The reason we have little evidence of symbolic behaviour dating to the last ice age is due to strong taphonomic influences. Use archaeological evidence to support or challenge this statement.

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Abstract

Of about 200 Pleistocene sites of the former landmass of Sahul, discovered by archaeologists within a variety of landforms and environmental zones, only 40% of the artefacts are symbolic in nature. The understanding of symbolic behaviour comes from seemingly sparse evidence, typically in the form of organic artefacts. The role of taphonomic influences on the aforementioned artefacts need to be assessed when studying human behaviours of the Pleistocene, as should other factors which result in the small amount of evidence from the archaeological record, such as archaeological sampling. Results indicate that taphonomy plays a major role in the scarcity of symbolic artefacts, as does the sampling techniques used by archaeologists both within Greater Australia and across the world.

Although the Sahul landmass was colonised around 50-45k years ago, there is surprisingly little evidence of human symbolic behaviour from the last Ice Age in Australia. Taphonomy, the processes that result in the burial of materials, is a likely reason for this lack of artefactual evidence. Strong taphonomy may be responsible for the scant remains from the Pleistocene. In the lead up to the Holocene, rising sea levels submerged over a third of the continent. The depositional environment is affected by geology, sedimentology, climate and location, and is part of the taphonomic process which biases the archaeological record by determining which artefacts are destroyed and which remain to be excavated. Artefacts of textile and wood are the most perishable materials, followed by other organic items such as shell, ochre and bone, with stone being the most resilient to these taphonomic pressures. Since much of the evidence of symbolic behaviour is comprised of organic materials, taphonomic influences have had a great impact on their survival rate, so that much of the number and variety of symbolic behavioural items used by the peoples of Greater Australia have been greatly reduced by taphonomic processes over the millennia. Archaeological techniques also impact the recovery of symbolic artefacts. Archaeological sampling, the process of selecting sites for fieldwork, determines whether surviving evidence of symbolic behaviour becomes part of the archaeological record. The reason we have little evidence of symbolic behaviour dating to the last Ice Age is therefore a combination of both strong taphonomic influences and the sampling techniques used by archaeologists to recover these artefacts.

What survives of the symbolic artefacts of the last Ice Age is only a remnant of that which was used by the Pleistocene people throughout Sahul. These symbolic artefacts, which have been found at over 200 sites around Sahul, include human burial, pigmentation, ornamentation, rock art and skulls with signs of deliberate cranial deformation (Table 1), each exhibiting signs of regional uniqueness (Hiscock 2010, p. 110). Artefacts occur in various forms such as tiny beads, ochre pieces, human bones and engraved or painted

artwork. As Langley, Clarkson and Ulm have catalogued (2011, p. 199), only 124 instances of symbolic behaviour have been recovered from 40% of Pleistocene sites, the earliest dated to around 45k years. When compared with 336 instances of technological, exploitative or explorational artefacts found at Pleistocene sites, it becomes clear that only just over a quarter of the artefacts relate to symbolic behaviour. The lack of symbolic artefactual material during this period could be linked to population growth or demography (Veth *et al*. 2011, p. 206), or issues with archaeological sampling (Habgood and Franklin 2008, p. 211; Langley, Clarkson and Ulm 2011, pp. 203-204). 59% of artefacts recovered from the aforementioned sites were organic. However, due to the fragile nature of organic artefacts, it is likely that there were many more Pleistocene artefacts in the original assemblage which did not survive the ages (Langley, Clarkson and Ulm 2011, p. 202). As such, taphonomy certainly influences the number of organic symbolic artefacts of the Pleistocene record.

Principle	Category	Symbolic Evidence	Number of instances recorded in Sahul
Symbolic Behaviour, abstract thought & innovativeness	Social communication, art, ritual behaviour	Burial	20
		Pigment	63
		Ornamentation	13
		Rock Art	22
		Intentional Cranial Deformation	6
		Total	**124**

Table 1: Archaeological instances of complex behaviour in Sahul (after Langley, Clarkson and Ulm 2011, p. 199), with Notational Pieces removed due to their questionable nature (Habgood and Franklin 2008, pp. 195-196).

