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Painted shark vertebrae beads from the Djawumbu–Madjawarrnja complex, western Arnhem Land

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ABSTRACT

In Europe and Africa, fine grained use wear and residue analyses of various organic bead technologies have provided remarkable information about specialist artisans and their affiliate communities. Ethnographic research suggests that personal ornaments represent one of the best ways to explore past human interactions and ethno-linguistic diversity. The study of material culture featured in rock art is now well established in Australia, but few detailed analyses have concentrated on personal ornaments recovered from the archaeological record. Fewer still have assessed the potential of this medium for assessing regional variations, despite rich ethnographic histories which point to the significance of these objects for self-differentiating communities and/or clans. This paper examines a collection of painted shark vertebrae beads recently discovered during archaeological survey in Arnhem Land. Detailed morphometric and use wear analysis is presented for these ornaments, alongside Aboriginal oral traditions, and assessment of similar artefacts held in museum collections across Australia. The potential of this combined approach within the Australian context is discussed, including how these studies add to our understanding of group signifying behaviour.

ARTICLE HISTORY
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Introduction

Personal ornaments (including items termed 'beads' and 'pendants') consist of objects worn on the body and which serve to demonstrate affiliations with or distinctions between members of the same or nearby communities (Wiessner 1983, 1984; Wobst 1977). This behaviour is specific to humans (both Modern Humans and Neanderthals: Bouzouggar et al. 2007; Henshilwood et al. 2004; Morin and Laroulandie 2012; Romandini et al. 2014; Taborin 1987; Zilhão et al. 2010), and has provided archaeologists with numerous insights into the cognitive development, cultural variability and cultural interaction of various communities throughout Africa, Western Asia and Europe (e.g. Álvarez-Fernandez and Joris 2008; Kuhn and Stiner 2007; Vanhaeren and d'Errico 2006; White 2007a, 2007b). Studies have demonstrated the value of detailed analysis of bead assemblages to isolate the 'systemic relationships that existed at an ethno-linguistic level between different [(pre)historic] population clusters' (Vanhaeren and d'Errico 2006:1123; see also Taborin 1987).

In Australia, rock art has been used to establish regionalisation and boundedness of past communities (e.g. David and Lourandos 1998; Mulvaney 2012; Taçon 1993). It has been argued that stylistic 'groups' may have increased during the late Holocene, potentially overlapping with ethno-linguistic regions (e.g. David and Lourandos 1998). Examples of this correlation occur in Northern Australia where rock art style 'boundaries' parallel ethnographically-stated clan groups (David 2002; Taçon 1993). On Cape York, an expansive tradition of engraved geometric figures shifted to a dualistic division of painted motifs, closely correlating with two ethnographically-known regions (David 1991; David and Cole 1990; David and Lourandos 1998). This duality was also observed in a number of other regions of Queensland (Lourandos 1997) and Western Arnhem Land (Taçon 1993, 1994). Furthermore, Taçon (1994:119) observed one case where an ethnographically recorded clan boundary was apparent through a '47 metre non-engraved gap' between two sets of distinctive, totemic motifs.

Similarly, regional variation may occur in material culture distributions as exemplified in the Australian context by Western Australian stone point traditions (Hiscock 1994). Alternatively, distinctive sites and site type combinations may occur as was the case for burials in South East Australia, South East

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Queensland and New South Wales (Barker 2004; Hope and Littleton 1995; Pardoe 1988; Pate 1995; Webb 1989). The establishment of new communities may result in increased territoriality, but also formalised intergroup alliances and social gatherings associated with ceremonies, trade and exchange (David and Lourandos 1998:198; Dortch 2002:13; Lourandos 1997; McNiven 1999:162; McNiven and Feldman 2003:171). The lowering of inter- and intra-community restrictions in particular places and on particular occasions may result in site complexes that include multiple features that are otherwise regionally discrete (Wright 2011).

While a number of publications have incorporated Australian portable art objects in an assessment of human cognitive development (e.g. Balme and Morse 2006; Balme et al. 2009; Brumm and Moore 2005; Davidson 2007; Davidson and Noble 1992; Habgood and Franklin 2008; O'Connell and Allen 2007), temporal and regional variation across the Australian continent has received less attention.

Without providing an exhaustive review of Australian Pleistocene and early Holocene beads, the likes of which have been given by several authors previously (Balme 2000; Balme and Morse 2006; McAdams 2008; Morse 1993), we would like to highlight the pervasiveness of hard animal materials for personal ornaments used in this southern continent. In all confirmed cases of Pleistocene and early Holocene personal ornamentation, it has been marine shell (*Dentalium* sp., *Conus* sp., *Melo* sp., *Nerita* sp., *Geloina* sp., *Anadara* sp., *Hyriidae* sp., scaphopod: as found at Riwi, Mandu Mandu Creek, Carpenter's Gap 1, Cape Range Peninsula, Bundeena, Capertee, Nawamoyn) or terrestrial animal bone or teeth (primarily macropod, but also Dasyurid and *Sarcophagus harrisii*: as found at Devil's Lair, Kow Swamp, Lake Nitchie, Roonka, Cooma, Wallpolla Island) which have been targeted for use (Balme 2000; Balme and Morse 2006; Dortch 1979, 1980; Feary 1996; Harper 1899; Irish 2007; McCarthy 1964; Morse 1993; O'Connor 1995; Pardoe 1995; Pate et al. 1998; Pretty 1977; Przywolnik 2003; Schrire 1982; Figure 1). As recognised by McAdams (2008:15; and in line with European research by Vanhaeren and d'Errico 2006), there is clear evidence for spatial patterning of beads in Australia, along with 'ethnolinguistic associations with bead distributions'.

