Annual Meeting of the European Archaeologists Association, September 10–14, 2003. http://www.semioticon.com

Chase, P. & H.L. Dibble, 1987. Middle Palaeolithic symbolism: a review of current evidence and interpretations. *Journal of Anthropological Archaeology* 6, 263–96.

Chase, P. & H.L. Dibble, 1992. Scientific archaeology and the origins of symbolism: a reply to Bednarik. *Cambridge Archaeological Journal* 2(1), 43–51.

Chase, P. & A. Nowell, 1998. Taphonomy of a suggested Middle Paleolithic bone flute from Slovenia. *Current Anthropology* 39(4), 549–53.

Clark, A.M.B., 1999. Late Pleistocene technology at Rose Cottage Cave: a search for modern behavior in an MSA context. *African Archaeological Review* 16(2), 93–119.

Cole, N., 2000. The 'direct dating' of rock-pictures at Laura, in *Advances in Dating Australian Rock-Markings: Papers from the First Australian Rock-Picture Dating Workshop*, eds. G.K. Ward & C. Tuniz. (Australian Rock Art Research Association, Occasional Publication 10.) Melbourne: Australian Rock Art Research Association, 76–9.

Cole, N., A. Watchman & M. Morwood, 1995. Chronology of Laura rock art, in *Quinkan Prehistory: the Archaeology of Aboriginal Art in S.E. Cape York Peninsula, Australia*, eds. M.J. Morwood & D.R. Hobbs. (*Tempus* 3.) St Lucia: Anthropology Museum, University of Queensland, 161–77.

Conard, N.J., 2003. Palaeolithic ivory sculptures from southwestern Germany and the origins of figurative art. *Nature* 426, 830–32.

Coolidge, F.L. & T. Wynn, 2001. Executive functions of the frontal lobes and the evolutionary ascendancy of *Homo sapiens*. *Cambridge Archaeological Journal* 11(2), 255–60.

Cullen, B., 1996. Social interaction and viral phenomena, in *The Archaeology of Human Ancestry: Power, Sex and Tradition*, eds. J. Steele & S.J. Shennan. London: Routledge, 420–33.

David, B., 2002. *Landscapes, Rock-Art and the Dreaming: an Archaeology of Pre-Understanding*. Leicester: Leicester University Press.

Davidson, I., 1992. There's no art — to find the mind's construction — in offence. *Cambridge Archaeological Journal* 6(1), 52–7.

Davidson, I., 2002. Archaeology of Language Origins 2002. Paper presented at the Institute of Advanced Studies, University of Western Australia, Perth, June 2002.

Davidson, I. & W. Noble, 1989. The archaeology of perception: traces of depiction and language. *Current Anthropology* 30(2), 125–55.

Davidson, I. & W. Noble, 1992. Why the first colonisation of the Australian region is the earliest evidence of modern human behaviour. *Archaeology in Oceania* 27, 113–19.

Davidson, I. & W. Noble, 1998. Two views on language origins. *Cambridge Archaeological Journal* 8(1), 82–8.

Davidson, I., N. Cook, M. Fischer, M. Ridges, J. Ross & S. Sutton, in press. Archaeology in another country: exchange and symbols in north west central Queensland, in *Many Exchanges: Essays in Honour of Isabel McBryde*, eds. I. Macfarlane, R. Paton & M-J. Mountain. Canberra: Aboriginal History Inc.

Deacon, T., 1997. *The Symbolic Species: the Co-Evolution of Language and Brain*. New York (NY): W.W. Norton & Company.

d'Errico, F., 2003. The invisible frontier: a multiple species model for the origin of behavioral modernity. *Evolutionary Anthropology* 12, 188–202.

d'Errico, F. & A. Nowell, 2000. A new look at the Berekhat Ram figurine: implications for the origins of symbolism. *Cambridge Archaeological Journal* 10(1), 123–67.

d'Errico, F. & M. Soressi, 2002. Systematic Use of Manganese Pigment by Pech-de-l' Azé I Neandertals: Implications for the Origin of Behavioral Modernity. Paper presented at Palaeoanthropology Society Meetings, Denver, Colorado, 2002.

d'Errico, F., C. Henshilwood, G. Lawson, M. Vanhaeren, A.-M. Tillier, M. Soressi, F. Bresson, B. Maureille, A. Nowell, J. Lakarra, L. Backwell & M. Julien, 2003. Archaeological evidence for the emergence of language, symbolism, and music: an alternative multidisciplinary perspective. *Journal of World Prehistory* 17(1), 1–70.