Taphonomic processes also include trampling, cooking (heating at hearths), weathering and decay of artefacts within a deposit (Hiscock 1985, p. 84). The geology, sedimentology and moisture level of sites also influences artefacts in dynamic ways (Henshilwood and Marean 2003, p. 634; Figure 2) and can preserve, alter or even destroy artefacts (Bednarik 1994, p. 68; Cosgrove 1995, p. 128; Hiscock 1985, p. 83). Thus, older sites are more likely

to be affected than younger sites, which introduces bias to the archaeological record (Perreault 2011, p. 50). Langley, Clarkson and Ulm (2011, p. 205; Figure 1) have suggested that a gradual increase in evidence from the early Pleistocene onwards reveals a taphonomic curve which illustrates this bias. Since the last Ice Age (c. 1.5m-10k years) (Sharp 1988, p. 170), taphonomic influence on artefactual remains can be expected, especially on those relating to human symbolic behaviour during the Pleistocene. One of the strongest taphonomic influences on the archaeological record of Greater Australia was the ocean.

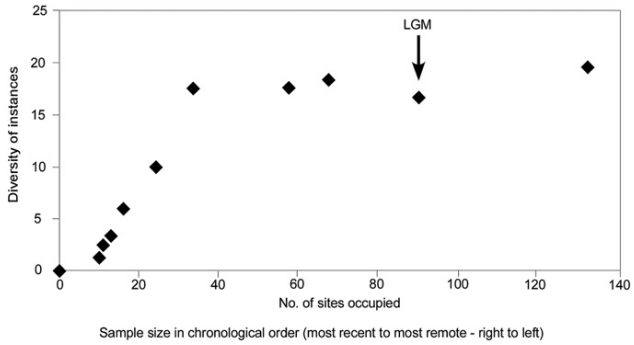

Figure 1: Correlation between the diversity of instances and the chronological order of sites where artefacts have been recovered (Langley, Clarkson and Ulm 2011, p. 205).

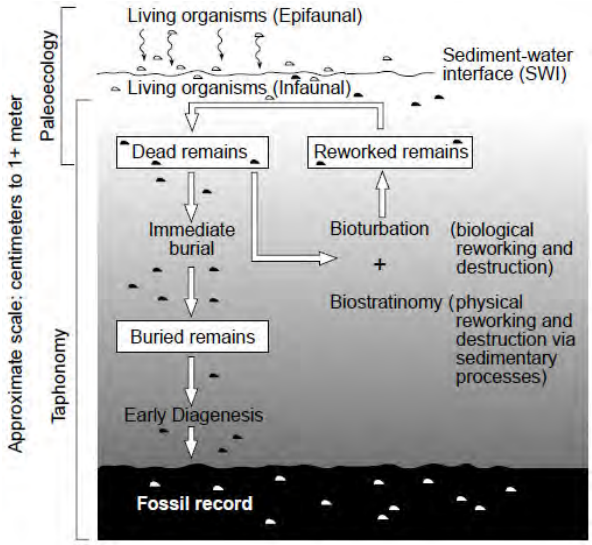

Figure 2: The processes of taphonomy on paleoecology – note the dynamic recycling of remains before final destruction or burial (Martin 1999, p. 2).

During the Pleistocene, Australia, New Guinea and Tasmania were one landmass, known as Sahul (Figure 3), but sea levels rose, separating mainland Australia from New Guinea and Tasmania when the Ice Age ended. Earlier coastal and low-lying sites "have been covered by rising sea levels or sand dune movement, or destroyed by weathering and erosion" (Habgood and Franklin 2008, p. 203). As Martin (1999, p. 13) notes, taphonomic loss is most severe in shallow-water marine environments. Dortch's investigation at Lake Jasper (1997) suggests that, while non-organic artefacts have survived, few organic artefacts were found under water. The likelihood of finding surviving symbolic artefacts in the ocean is clearly limited. As Sahul was about 35% larger than Australia today (Allen and O'Connell 1995), many potential sites containing evidence of symbolic behaviour are now beyond the reach of archaeological investigation.