Taphonomic factors are expected to have significantly influenced the survival of Pleistocene portable art objects within the Australian setting (Langley et al. 2011). It is intriguing, however, that these objects are also poorly represented in published Holocene archaeologies. The paucity of published articles runs contrary to the rock art, which provides pictographic evidence for the existence of a vast corpus of portable art objects throughout Australia's Aboriginal past. For example, the figures in the Dynamic Figure rock art in Arnhem Land, Northern Territory are frequently depicted with arm and neck ornaments and headdresses decorated with tassels and feathers (Chaloupka 1984, 1993), while a possible stencil of a tooth necklace, reminiscent of that found on the (Holocene) Lake Nitchie burial, has also been found (Macintosh et al. 1970). Similarly, the prominence (and variety) of personal ornaments during the late Holocene is evident in ethnographic studies (e.g. Akerman and Stanton 1994; Allen and Hamby 2013; Hamby and Young 2001; McAdams 2008; Roth 1904) and museum collections (cf. Hamby 2005; Lakic 1995; May 2009; Peterson et al. 2008; Simak 2007). Significant numbers of neck ornaments were recorded and collected by Donald Thomson from Cape York and Arnhem Land in the 1920s and 1930s (Allen 2008), and by Charles Mountford in Arnhem Land in 1948 (see May 2008, 2009). In addition, Alfred Haddon in the Torres Strait collected thousands of coix seeds, dog teeth, and shell beads which adorn necklaces, armlets, tobacco pipes, skull caps, and a beheading knife (Moore 1984). McAdams' (2008) doctoral thesis has identified the scale and significance of bead assemblages in Australia, and also the extent to which these objects lie buried in consultancy and museum reports.

In keeping with their better known African and European counterparts, these Australian artefacts have provided insights into the communities which produced them. For example, new forms of symbolic expression, which include portable art objects, appear across the continent after the Antarctic Cold Reversal (ACR $\sim$ 14.5–12.5 ka; Langley et al. 2011; Williams et al. 2013). Necklaces, headbands and armbands are frequently found associated with burials during this period, and include the remarkable Roonka burials located on the Murray River in South Australia (Pretty 1977). At this site, 70 inhumations were recorded in layers dating to approximately 4000 BP. The burial of a man and child contained a wallaby teeth headdress and armband, a pendant made from a bird skull and a necklace of reptile vertebrae. Ochre was found on the feet of the child along with other items of personal adornment. This form of archaeology consequently provided rare insight into the socio-political and ceremonial underpinnings of late Holocene communities living in this region (Pretty 1977:301; see also Pardoe 1995).

With these facts in mind, we now present an object biography for a small collection of vertebrae beads collected from Mirarr Country, located in the Northern Territory. Through use wear analysis and a review of ethnography and museum collections, we will present an outline of how these few beads can inform us about artisan and community identities.