Dickson, D.B. & G.Y. Gang, 2002. Evidence of the emergence of 'modern' behavior in the Middle and Late Stone Age lithic assemblages at Shurmai Rockshelter (GnJm2) and Kakwa Lelash Rockshelter (GnJm2) in the Mukogodo Hills of north-central Kenya. *African Archaeological Review* 19(1), 1–26.

Dorn, R.I., 1996. Uncertainties in ages for petroglyphs from the Olary province, South Australia. *Archaeology in Oceania* 31, 214–15.

Dortch, C.E., 1977. Early and late stone industrial phases in Western Australia, in *Stone Tools as Cultural Markers: Change, Evolution and Complexity*, ed. R.V.S. Wright. Canberra: Australian Institute of Aboriginal Studies, 104–32.

Dortch, C.E., 1979a. Australia's oldest known ornaments. *Antiquity* 53, 39–43.

Dortch, C.E., 1979b. Devil's Lair, an example of prolonged cave use in Western Australia. *World Archaeology* 10(3), 258–81.

Dortch, C.E., 1980. A possible pendant of marl from Devil's Lair, Western Australia. *Records of the Western Australian Museum* 7, 329–67.

Dortch, C.E. & F. Bordes, 1977. Blade and Levallois technology in Western Australian prehistory. *Quartär* 27–8, 1–19.

Dortch, J., 2000. Palaeo-environmental Change and the Persistence of Human Occupation in South-western Australian Forests. Unpublished PhD thesis, University of Western Australia.

Dowson, T.A. & M. Porr, 2001. Special objects — special creatures: shamanistic imagery and the Aurignacian art of south-west Germany, in *The Archaeology of Shamanism*, ed. N. Price. London: Routledge, 165–77.

Dragovich, D., 1986. Minimum age of some desert varnish near Broken Hill, New South Wales. *Search* 17(5–6), 149–51.

Dragovich, D., 1993. Varnish cation ratios and relative dating of rock engravings. *The Artefact* 16, 27–31.

Dragovich, D., 2000. Cation-ratio dating of rock-carvings, in *Advances in Dating Australian Rock-Markings: Papers from the First Australian Rock-Picture Dating Workshop*, eds. G.K. Ward & C. Tuniz. (Australian Rock Art Research Association, Occasional Publication 10.) Melbourne: Australian Rock Art Research Association, 45–51.

Duff, A.I., G.A. Clark & T.J. Chadderdon, 1992. Symbolism in the early Palaeolithic: a conceptual odyssey. *Cambridge Archaeological Journal* 2(2), 211–29.

Evans, N. & R. Jones, 1997. The cradle of the Pama-Nyungans: archaeological and linguistic speculations, in *Archaeology and Linguistics: Aboriginal Australia in Global Perspective*, eds. P. McConvell & N. Evans. Oxford: Oxford University Press, 385–418.

Feary, S., 1996. An Aboriginal burial with grave goods near Cooma, New South Wales. *Australian Archaeology* 43, 40–42.

Flood, J., 1996. Culture in early Aboriginal Australia. *Cambridge Archaeological Journal* 6(1), 3–36.

Foley, R. & M.M. Lahr, 1997. Mode 3 technologies and the evolution of modern humans. *Cambridge Archaeological Journal* 7(1), 3–36.

Frankel, D., 1993. Pleistocene chronological structures and explanations: a challenge, in *Sahul in Review: Pleistocene Archaeology in Australia, New Guinea and Island Melanesia*, eds. M.A. Smith, M. Spriggs & B. Fankhauser. Canberra: The Australian National University, 24–36.

Franklin, N., 1996. Rock art in Australia and New Guinea 1990–1994: research, management and conservation, in *Rock Art Studies, News of the World I: Recent Developments in Rock Art Research*, eds. P.G. Bahn & F. Angelo. Oxford: Oxbow Books, 145–62.

Freeman, L.G., 1983. More on the Mousterian: flaked bone from Cueva Morín. *Current Anthropology* 24(3), 366–77.

Gamble, C., 1999. *The Palaeolithic Societies of Europe*. Cambridge: Cambridge University Press.

Gillespie, R., 1997a. On human blood, rock art and calcium oxalate: further studies on organic carbon content and radiocarbon age of materials relating to Australian rock art. *Antiquity* 71, 430–37.

Gillespie, R., 1997b. Burnt and unburnt carbon: dating charcoal and burnt bone from the Willandra Lakes, Australia. *Radiocarbon* 39, 225–36.

Gillespie, R., 1998. Alternative timescales: a critical review of Willandra Lakes dating. *Archaeology in Oceania* 33, 169–82.