Sahul's climate can also be hostile to the preservation of organic artefacts. According to Langley, Clarkson and Ulm (2011, p. 203), climate affects the survival of ancient sites, (Figure 3) as limestone shelters in equatorial, arid or temperate zones offer the best preservation. Rockshelters and caves thus afford good protection to organic artefacts; lunettes, wetlands and swamps, open sites, and alluvial terraces, offer reasonable protection, depending on the deposition of the area; while coastal dunes provide the lowest rate of preservation (Figure 4). Past climatic zones also affected the survival of sites. Good preservation rates of organic artefacts are found in equatorial, grassland, desert and temperate regions (Figure 5). Most Pleistocene sites are located in grassland and temperate areas, and in the equatorial north of Sahul, "where proportions of organic artefacts actually exceed those of inorganic artefacts" (Langley, Clarkson and Ulm 2011, p. 203). In sub-tropical regions and areas of climate hostile to the preservation of archaeological material, artefacts and whole sites may have been destroyed by such environmental conditions.

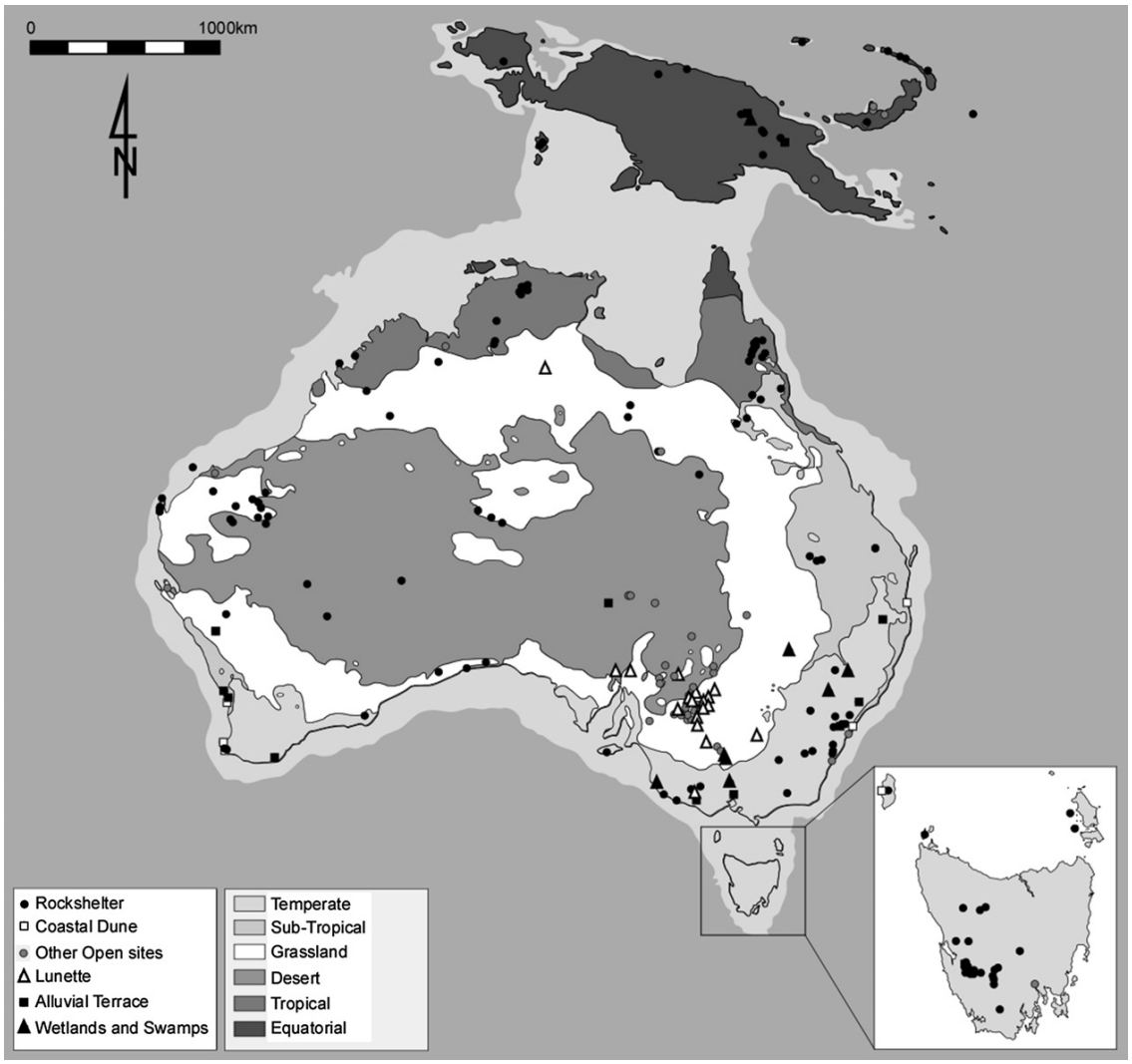

Figure 3: Distribution of Sahul Pleistocene sites showing location of environmental zones. Inset: Tasmania (Langley, Clarkson and Ulm 2011, p. 200).