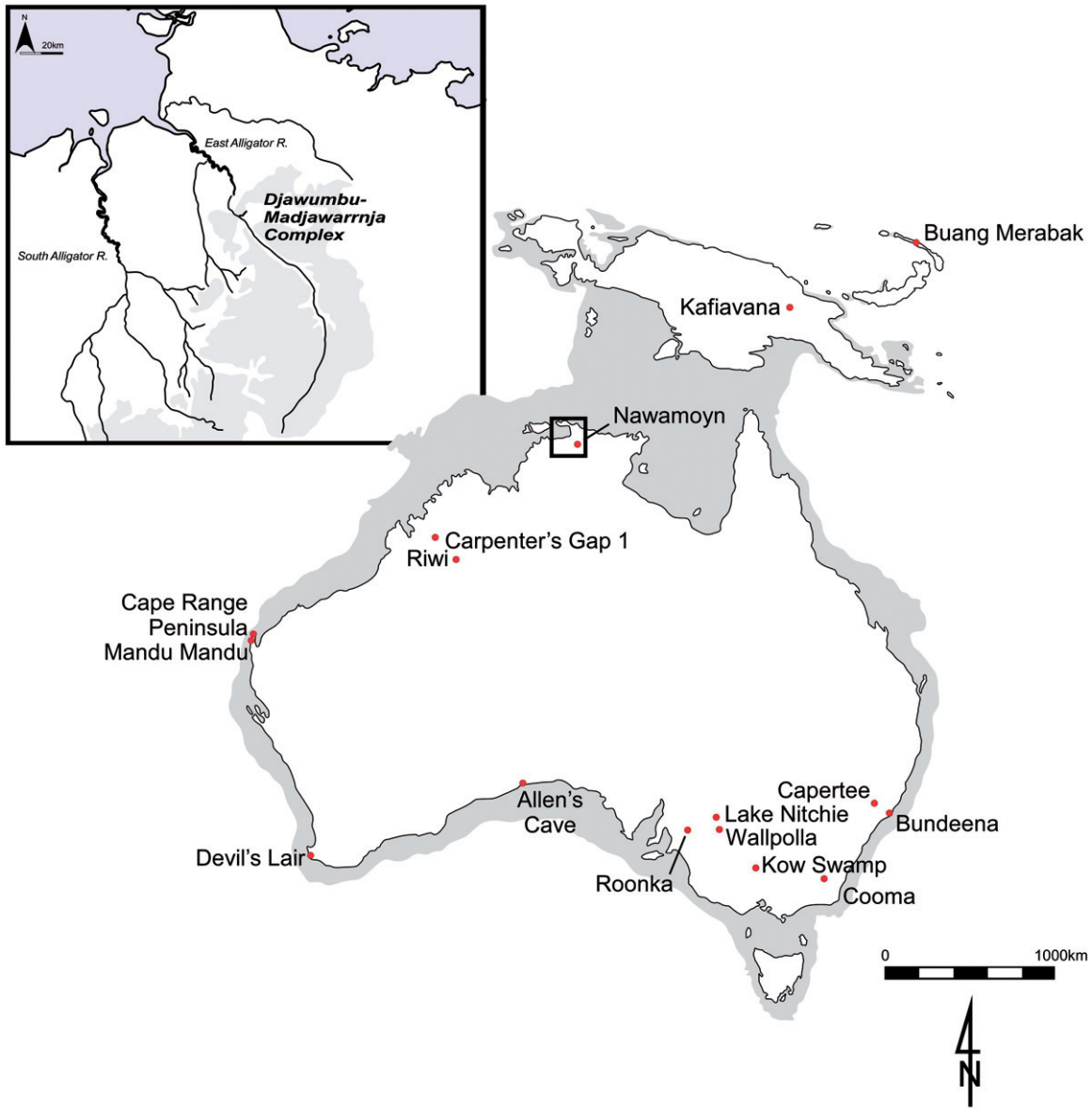

Figure 1. Distribution of beads and pendants identified in Australian Pleistocene sites.

Ultimately, we hope that the data presented here demonstrate the importance of undertaking such focused analyses and wide-reaching regional comparisons of Australian ornamentation and other portable art objects.

Archaeological context

The discovery of six small painted shark vertebrae beads within the Jabiluka leasehold area, western Arnhem Land, provides the opportunity to re-examine the distribution and role of distinctive cartilaginous ornaments in far north Australia. The site is located near the top of the Djawumbu Massif, an isolated sandstone outlier on the eastern margin of the Magela flood plain. This outlier is approximately 3 km long, 1 km wide (at the widest point), and located along the Oenpelli-Jabiru road (to the west). The top of Djawumbu varies between a sparsely vegetated, boulder-strewn plain in the south/centre to a maze of eroded passageways, chambers and rockshelters in the north and west. The latter area contains a large quantity of cultural sites, including rock art, stone arrangements and grinding hollows.

In 2013/14, surveys of Djawumbu were completed by the authors (SKM, DW) as part of a Mirarr community funded project (Mirarr Gunwardibim; see Wright et al. 2014 for details). These surveys confirmed results from previous studies (Cundy 1982; Kamminga and Allen 1973; Morley and Lovett 1980), identifying a high density of sites (including rock art, stone arrangements, lithic scatters and burials). One site (R1 0018 16/07/2013), a rockshelter located on a substantial ledge near the top of Djawumbu (the exact location is restricted at the request of the Mirarr traditional owners), consisted of one of four rock art panels along this ledge (sizes ranged from 1 to 5 m in length, with the larger sites containing over 100 motifs). The shelter in question measured 17 m in length, with nine grinding hollows and large chunks of roof fall located on the shelter floor (Figure 2).

Figure 2. The site where the beads were located with arrow indicating one of the sediment traps (shown centrally in second photograph) (photo: I. Johnston).

Figure 3. One of the painted panels from the site showing depictions of white human-like figures, fish, and a variety of other superimposed subject matter (photo: D. Wright, 2013).

The shelter housed over 500 rock art motifs located on wall and boulder panels (see, for example, Figure 3). The vast majority of motifs are characteristic of late Holocene freshwater period art (Chaloupka 1993). Subject matter includes turtles, fish, reptiles, macropods, flying foxes and human figures with body adornments (including feathered headdresses but with no clear depictions of beaded body adornments) and assorted material culture, such as spear-throwers. Nearly all of the art is produced using pigment, but there are examples of beeswax art in both geometric form and as human-like figures.

When the site was visited, in June 2014, small pools of water survived in a wet season water channel 50 m south of the main shelter. It was observed that wet season run off had scoured recesses of the shelter, and transported soil across the shelter. Three sediment traps (formed against rock fall basins) were noted in the northern end of this shelter. The largest was 2.66 m wide at the shelter wall, tapering to 1.03 m wide at the drip line before spilling down slope.