Gillespie, R., 2002. Dating the first Australians. *Radiocarbon* 44(2), 455–72.

Goren-Inbar, N. & S. Peltz, 1995. Additional remarks on the Berekhat Ram figurine. *Rock Art Research* 12(2), 131–2.

Gowlett, J.A.J., 1987. The coming of modern man. *Antiquity* 61, 210–19.

Güleç, E., S.L. Kuhn & M.C. Stiner, 2002. The early Upper Palaeolithic of Üçağızlı Cave, Turkey. *Antiquity* 76, 615–16.

Haglund, L., 1976. *The Broadbeach Aboriginal Burial Ground: an Archaeological Analysis*. St Lucia: The University of Queensland.

Henshilwood, C. & C.W. Marean, 2003. The origin of modern human behavior: critique of the models and their test implications. *Current Anthropology* 44(5), 627–51.

Hiscock, P., 1988. A cache of tulas from the Boulia district, western Queensland. *Archaeology in Oceania* 23, 60–70.

Hiscock, P., 2002. Pattern and context in the Holocene proliferation of backed artifacts in Australia, in *Thinking Small: Global Perspectives on Microlithization*, eds. R.G. Elston & S.L. Kuhn. (Archaeological Papers 12.) Washington (DC): American Anthropological Association, 163–77.

Hiscock, P. & V. Attenbrow, 1996. Backed into a corner. *Australian Archaeology* 42, 64–5.

Holdaway, S., 1995. Stone artefacts and the transition, in *Transitions*: *Pleistocene to Holocene in Australia and Papua New Guinea*, eds. J. Allen & J.F. O'Connell. *Antiquity* special number 265, 784–97.

Holdaway, S. & R. Cosgrove, 1997. The archaeological attributes of behaviour: difference or variability? *Endeavour* 21(2), 66–71.

Hovers, E., B. Vandermeersch & O. Bar-Yosef, 1997. A Middle Palaeolithic engraved artefact from Qafzeh Cave, Israel. *Rock Art Research* 14(2), 79–87.

Humphrey, N., 1998. Cave art, autism, and the evolution of the human mind. *Cambridge Archaeological Journal* 8(2), 165–91.

Jones, R. & I. Johnson, 1985. Deaf Adder Gorge: Lindner Site, Nauwalabila 1, in *Archaeological Research in Kakadu National Park*, ed. R. Jones. Canberra: Australian National Parks and Wildlife Service, 165–227.

Klein, R.G., 1989. Perspectives on modern human origins in southern Africa, in *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*, eds. P. Mellars & C. Stringer. Edinburgh: Edinburgh University Press, 529–46.

Klein, R.G., 1992. The archaeology of modern human origins. *Evolutionary Anthropology* 1, 5–14.

Klein, R.G., 1998. Why anatomically modern people did not disperse from Africa 100,000 years ago, in *Neandertals and Modern Humans in Western Asia*, eds. T. Akazawa, K. Aoki & O. Bar-Yosef. New York (NY): Plenum Press, 509–28.

Klein, R.G., 2000. Archeology and the evolution of human behaviour. *Evolutionary Anthropology* 9, 17–36.

Klein, R.G. & B. Edgar, 2002. *The Dawn of Human Culture*. New York (NY): John Wiley & Sons.

Knight, C., C. Power & I. Watts, 1995. The human symbolic revolution: a Darwinian account. *Cambridge Archaeological Journal* 5(1), 75–114.

Kuhn, S.L. & M.C. Stiner, 1998. Middle Palaeolithic 'creativity': reflections on an oxymoron?, in *Creativity in Human Evolution and Prehistory,* ed. S. Mithen. London: Routledge, 143–64.

Kuhn, S.L., M.C. Stiner, D.S. Reese & E. Güleç, 2001. Ornaments of the earliest Upper Paleolithic: new insights from the Levant. *Proceedings of the National Academy of Sciences of the USA* 98(13), 7641–6.

Lahr, M.M. & R. Foley, 1994. Multiple dispersals and modern human origins. *Evolutionary Anthropology* 3(2), 48–60.

Layton, R., 1997. Small tools and social change, in *Archaeology and Linguistics: Aboriginal Australia in Global Perspective*, eds. P. McConvell & N. Evans. Oxford: Oxford University Press, 377–84.

Leary, M.R. & N.R. Buttermore, 2003. The evolution of the human self: tracing the natural history of self-awareness. *Journal for the Theory of Social Behaviour* 33(4), 365–404.

Lewis-Williams, D., 2002. *The Mind in the Cave: Consciousness and the Origins of Art*. London: Thames & Hudson.