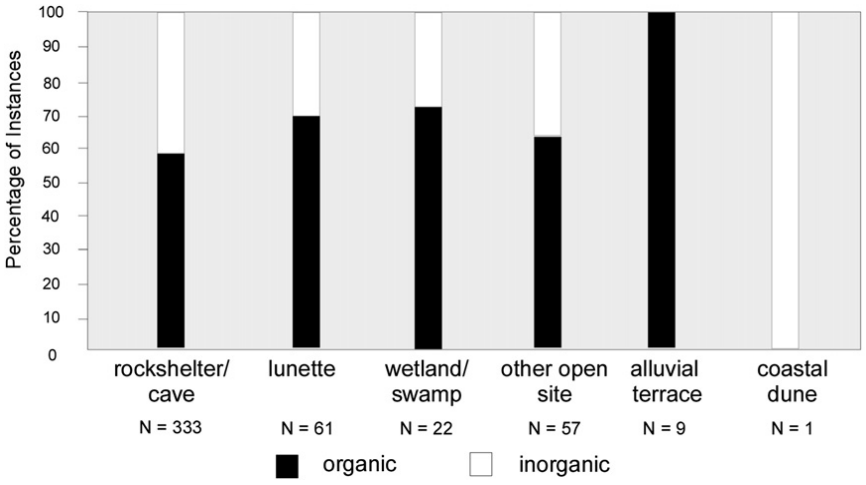

Figure 4: Comparison of the numbers of organic versus inorganic instances in each landform (Langley, Clarkson and Ulm 2011, p. 202).

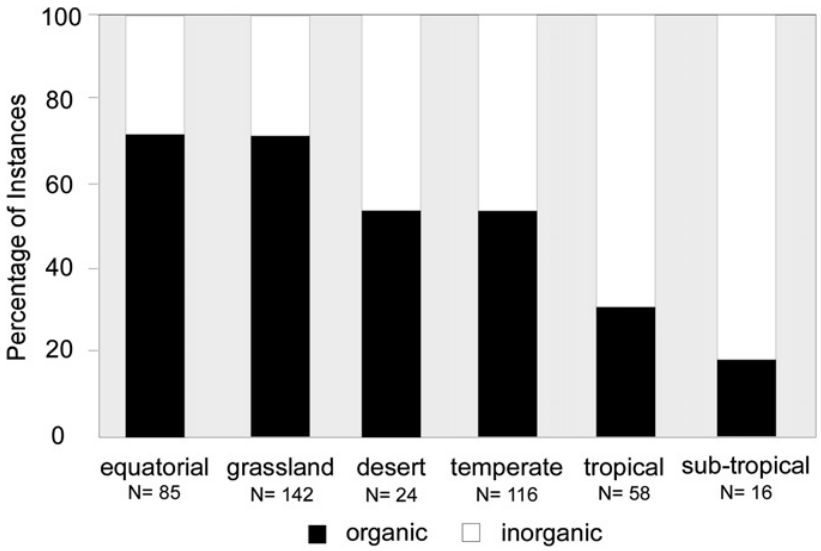

Figure 5: Comparison of organic and inorganic instances found in each environment (Langley, Clarkson and Ulm 2011, p. 203).