In 2013, three beads and a small bone point were collected from eroded spill 1.5 m in front of the main deposit. This eroded sediment contained large quantities of cultural materials. A partially exposed human long bone (probable femur) was observed in a shallow sediment trap in the centre of the shelter. A small fragment of turtle shell (unknown species) was observed in the same area, alongside a small, undiagnostic terrestrial vertebrate long bone, one freshwater mussel (*Velesunio angasi*) valve, and several small fish bones (undiagnostic). Most probably originating from a macropod, the recovered bone point features a triangular cross-section and measures only 27.3 mm in total length, 3.2 mm at its maximum width, and 3 mm at maximum thickness. Like the vertebrae beads described below, this piece exhibits a thick layer of red ochre (Figure 4). Microscopic analysis revealed post-depositional damage to the distal tip, along with crushing and rounding which is consistent with use as an awl or similar action. Given its size, painted decoration, and association with the beads it is possible that this artefact was also used for ornamentation, such as a nose pin, its size being consistent with these items and which could conceivably accrue this same type of wear. The mesial section of the artefact exhibits a small indentation and traces of a black residue (Figure 4: C), which would also be consistent with use as a pin.

In 2014, two additional complete beads and one broken example were found cemented within sediment at the back of the rockshelter. These beads were collected with seven unpainted and unaltered fish vertebrae. A single human tooth, a molar, with roots attached was recorded in this context. No subsurface investigation was undertaken, with additional cultural materials likely to remain buried at this site.

The Djawumbu vertebrae beads

Microscopic and morphological analysis undertaken by one of us (MCL) was completed for all six of the recovered beads. Identification and recording of manufacturing marks and use wear follows the methods developed by d'Errico (1993), d'Errico and Villa (1997), and White (1995, 2007a, 2007b). Based on a review of the ANU Archaeology and Natural History

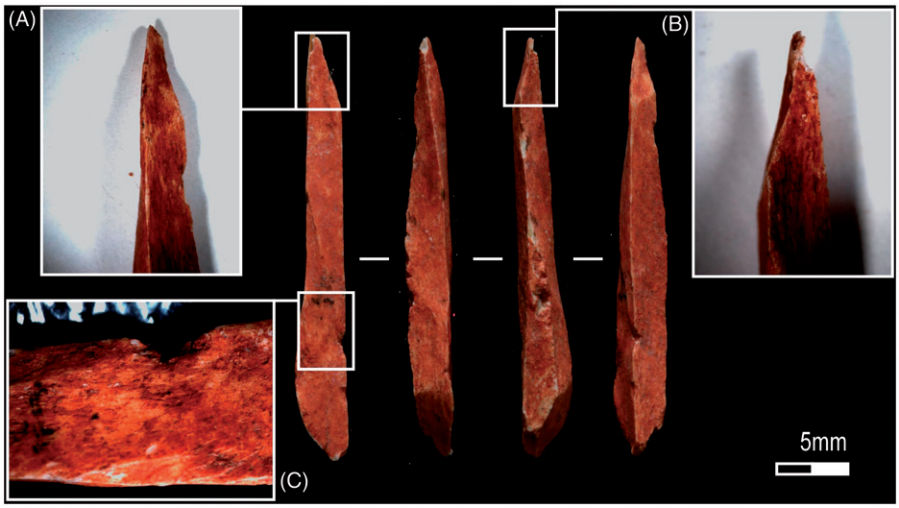

Figure 4. Small bone point found alongside the six bone beads. This point appears to be covered in the same red colourant as the beads. (A) Superior surface (8×); (B) Inferior surface (12.5×); and (C) notch and black reside (16×).

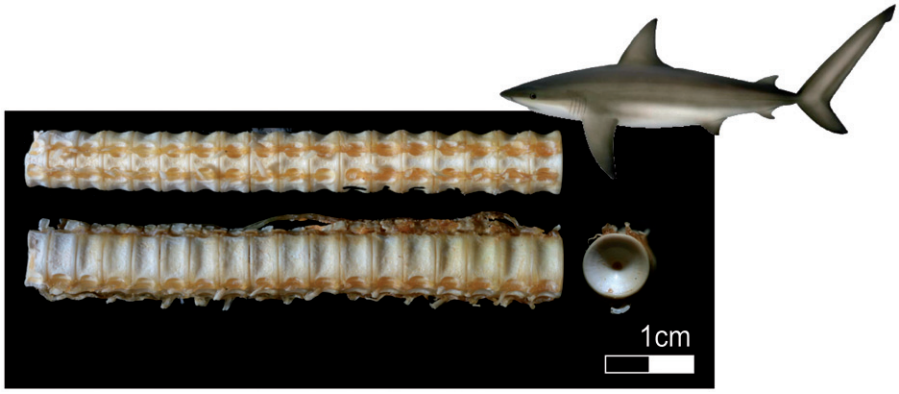

Figure 5. Reference collection example of vertebrae from a Bronze Whaler (*Carcharhinus brachyurus*). Bronze whaler image - http://www.dpi.nsw.gov.au/fisheries/recreational/saltwater/sw-species/bronze-whaler

Table 1. Metrics of the Djawumbu vertebrae beads.