Lourandos, H., 1983. Intensification: a Late Pleistocene–Holocene archaeological sequence from southwestern Victoria. *Archaeology in Oceania* 18, 81–94.

Lourandos, H., 1997. *Continent of Hunter-Gatherers: New Perspectives in Australian Prehistory*. Cambridge: Cambridge University Press.

Lourandos, H. & A. Ross, 1994. The great 'intensification debate': its history and place in Australian archaeology. *Australian Archaeology* 39, 54–63.

Loy, T.H., 1994. Direct dating of rock art at Laurie Creek (NT), Australia: a reply to Nelson. *Antiquity* 68, 147–8.

Loy, T.H., R. Jones, D.E. Nelson, B. Meehan, J. Vogel, J. Southon & R. Cosgrove, 1990. Accelerator radiocarbon dating of human blood proteins in pigments from late Pleistocene art sites in Australia. *Antiquity* 64, 110–16.

Macintosh, N.W.G., 1971. Analysis of an Aboriginal skeleton and pierced tooth necklace from Lake Nitchie, Australia. *Anthropologie* 12, 49–62.

Mania, D. & U. Mania, 1988. Deliberate engravings on bone artefacts of *Homo erectus*. *Rock Art Research* 5(2), 91–107.

Marquet, J.-C. & M. Lorblanchet, 2003. A Neanderthal face? The proto-figurine from La Roche-Cotard, Langeais (Indre-et-Loire, France). *Antiquity* 77, 661–70.

Marshack, A., 1990. Early human symbolism and the evolution of human capacity, in *The Emergence of Modern Humans*, ed. P. Mellars. Edinburgh: Edinburgh University Press, 457–98.

Marshack, A., 1996. A Middle Palaeolithic symbolic composition from the Golan Heights: the earliest known depictive image. *Current Anthropology* 37, 357–65.

Marshack, A., 1997a. Paleolithic image making and symbolling in Europe and the Middle East: a comparative review, in *Beyond Art: Pleistocene Image and Symbol*, eds. M.W. Conkey, O. Soffer, D. Stratmann & N.G. Jablonski. San Francisco (CA): California Academy of Sciences, 53–92.

Marshack, A., 1997b. The Berekhat ram figurine: a late Acheulian carving from the Middle East. *Antiquity* 71, 327–37.

Marwick, B., 2003. Pleistocene exchange networks as evidence for the evolution of language. *Cambridge Archaeological Journal* 13(1), 67–81.

McBrearty, S. & A.S. Brooks, 2000. The revolution that wasn't: a new interpretation of the origin of modern human behaviour. *Journal of Human Evolution* 39(5), 453–563.

McBryde, I., 1987. Goods from another country: exchange networks and the people of the Lake Eyre Basin, in *Australians to 1788*, eds. D.J. Mulvaney & J.P. White. Broadway: Fairfax, Syme & Weldon, 252–73.

McNiven, I.J., 2000. Backed to the Pleistocene. *Archaeology in Oceania* 35, 48–52.

Mellars, P., 1989a. Major issues in the emergence of modern humans. *Current Anthropology* 30, 349–85.

Mellars, P., 1989b. Technological changes at the Middle-Upper Palaeolithic transition: economic, social and cognitive perspectives, in *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*, eds. P. Mellars & C. Stringer. Edinburgh: Edinburgh University Press, 338–65.

Mellars, P., 1996. *The Neanderthal Legacy: an Archaeological Perspective from Western Europe*. Princeton (NJ): Princeton University Press.

Mellars, P., 1998. Modern humans, language, and the 'Symbolic Explosion'. *Cambridge Archaeological Journal* 8(1), 88–90.

Mellars, P. & C. Stringer (eds.), 1989. *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*. Edinburgh: Edinburgh University Press.

Mithen, S., 1996. *The Prehistory of the Mind: a Search for the Origins of Art, Religion and Science*. London: Thames & Hudson.

Moore, M.W., 2003a. Australian Aboriginal blade production methods on the Georgina River, Camooweal, Queensland. *Lithic Technology* 28(1), 35–63.

Moore, M.W., 2003b. Australian Aboriginal biface reduction techniques on the Georgina River, Camooweal, Queensland. *Australian Archaeology* 56, 22–34.

Moore, M.W., 2004. The tula adze: manufacture and purpose. *Antiquity* 78, 61–73.

Morse, K., 1993. Shell beads from Mandu Mandu Creek rock shelter, Cape Range Peninsula, Western Australia, dated before 30,000 bp. *Antiquity* 67, 877–83.