Surviving symbolic artefacts have been found at land-based locations around Greater Australia. Ice Age burials in Sahul (Table 1) were commonly found in sands or lunettes associated with lakes or waterways, although one was discovered within a cave at Liang Lemdubu on the Aru Islands to the north of Australia (Habgood and Franklin 2008, p. 202). The oldest ceremonial burials have been found at Lake Mungo (c. 40k years) in Australia's southeast; a cremation (LM1) and an ochre-powdered body (LM3, Plate 1) (Brumm and Moore 2005, p. 165; Habgood and Franklin 2008, p. 201; Langley, Clarkson and Ulm 2011, p. 200). The stratigraphy of the Lake Mungo region consists of lunettes, a landform in which organic evidence is commonly found, and may be a contributing factor to the greater incidence of burial finds in the southeast (Langley, Clarkson and Ulm 2011, p.202; Figure 5). Elsewhere in the world, late Pleistocene cemeteries have been found in caves and rockshelters within temperate or arid zones such as at Arene Candide cave and Matjes River rockshelter (Table 2). This is "the result of extraordinarily favourable taphonomic contexts" (Conard 2005, p. 309), which is true of all Pleistocene burial finds. Nawrocki (1991) discussed taphonomic issues affecting historic cemeteries, such as flooding, erosion, vegetation encroachment and burrowing animals, which also affects

Pleistocene burials. Caves, rockshelters, lunettes and sand ridges associated with waterways offer the best preservation of Pleistocene burials, and those in other archaeological contexts may be lost to taphonomy. Depositional and dynamic taphonomic influences have clearly affected the number of burial finds from the Ice Age.

Site	Landform	Climate	Location
Liang Lemdubu	Cave	Equatorial	Aru Islands
Lake Mungo	Lunette	Arid	western New South Wales
Nacurrie	Creek sand ridge	Grassland	southwest New South Wales
Coobool Creek	Creek sand ridge	Grassland	southwest New South Wales
Lake Tandou	Lunette	Arid	southwest New South Wales
Kow Swamp	Lunette	Grassland	northern Victoria
Keilor	Creek sand ridge	Temperate	Victoria
Arene Candide	Cave	Temperate	Liguria, Italy
Grotta Romanelli	Cave	Temperate	Apulia, Italy
Grotta Polesini	Cave	Temperate	Latium, Italy
Raqefet	Cave	Arid	Mount Carmel, Israel
Matjes River	Rockshelter	Arid	South Africa
Oakhurst	Cave	Arid	South Africa
Taforalt	Cave	Arid	Morocco
Marmes	Rockshelter	Temperate	Washington State, America

Table 2: Pleistocene burials and cemeteries (after Habgood and Franklin 2008, p. 202; Pettitt 2010, pp. 249-259; Smith *et al.* 2002, p. 1184, Fig. 15; Figure 3).

Plate 1: Lake Mungo 3 burial. Note red ochre stains in the sand around the skeleton and the skeleton's clasped hands (Bowler & Thorne 1976, cover).

Ochre is a natural pigment identified as a mark of symbolic behavioural due to its use in artwork such as finger markings and paintings (Habgood and Franklin 2008, p. 196). Compared with engraved art, the organic nature of this material has caused its low survival rate (Balmea *et al*. 2009, p. 64), yet it has the highest longevity of all pigments used by the Pleistocene artists of Sahul (Bednarik 1994, p. 70). Different colours of ochre have been found at Malangangerr rockshelter (c. 24-18k years), in the tropical north of Sahul. Ochre has been recovered mainly from caves and rockshelters through the tropical north to the temperate south, within lunettes at Lake Mungo, and at the open Cuddie Springs site (Habgood and Franklin 2008, pp. 196-199). The protection offered by these landforms creates better conditions for preservation of organic artefacts (Figure 5). Elsewhere, pigments have been found at caves and rockshelters suitable for their preservation, situated in temperate and desert zones, like Hollow Rock Shelter and Pech de L'Azé (Table 3). Despite its seeming fragility under taphonomic influences, ochre is the most abundant form of symbolic evidence of behaviour in the Pleistocene (Table 1).