	Whole bead			Perforation	
Bead #	Max. Width	Max. Height	Max. Thickness	Max. Width	Max Height
Bead 1	5.2	5.3	2.4	1.7	2.0
Bead 2	4.3	3.7	2.3	1.5	1.6
Bead 3	5.0	4.4	2.4	1.2	1.6
Bead 4	5.0	5.2	2.5	1.3	1.4
Bead 5	5.0	4.8	2.4	1.7	2.1
Bead 6	na	na	na	na	na

Bead numbers correlate with Figure 6.

osteological reference collection, all six beads were found to be consistent with vertebrae belonging to the Carcharhinidae family (Figure 5). This family is commonly known as 'whaler sharks' and includes numerous species, such as bull sharks, spinner sharks, dusky, blacktip and bronze whalers. The beads measure within one to 2 mm of each other (average: 4.49 mm maximum height, 4.72 mm maximum width, 2.43 mm maximum depth) suggesting that, either they all came from the same animal, or from multiple animals of similar size (Table 1).

Four of the beads are largely intact and complete (Beads 1, 2, 4, 5 in Figure 6), one was collected in three pieces (Bead 6 in Figure 6), and the last is missing a significant portion of one side (Bead 3 in Figure 6). While the artefacts are extremely fragile and there is evidence for low-level fragmentation of small sections of the surface, intact ochre slip across all artefact surfaces suggests little sustained exposure to the elements. Microscopic analysis with a Zeiss 2000-C stereo microscope fitted with a AxioCam MRc5 camera, along with a Dino-Lite AM413ZTAS digital microscope found that the centre of each vertebrae has been worked from both the superior and inferior surfaces as evidenced by the inward curvature of the perforation edges (Figure 7: C). While it is likely that drilling was the technique used, the heavy coating of ochre makes it impossible to identify the curved striations which would confirm this hypothesis. Furthermore, if a wooden drill was used, no such striations would be evident. The holes average 1.5 mm in width and comparison of the perforations with the reference examples of Carcharhinidae vertebrae clearly demonstrates the significant differences between the natural perforation found in this type of shark vertebrae and the artefacts presented herein (compare reference example to bead perforations in Figure 7).

Localised use wear consistent with suspension is evident on each of the beads, though it is particularly clear on Beads 1 and 5, where a notch (sometimes known as 'key-holing') is worn into a section of the perforation wall (Figure 7: D). Other evidence for human alteration is found in the creation of a c.1 mm deep groove around the circumference of two of the beads (Beads 2 and 3; Figure 8: B and C). In each of these two cases, the groove has almost completely removed the paired notches which are diagnostic of shark vertebrae, though close examination finds remnants of these anatomical features allowing us to confirm that they are of the same origin as the remaining four beads. The smooth surfaces of the grooves suggests abrasion as the technique utilised in their manufacture, although again, the heavy coating of ochre inhibits the identification of clear diagnostic marks. The remaining four beads show no evidence for similar alteration of the vertebra edge, here instead the notches are choked with red ochre (Figure 8: A, D and E).

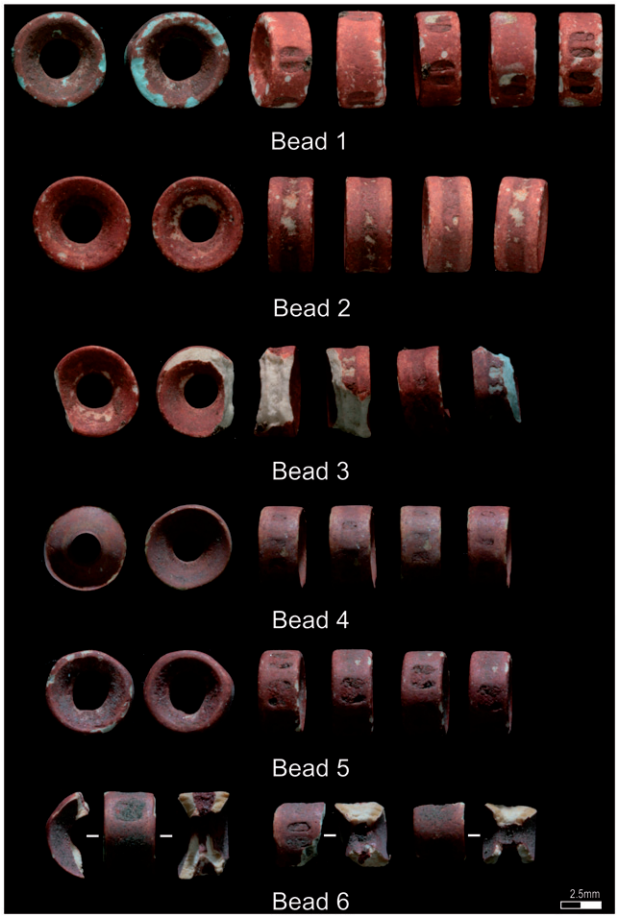

Figure 6. Views of the six Djawumbu shark vertebrae beads recovered.