Morwood, M.J., 2002. *Visions from the Past: the Archaeology of Australian Aboriginal Art*. Crow's Nest: Allen & Unwin.

Morwood, M.J. & D.R. Hobbs, 1995. Themes in the prehistory of tropical Australia, in *Transitions*: *Pleistocene to Holocene in Australia and Papua New Guinea*, eds. J. Allen & J.F. O'Connell. *Antiquity* special number 265, 747–68.

Morwood, M.J. & P.J. Trezise, 1989. Edge-ground axes in Pleistocene greater Australia: new evidence from S.E. Cape York Peninsula. *Queensland Archaeological Research* 6, 77–90.

Morwood, M.J., D.R. Hobbs & D.M. Price, 1995. Excavations at Sandy Creek 1 and 2, in *Quinkan Prehistory: the Archaeology of Aboriginal Art in S.E. Cape York Peninsula, Australia*, eds. M.J. Morwood & D.R. Hobbs. *Tempus* 3. St Lucia: Anthropology Museum, University of Queensland, 71–92.

Mulvaney, D.J., 1962. Advancing frontiers in Australian archaeology. *Oceania* 33(2), 135–8.

Murray, P. & G. Chaloupka, 1984. The Dreamtime animals: extinct megafauna in Arnhem Land rock art. *Archaeology in Oceania* 19(3), 105–16.

Nelson, D.E., 1993. Second thoughts on a rock-art date. *Antiquity* 67, 893–5.

Nobbs, M. & R. Dorn, 1993. New surface exposure ages for petroglyphs from the Olary Province, South Australia. *Archaeology in Oceania* 28(1), 18–39.

Noble, W. & I. Davidson, 1996. *Human Evolution, Language and Mind: a Psychological and Archaeological Inquiry*. Cambridge: Cambridge University Press.

O'Connell, J.F. & F.J. Allen, 1998. When did humans first arrive in Greater Australia, and why is it important to know? *Evolutionary Anthropology* 6, 132–46.

O'Connor, S., 1995. Carpenter's Gap Rockshelter 1: 40,000 years of Aboriginal occupation in the Napier Ranges, Kimberley, W.A. *Australian Archaeology* 40, 58–60.

O'Connor, S., 1999. *30,000 years of Aboriginal Occupation: Kimberley, North West Queensland*. Canberra: Australian National University.

O'Connor, S. & J. Chappell, 2003. Colonisation and coastal subsistence in Australia and Papua New Guinea: different timing, different modes, in *Pacific Archaeology: Assessments and Prospects. Proceedings of the International Conference for the 50th Anniversary of the First Lapita Excavation (July 1952), Koné-Nouméa 2002*, ed. C. Sand. Nouméa: Le Cahiers de l'Archéologie en Nouvelle-Calédonie 15, 15–32.

O'Connor, S. & B. Fankhauser, 2001. Art at 40,000 bp.? One step closer, an ochre covered rock from Carpenter's Gap Shelter 1, Kimberley region, W.A., in *Histories of Old Ages: Essays in Honour of Rhys Jones*, eds. A. Anderson, I. Lilley & S. O'Connor. Canberra: Pandanus Books, 287–300.

O'Connor, S., P. Veth & A. Barham, 1999. Cultural versus natural explanations for lacunae in Aboriginal occupation deposits in northern Australia. *Quaternary International* 59, 61–70.

Ouzman, S., P.S.C. Taçon, K. Mulvaney & R. Fullagar, 2002. Extraordinary engraved bird track from North Australia: extinct fauna, Dreaming Being and/or aesthetic masterpiece? *Cambridge Archaeological Journal* 12(2), 103–12.

Pardoe, C., 1988. The cemetery as symbol. The distribution of prehistoric Aboriginal burial grounds in southeastern Australia. *Archaeology in Oceania* 23(1), 1–16.

Pettitt, P. & P. Bahn, 2003. Current problems in dating Palaeolithic cave art: Candamo and Chauvet. *Antiquity* 77(295), 134–41.

Pfeiffer, J.E., 1982. *The Creative Explosion: an Inquiry into the Origins of Art and Religion*. New York (NY): Harper & Row.

Pretty, G.L., 1977. The cultural chronology of the Roonka Flat, a preliminary consideration, in *Stone Tools as Cultural Markers: Change, Evolution and Complexity*, ed. R.V.S. Wright. Canberra: Australian Institute of Aboriginal Studies, 288–331.

Roberts, R.G., R. Jones & M.A. Smith, 1990. Thermoluminescence dating of a 50,000-year-old human occupation site in northern Australia. *Nature* 345(6271), 153–6.