Site	Landform	Climate	Location
Carpenter's Gap	Rockshelter	Tropical	western Kimberley
Riwi Cave	Cave	Grassland	southern Kimberley
Malangangerr	Rockshelter	Tropical	Arnhem Land
Nawamoyn & Nauwalabila I	Rockshelter	Tropical	Arnhem Land
Mandu Mandu Creek	Rockshelter	Grassland	northwestern Australia
Puritjarra	Rockshelter	Arid	central Australia
Lake Mungo	Lunette	Arid	western New South Wales
Devil's Lair	Cave	Temperate	southwestern Australia
Cuddie Springs	Open Site	Grassland	western New South Wales
Wargata Mina, Ballawinne & Keyhole Cavern	Cave	Temperate	southwest Tasmania
Twin Rivers	Cave	Arid	Zambia
Klasies River	Caves	Arid	South Africa
Hollow Rock Shelter	Rockshelter	Arid	South Africa
Peers Cave	Cave	Arid	South Africa
Blombos Cave	Cave	Arid	South Africa
Diepkloof	Rockshelter	Arid	South Africa
Apollo 11	Cave	Arid	Namibia
Qafzeh	Cave	Arid	Israel
Pech de l'Azé	Cave	Temperate	France

Table 3: Sites of Pleistocene ochre and pigment finds (after Conard 2005, pp. 309-310; Habgood and Franklin 2008, p. 198; Smith *et al.* 2002, p. 1184, Fig. 15; Figure 3).

After ochre, the most common evidence of symbolic behaviour in the archaeological record is rock art. Although difficult to date, rock art dating techniques are based on the subject matter of the artwork or on archaeological deposit samples (Habgood and Franklin 2008, p. 197). One of the oldest art styles is the 'archaic faces' motif (Plate 2), engravings found within the western and central arid region of Sahul. Geological alteration of the rock and heavy weathering suggest a date of c. 25-10k years for engravings found within a semipermanent rock hole in Cleland Hills (McDonald 2005, pp. 129-130). At Early Man cave in northern Queensland, charcoal recovered from engravings led scientists to assign the artwork a minimum date of c. 13k years (Habgood and Franklin 2008, p. 199). Rock art (Table 4) also provides evidence of a diverse Pleistocene material culture which has not survived taphonomic processes, including wooden artefacts, clothing, headdresses and other textiles (Langley, Clarkson and Ulm 2011, p. 201). Taphonomic influences affect permanent-seeming petroglyphs: those in dry regions survive better than those in humid areas, whilst those within caves or sheltered areas endure over those at more exposed sites (Bednarik 1994, p. 69). Rock art has been found at sites across Australia (Figure 6), yet there are only 22 instances dated to the Ice Age. A wide variety of art, including painted mobile art, carved figurines and rock paintings, come from sites elsewhere in the world. These finds display a similar pattern to that of the previous organic finds as they are mostly found in caves and rockshelters, apart from the open site at Stratzing, within temperate and desert zones (Table 4). Open sites give reasonable protection to organic items. Taphonomic stressors even impact this most enduring form of symbolic evidence.

Site	Landform	Climate	Location
Tari Region	Cave	Equatorial	Papua New Guinea
Carpenter's Gap	Rockshelter	Tropical	western Kimberley
Bradshaw Figures, Kimberly region	Rockshelters	Tropical	Kimberley, Western Australia
Sandy Creek	Rockshelter	Equatorial	Laura region, Queensland
Walkunder Arch Cave	Rockshelter	Tropical	northeastern Queensland
Arnhem Land Sites	Caves	Tropical	Arnhem Land
Puritjarra, Cleland Hills	Rockshelter	Arid	central Australia
Koonalda Cave	Cave	Grassland	South Australia
Wargata Mina, Ballawinne & Keyhole Cavern	Cave	Temperate	southwest Tasmania

Apollo 11	Cave	Arid	Nambia
Tan Tan	Alluvial Terrace	Arid	Morocco
Swabia	Caves	Temperate	Germany
Fumane	Cave	Temperate	Italy
Grotte Chauvet	Cave	Temperate	France
Abri Cellier	Rockshelter	Temperate	France
La Ferrassie	Rockshelter	Temperate	France
Abri Blanchard	Rockshelter	Temperate	France
Abri Castanet	Rockshelter	Temperate	France
Stratzing	Open Site	Temperate	Austria

Table 4: Pleistocene rock art finds within Sahul and art finds elsewhere in the world (after Conard 2005, pp. 313-317; Habgood and Franklin 2008, p. 199; Smith *et al.* 2002, p. 1184, Fig. 15; Figure 3).

Plate 2: Cleland Hills (CH1) archaic face (McDonald 2005, p. 134).

Figure 6: Rock art sites in Australia (Mulvaney and Kamminga 1999, p. 358).