Interestingly, while three of the beads (Beads 1, 2, and 5) exhibit rounding to the proximal edges (Figure 9), the other three (Beads 3, 4 and 6) display edges which are sharper in form and consequently closer to their original (natural) morphology (Figure 8: C). Since intensity along with type of use dictates the severity and type of wear to accumulate on an ornament, the sub-groups identified in the Djawumbu bead assemblage suggests a number of different interpretations. First, the beads may not have been manufactured at the same time, and thus, half were in use longer than the three less worn examples. This interpretation will be discussed further below. Another explanation might be that the more heavily worn beads were utilised differently (used to decorate a different object which of itself was used in a different motion or more intensively) than the other three, resulting in the different levels of wear observed. Given that the beads were found in one locality and display the same ochre coating (see below), we might argue that they all originally belonged to the same item, and thus, the distribution of the two beads with proximal grooves across these two sub-groups (one with more extensive wear and one with less extensive wear) suggests that as many

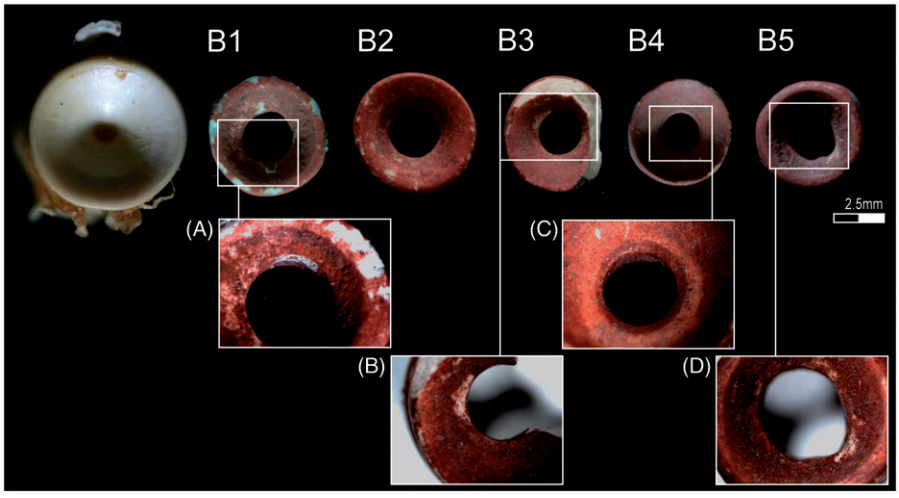

Figure 7. Examples of use wear and colourants identified on dorsal and ventral sides of the Djawumbu beads: (A) White residue inside perforation (20×); (B) Wearing away of red residue on side of perforation (20×); (C) Bevelled edges around perforation (20×); (D) Example of significant rounding to edges and perforation wear from stringing (20×).

as four manufacturing events may even be represented by this find.

The defining feature of the Djawumbu beads is the heavy and even coating of red colourant. Indeed the coating of all beads is so substantial, that clear traces of manufacturing and use wear are difficult to identify clearly (as mentioned above). This red residue is compacted into the notches located on the sides of each bead (see examples in Figure 8: A, D and E), and is lightest on the dorsal and ventral surfaces, although here too thick accumulations are observed (Figure 7: A). Bead 1, Bead 2, Bead 4 and Bead 5 also exhibits traces of a white substance, located primarily around and inside the perforation (Figure 7: A). This residue is also consistent with a colourant, and its sporadic appearance and location suggests that its presence is not intentional (as the even coating of red colourant appears to be), but was rather the by-product of use (such as being transferred from skin or string onto bead).

To summarise, the Djawumbu beads appear to have been bifacially drilled to create perforations large enough to be strung sequentially or attached to an item, before being coated with a red paint mixture and utilised as an item of adornment. A white colourant appears to have been incidentally transferred to the perforations of several of these beads, suggesting that the string, person/s, or item against which these beads came into contact during their use life was coated with a white colourant. Three of these beads exhibit more extensive wear than the others, suggesting that they experienced more intensive use before deposition. That all but one of these beads were recovered intact suggests that it was not bead breakage which resulted in their discard, but rather another process, which may include stringing failure, unintentional loss of an item or intentional discard (which may or may not have been ritual in nature).

Discussion

Detailed analysis of the Djawumbu beads demonstrates staged manufacture of shark vertebrae beads