Roberts, R.G., R. Jones & M.A. Smith, 1993. Optical dating at Deaf Adder Gorge, Northern Territory, indicates human occupation between 53,000 and 60,000 years ago. *Australian Archaeology* 37, 58.

Roberts, R.G., R. Jones, N.A. Spooner, M.J. Head, A.S. Murray & M.A. Smith, 1994. The human colonization of Australia: optical dates of 53,000 and 60,000 years bracket human arrival at Deaf Adder Gorge, Northern Territory. *Quaternary Science Reviews* 13, 575–83.

Roberts, R.G., G. Walsh, A. Murray, J. Olley, R. Jones, M. Morwood, C. Tuniz, E. Lawson, M. Macphail, D. Bowdery & I. Naumann, 1997. Luminescence dating of rock art and past environments using mud-wasp nests in northern Australia. *Nature* 387(12), 696–9.

Roberts, R.G., R. Jones & M.A. Smith, 1998a. Beyond the radiocarbon barrier in Australian prehistory, in *Archaeology of Aboriginal Australia: a Reader*, ed. T. Murray. St Leonards: Allen & Unwin, 19–25.

Roberts, R.G., H. Yoshida, H., R. Lastett, R. Jones & M.A. Smith, 1998b. Single-aliquot and single grain optical dating confirm thermoluminescence age estimates at Malakunanja II rock shelter in northern Australia. *Ancient TL* 16, 19–24.

Roberts, R.G., H. Yoshida, J.M., Olley, M. Ashton, E.M., Lawson, G.L. Walsh, G. Chaloupka, N.G. White, B. Meehan & R. Jones, 2003. Optical Dating of Fossil Mud-wasp Nests and Associated Rock Art in Northern Australia: Implications for the Antiquity of Modern Human Behaviour. Paper presented at Modern Human Origins: Australian Perspectives conference, 29–30 September 2003, University of New South Wales, Sydney, Australia.

Ronen, A., 1998. Domestic fire as evidence for language, in *Neandertals and Modern Humans in Western Asia*, eds. T. Akazawa, K. Aoki & O. Bar-Yosef. New York (NY): Plenum Press, 439–48.

Rosenfeld, A., 1993. A review of the evidence for the emergence of rock art in Australia, in *Sahul in Review: Pleistocene Archaeology in Australia, New Guinea and Island Melanesia*, eds. M.A. Smith, M. Spriggs & B. Fankhauser. Canberra: The Australian National University, 71–80.

Rosenfeld, A., D. Horton & J. Winter, 1981. *Early Man in North Queensland: Art and Archaeology in the Laura Area*. Canberra: The Australian National University.

Rosenfeld, A. & M.A. Smith, 2002. Rock-art and the history of Puritjarra rock shelter, Cleland Hills, Central Australia. *Proceedings of the Prehistoric Society* 68, 103–24.

Schrire, C., 1982. *The Alligator Rivers: Prehistory and Ecology in Western Arnhem Land*. Canberra: Australian National University.

Shea, J.J., 2003. Neandertals, competition, and the origin of modern human behavior in the Levant. *Evolutionary Anthropology* 12, 173–87.

Shennan, S., 2001. Demography and cultural innovation: a model and its implications for the emergence of modern human culture. *Cambridge Archaeological Journal* 11(1), 5–16.

Skoyles, J.R. & D. Sagan, 2002. *Up from Dragons: the Evolution of Human Intelligence*. New York (NY): McGraw-Hill.

Smith, M.A. & N.D. Sharp, 1993. Pleistocene sites in Australia, New Guinea and Island Melanesia: geographic and temporal structure of the archaeological record, in *Sahul in Review: Pleistocene Archaeology in Australia, New Guinea and Island Melanesia*, eds. M.A. Smith, M. Spriggs & B. Fankhauser. Canberra: The Australian National University, 37–59.

Smith, M.A., B. Fankhauser & M. Jercher, 1998. The changing provenance of red ochre at Puritjarra rock shelter, Central Australia: Late Pleistocene to present. *Proceedings of the Prehistoric Society* 64, 275–92.

Stepanchuk, V.M., 1993. Prolom II, a Middle Palaeolithic cave site in the Eastern Crimea with non-utilitarian bone artefacts. *Proceedings of the Prehistoric Society* 59, 17–37.

Stiner, M.C., 2002. Carnivory, coevolution, and the geographic spread of the genus *Homo*. *Journal of Archaeological Research* 10(1), 1–63.