Small pieces of personal adornment are occasionally recovered from Pleistocene sites. These artefacts are typically pierced or drilled beads, or pendants made of shell, tooth, bone or stone dating from c. 40k years (Habgood and Franklin 2008, p. 192; Langley, Clarkson and Ulm 2011, p. 200-201; Plate 3). Such personal adornments have been recovered from cave, rockshelter and lunette landforms from the tropical north to the temperate south (Habgood and Franklin 2008, pp. 194-195; Table 5). Although bone and shell are more likely to be preserved than other organic matter, only a few instances have survived (Langley, Clarkson and Ulm 2011, p. 202). Both the durability and location of these organic pieces were conducive to their survival (Veth *et al.* 2011, 208). Other early evidence for ornamentation, typically materials such as ochre, shell, tooth and ivory, come

from caves and rockshelters in arid and temperate zones which preserve these fragile ornaments, apart from the Kenyan and Tanzanian sites which are both sheltered sites in the tropical zone (Table 5). The delicate nature of these ornaments and the ease of their destruction during taphonomic processes explain why so few have been recovered.

Site	Landform	Climate	Location
Buang Merabak	Cave	Equatorial	New Ireland
Carpenter's Gap	Rockshelter	Tropical	western Kimberley
Riwi Cave	Cave	Grassland	southern Kimberley
Devil's Lair	Cave	Temperate	southwestern Australia
Kow Swamp	Lunette	Grassland	northern Victoria
Allen's Cave	Cave	Grassland	Nullarbor Plain, S.A.
Blombos	Cave	Arid	South Africa
Enkapune Ya Muto	Cave	Tropical	Kenya
Mumba	Cave	Tropical	Tanzania
Qafzeh	Cave	Arid	Israel
Ksar Akil	Rockshelter	Arid	Lebanon
Üçagizli	Cave	Arid	Turkey
Riparo Mochi	Rockshelter	Temperate	Italy
Grotte du Renne	Cave	Temperate	France
Swabia	Caves	Temperate	Germany

Table 5: Pleistocene sites where ornamentation has been discovered (after Conard 2005, pp. 311-313; Habgood and Franklin 2008, pp. 194-195; Smith *et al.* 2002, p. 1184, Fig. 15; Figure 3).

Plate 3: Cone shell beads from Mandu Mandu Creek rockshelter, central Western Australia (Habgood and Franklin 2008, p. 196).

The final indication of symbolic behaviour during the Pleistocene is intentional cranial deformation, otherwise known as head binding or head flattening. A few instances of intentional skull modification were found in the Murray River Valley area, dating from c. 15k years (Langley, Clarkson and Ulm 2011, p. 201). The people of these areas are thought to have practiced cranial deformation as an "example of a system to enforce group identity and distinguish one group from another in a region experiencing population pressure" (Habgood and Franklin 2008, p. 215). Out of approximately 100 burials in the Kow Swamp and Coobool Creek regions, only eight individuals had deliberate cranial deformation through a process of 'head pressing': three from Coobool Creek, three from Kow Swamp (including the Cohuna cranium) and two from Nacurrie, while five others from Kow Swamp and Coobool Creek showed possible signs of cranial modification (Table 6). This is a remarkably small number of individuals physically changed in this manner over the course of approximately 5,000 years. Whilst it is possible to reconstruct the attributes of some damaged skulls (Brown 2010, p. 171; Plate 4), bone can also be taphonomically damaged or completely broken down (White, Black and Folkens 2012, p. 462). Diagnostic features of cranial modification may therefore be unidentifiable, or the body may have completely broken down due to its depositional environment. It is also possible that this was not a wide-spread practice, only adopted within the Murray River Valley. Neanderthal skulls from Shanidar Caves 1 and 5 in Iraq and the cranium from Arene Candide 19 cave in Italy are the only examples of pre-Holocene artificial cranial deformation outside of Sahul and are situated in arid and temperate climactic zones (Table 6). However, as with the Australian examples, this does not seem to have been a wide-spread practice during the Pleistocene. Taphonomic influences on delicate bone, and a short-lived, localised practice, greatly contributes to the scarcity of evidence for this social behaviour in the Greater Australian fossil record.