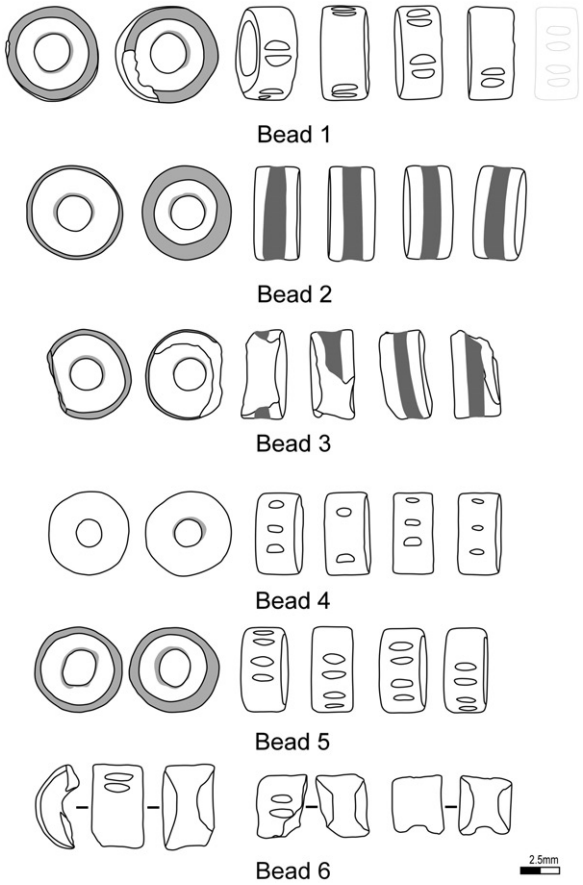

Figure 9. Location of use wear (light grey shading) and more intensive working of Beads 2 and 3 (dark grey shading).

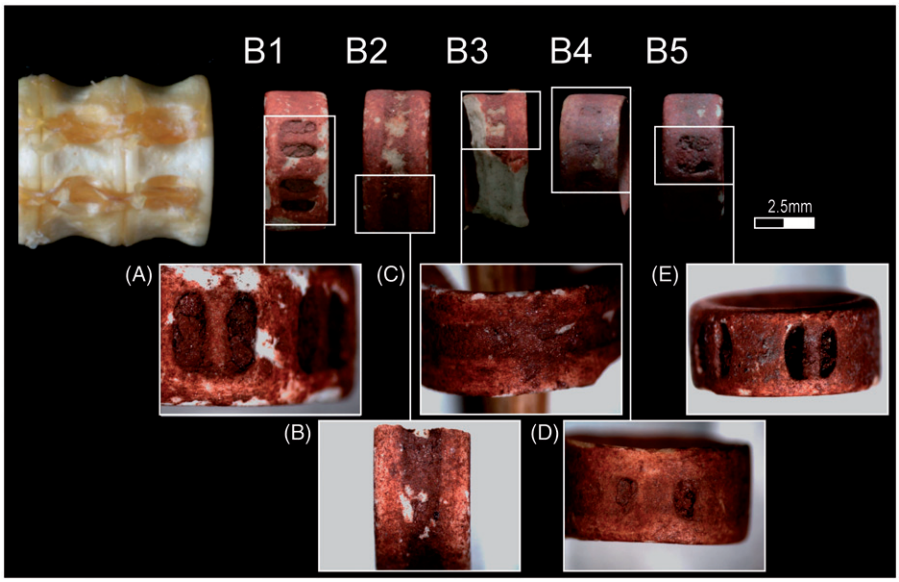

Figure 8. Examples of use wear and colourants identified on sides of the Djawumbu beads: (A, D and E) Colourant buildup in notches (Mag. A: 16× D: 16× E:12.5×); B and (C) Groove around side (Mag. B: 16× C: 20×).

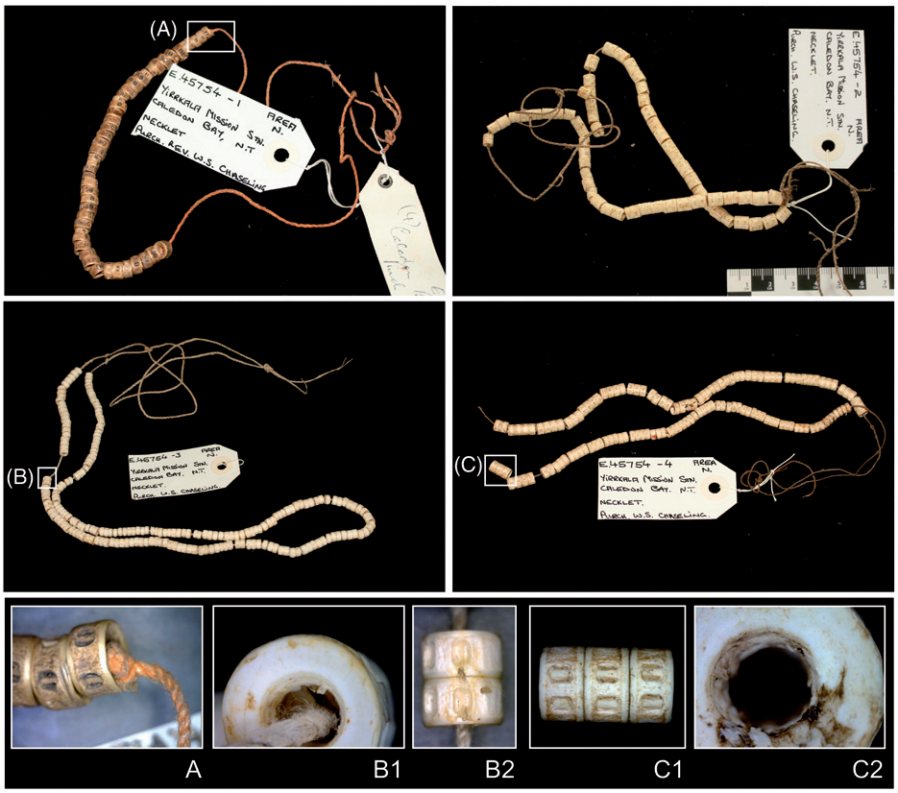

Figure 10. Shark vertebrae bead necklaces from Caledon Bay, Northern Territory, The Australian Museum (Sydney). (A) Red colourant staining on string; (B1 and C2) striations around perforation wall; (B2 and C1) Multiple vertebrae still in anatomical connection (Photos: M.C. Langley with permission from The Australian Museum, Sydney).