Stiner, C., N.D. Munro & T.A. Surovell, 2000. The tortoise and the hare: small-game use, the broad-spectrum revolution, and Paleolithic demography. *Current Anthropology* 41(1), 39–73.

Stringer, C., 2001. Modern human origins — distinguishing the models. *African Archaeological Review* 18(2), 67–75.

Stringer, C. & C. Gamble, 1993. *In Search of the Neanderthals: Solving the Puzzle of Human Origins*. London: Thames & Hudson.

Taçon, P.S.C. & S. Brockwell, 1995. Arnhem Land prehistory in landscape, stone and paint, in *Transitions*: *Pleistocene to Holocene in Australia and Papua New Guinea*, eds. J.

Allen & J.F. O'Connell. *Antiquity* special number 265, 676–95.

Taçon, P.S.C. & C. Chippindale, 2002. Changing Places: North Australian Rock-art Transformations 4000–6000 bp. Paper presented at the Ninth International Conference on Hunting and Gathering Societies, Heriott-Watt University, Edinburgh, Scotland.

Taçon, P.S.C., M. Wilson & C. Chippindale, 1996. Birth of the Rainbow Serpent in Arnhem Land rock art and oral history. *Archaeology in Oceania* 31, 103–24.

Taçon, P.S.C., K. Mulvaney, R. Fullagar & L. Head, 1999. 'Bradshaws' — an eastern province? *Rock Art Research* 16(2), 127–9.

Tattersall, I., 1998. *Becoming Human: Evolution and Human Uniqueness*. New York (NY): Harcourt Brace & Company.

Thorne, A., R. Grün, G. Mortimer, N. Spooner, J. Simpson, M. McCulloch, L. Taylor & D. Curnoe, 1999. Australia's oldest human remains: age of the Lake Mungo 3 skeleton. *Journal of Human Evolution* 36(6), 591–612.

Tibbett, K., 2002. Archaeological analysis of stone axe exchange networks in the Lake Eyre Basin during the mid- to late Holocene. *Australian Archaeology* 55, 22–9.

Turney, C.S.M., M.I. Bird, L.K. Fifield, R.G. Roberts, M. Smith, C.E. Dortch, R. Grün, E. Lawson, L.K. Ayliffe, G.H. Miller, J. Dortch & R.G. Cresswell, 2001. Early human occupation at Devil's Lair, southwestern Australia 50,000 years ago. *Quaternary Research* 55, 3–13.

Vanderwal, R. & R. Fullagar, 1989. Engraved *Diprotodon* tooth from the Spring Creek locality, Victoria. *Archaeology in Oceania* 24, 13–16.

Vishnyatsky, L.B., 1994. 'Running ahead of time' in the development of Palaeolithic industries. *Antiquity* 68, 134–40.

Wadley, L., 2001. What is cultural modernity? A general view and a South African perspective from Rose Cottage Cave. *Cambridge Archaeological Journal* 11(2), 201–21.

Wall, J.D. & M. Przeworski, 2000. When did the human population size start increasing? *Genetics* 155(4), 1865–74.

Walsh, G.L., 1994. *Bradshaws: Ancient Rock Paintings of North-West Australia*. Geneva: Carouge.

Ward, G.K. & C. Tuniz (eds.), 2000. *Advances in Dating Australian Rock-Markings: Papers from the First Australian Rock-Picture Dating Workshop*. (Australian Rock Art Research Association, Occasional Publication 10.) Melbourne: Australian Rock Art Research Association.

Watchman, A., 1993a. The use of laser technology in rock art dating. *The Artefact* 16, 39–45.

Watchman, A., 1993b. Evidence of a 25,000-year-old pictograph in Northern Australia. *Geoarchaeology* 8(6), 465–73.

Watchman, A., G.L. Walsh, M.J. Morwood & C. Tuniz, 1997. AMS radiocarbon dating age estimates for early rock paintings in the Kimberley, NW Australia: preliminary results. *Rock Art Research* 14, 18–26.

Watchman, A., P. Taçon, R. Fullagar & L. Head, 1999. Minimum ages for pecked rock markings from Jinmium, north western Australia. *Archaeology in Oceania* 35, 1–10.

Watkins, T., 2000. The Neolithic Revolution and the Emergence of Humanity: a Cognitive Approach to the First Comprehensive World View. Paper presented at the conference on The Transmission and Assimilation of Culture in the Near East, Council for British Research in the Levant, Jerusalem, February 2000.

Watkins, T., 2001. The Beginning of Religion at the Beginning of the Neolithic. Paper presented at the Liverpool conference of BANEA, the British Association for Near Eastern Archaeology, January 2001.