Site	Landform	Climate	Location
Coobool Creek	Creek sand ridge	Grassland	southwest New South Wales
Nacurrie	Creek sand ridge	Grassland	southwest New South Wales
Kow Swamp	Lunette	Grassland	northern Victoria
Shanidar	Caves	Arid	Iraq
Arene Candide 19	Cave	Temperate	Italy

Table 6: Sites with evidence of intentional cranial modification dated to the Pleistocene (after Antón and Weinstein 1999, p. 197; Brown 1981, p. 165; Meiklejohn *et al.* 1992, p. 84; Smith *et al.* 2002, p. 1184, Fig. 15; Figure 3).

Plate 4: Left lateral and facial views of Nacurrie 1 with digital reconstruction of damaged sections of the skull (Brown 2010, p. 171).

While loss of evidence of symbolic behaviour from the Ice Age can largely be attributed to taphonomy, other factors also influence what is recovered. The evidence that exists today was found in locations which allowed the artefacts the best possible chance of survival (Veth *et al*. 2011, p. 208-209), such as in rockshelters and caves, alluvial terraces and

lunettes (Brumm and Moore 2005, p. 161). There are 223 such sites within Sahul which displayed evidence of complex human behaviour, but only 40% of the finds are classed as symbolic evidence (Langley, Clarkson and Ulm 2011, p. 199). Originally, the percentage would have been greater, except the more fragile organic evidence of symbolic behaviour has been destroyed by taphonomy, as evidenced by the absence of complex behavioural artefacts from 33% of the Pleistocene sites (Langley, Clarkson and Ulm 2011, p. 202). With the end of the Ice Age dated to 10k years, and colonisation dated to at least 45k years, most archaeological evidence covering 35k years of human occupation across the continent has not been recovered. Although intentional cranial modification was probably not widely practiced, this seems less likely for burial, pigmentation or artwork. Langley, Clarkson and Ulm (2011, pp. 203-204) contend that another issue for evidence reaching the archaeological record is archaeological sampling; small excavations and large meshed sieves which can miss artefacts. Additionally, archaeologists must know where to find regularly used Pleistocene sites and to have developed “a precise understanding of sampling and taphonomic issues for Sahul” (Langley, Clarkson and Ulm 2011, p. 205). This includes sample recovery techniques, the excavation volume, sieves used and the sample size itself (Habgood and Franklin 2008, p. 211; Langley, Clarkson and Ulm 2011, pp. 203-204; Perreault 2011, p. 53). Sampling influences the discovery and understanding of past symbolic behaviours as it profoundly affects what is – and isn’t – recovered.

The archaeological record is sensitive to taphonomy, climate zones, landforms and archaeological sampling. The nature of taphonomy means that organic artefacts are less likely to survive than inorganic ones, such as stone (Hiscock 2010, p. 103), and older artefacts are less likely to survive than younger ones. The strongest taphonomic influence, the rising sea-level around Sahul, ensured that many early coastal sites were either completely destroyed or are inaccessible. As most symbolic artefacts are organic, they are highly susceptible to taphonomic effects, and many wooden and textile evidences of

symbolic behaviour have been destroyed. Organic artefacts of symbolism, such as burials, pigment, rock art, ornamentation and evidence of head shaping, all have different rates of survival depending on their locations (Figure 4) and depositional environments (Figure 5). This pattern is repeated outside of Sahul, where symbolic evidence is mostly found in arid and temperate zones within protected rockshelters and caves. This suggests that taphonomy is the major cause for the lack of evidence of Pleistocene behavioural evidence world-wide. During their decision-making process about where to excavate and which sampling techniques to use, archaeologists must consider all of the above influences when investigating symbolic behaviour of the Ice Age. As Brumm and Moore state, “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” (2005, p. 168). The absence of evidence is not evidence that human symbolic behaviour was not widespread across Sahul (Brumm and Moore 2005, p. 169; Davidson 2010, p. S182). It is evident that taphonomic influences, irrespective of their strengths, have biased the archaeological record, so more archaeological research is required to find other artefacts of symbolic Pleistocene behaviour. Taphonomy and archaeological sampling have both contributed to the relatively small amount of instances of symbolic evidence from the Ice Age. What archaeologists unearth after taphonomy has had its destructive way is but a poor reflection of symbolic behaviour as it was lived by the peoples of Ice Age Sahul.

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