White, R., 1982. Rethinking the Middle/Upper Paleolithic Transition. *Current Anthropology* 23(2), 169–92.

White, R., 1989. Production complexity and standardisation in early Aurignacian bead and pendant manufacture: evolutionary implications, in *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*, eds. P. Mellars & C. Stringer. Edinburgh: Edinburgh University Press, 366–90.

Wurz, S., 1999. The Howisesons Poort backed artefacts from Klasies River: an argument for symbolic behaviour. *South African Archaeological Bulletin* 54, 38–50.

Wynn, T. & F.L. Coolidge, 2004. The expert Neandertal mind. *Journal of Human Evolution* 46, 467–87.

Author biographies

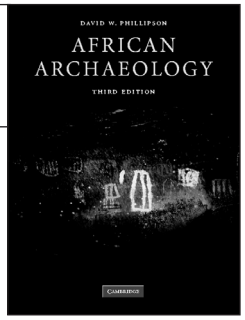
Adam Brumm is a doctoral candidate in archaeology at the Australian National University in Canberra. His research focuses on the Palaeolithic stone technologies of Island Southeast Asia, with specific emphasis on Lower Pleistocene sites in the Soa Basin of central Flores, Indonesia. He has also conducted fieldwork in south India and northern Australia.

Mark Moore is a doctoral candidate in archaeology at the University of New England, Armidale. His dissertation models stone-knapping techniques in the context of hominin cognitive evolution with special reference to the flaking technology of *Homo floresiensis*. He has conducted fieldwork and lithic analyses in North America, Australia, and Indonesia.

CAMBRIDGE

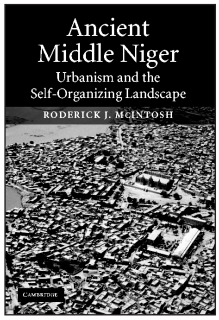
Essential Archaeology

textbook



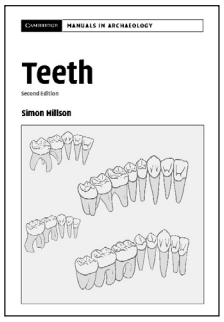
African Archaeology

Third edition
David W. Phillipson
In this fully revised and expanded edition of his seminal archaeological survey, David Phillipson presents a lucid, fully illustrated account of African prehistory.
£65.00 | HB | 404pp
£24.99 | PB



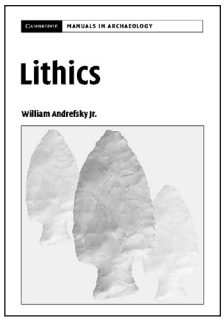
Ancient Middle Niger

Urbanism and the Self-organizing Landscape
Roderick J. McIntosh
Survey of the emergence of the ancient urban civilization of Middle Niger.
Case Studies in Early Societies, 7
£50.00 | HB | 282pp
£19.99 | PB



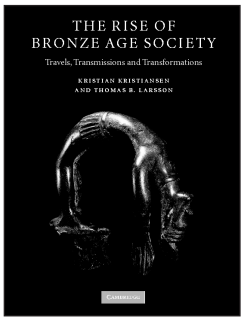
Teeth

Second edition
Simon Hillson
An examination of dental studies in archaeology and related disciplines.
Cambridge Manuals in Archaeology
£75.00 | HB | 387pp
£30.00 | PB



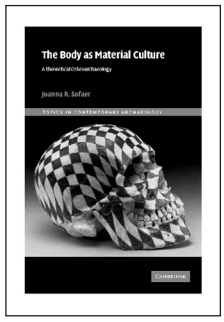
Lithics

Macroscopic Approaches to Analysis
Second edition
William Andrefsky, Jr
Completely updated and revised edition on the groundbreaking manual on stone artifact analysis, Lithics.
Cambridge Manuals in Archaeology
£50.00 | HB | 306pp
£24.99 | PB



The Rise of Bronze Age Society

Travels, Transmissions and Transformations
Kristian Kristiansen and Thomas B. Larsson
Presents a significant new interpretation of the social transformation in Bronze Age Europe.
£50.00 | HB | 418pp
£24.99 | PB



The Body as Material Culture

A Theoretical Osteoarchaeology
Joanna R. Sofaer
Examines the two distinct approaches taken when examining archaeological remains, one based on science, the other on social theory.
Topics in Contemporary Archaeology, 4
£45.00 | HB | 228pp
£17.99 | PB

www.cambridge.org

CAMBRIDGE UNIVERSITY PRESS