(involving grinding, piercing and coating with red ochre), while comparison of the Djawumbu beads to four ethnographic strands of shark vertebrae beads collected from Caledon Bay, in the Northern Territory, sheds light on the manufacture and possible use of these artefacts. Importantly, these four examples are not unique. The collections in the Australian Museum (Sydney) include some 46 to 100 + vertebrae strung consecutively to form necklaces (Figure 10); and an examination of the Donald Thomson Collection by one of us (LA) suggests that shark and fish vertebrae necklaces were frequently threaded onto a single strand of vegetable fibre string.

As the Caledon Bay beads in the Australian Museum are not painted, it was possible to clearly observe striations around the interior of the perforation (Figure 10: B1 and C2). These marks indicate that the centre of the vertebrae was drilled from both sides with the use of a stone point in order for the hole to be large enough for string to be passed through. Rounding similar to that seen on the edges of the Djawumbu beads was also apparent on these ethnographic artefacts (Figure 10: A), where their consecutive arrangement explains the process behind the accumulation of this form of wear. Of additional interest, one of the Caledon Bay examples was strung with string coloured with a red substance consistent with ochre (Figure 10: A).

The presence of vertebrae on these strands from multiple Whaler sharks suggests either systematic and focused hunting of these animals or the gathering of vertebrae from infrequent catches and over an extensive period of time. Additionally, three of the Caledon Bay necklaces feature groups of two to six vertebrae, which are still in anatomical connection (see examples in Figure 10: B2 and C1), suggesting, first, that groups of these beads were taken from the same animal, and second, that the beads were not altered for use individually. Instead, several beads were drilled while still attached to one another. In all, these four ethnographic examples match very well with the archaeologically recovered Djawumbu beads in terms of bead size, working traces and use wear.

While we are not able to provide precise temporal information, the striking similarity of Djawumbu beads to those found in 19th century ethnographic collections and the dominance of late Holocene rock art in the shelter suggests these date to the very recent past. The paucity of sediment in this shelter means that the beads and bone point are likely to have always been on (or near) the surface of the shelter floor. Survival of these delicate artefacts (complete with their ochre slip) for more than 200 years is considered unlikely.

The discovery of the Djawumbu beads enables the reassessment of regional differentiation between late-Holocene communities in Australia. Today, these beads function as social indicators in eastern Arnhem Land where they are intimately associated

Table 2. Distribution of vertebrae bone personal ornaments observed in museum collections (Adapted from McAdams 2008:487).

Location	Fish/Shark	Snake	Total
Archer Kendall Holroyd Rivers, QLD	1	1	2
Arnhem Land unprovenanced, NT	15	0	15
Caledon Bay, NT	4	0	4
Cape York East, QLD	1	0	1
King Leopold Ranges, NT	0	1	1
Mapoon. QLD	1	0	1
Milingimbi Island, NT	8	0	8
Trial Bay, NT	1	0	1
Total	31	2	33

Snake vertebrae perforated ornaments appear to share elements of manufacture/decoration with shark and therefore have been included in this table.

with the Galpu and Djapu clans (and the Dhuwa moiety), which have strong connections to the Shark Dreaming (Hamby and Young 2001). It was the responsibility of clan members to hunt sharks and make these ornaments. Rose Marmininy, a senior Galpu woman from Elcho Island, combines shark vertebrae with feathered string (feathers taken from the parrot *Trichoglossus rubritorquis*). She explained the special importance of shark for Djambarrpuyngu-Guyula and other Djambarrpuyngu groups: 'we sing this one, this one is ours' (Hamby and Young 2001:16). According to Donald Thomson, these necklaces were given the same generic name used to describe young sharks, which in Yolngu (eastern Arnhem Land) is *burrugu*, while Clement (1903) was informed that shark vertebrae beads enabled identification of medicine men on the Western Australian coast.

It is plausible that vertebrae necklaces were used as grave goods or as part of funeral and mourning rituals. The Arnhem Land ornaments were found in a shelter containing human skeletal remains. This association was also found to be the case at Roonka in the Lower Murray, with a necklace of snake vertebrae found with the 4000 year old skeleton of a boy (Pretty 1977). Further in situ discoveries are required to test this hypothesis further.

Examination of the Donald Thomson Collection from northern Australia, of which almost a quarter consists of body ornaments, revealed that less than ten per cent of the more than 150 neck ornaments included fish or macropod bone vertebrae. The provenance of these artefacts is northern Australia, the majority (85%) being collected in Arnhem Land and adjacent islands (Table 2). Snake vertebrae ornaments appear to fit this pattern with two artefacts collected from eastern Cape York and Leopold Ranges in the Kimberley, north Western Australia. It has also been observed that the majority of shark vertebrae beads were recovered from coastal areas, suggesting availability of fish as a prominent consideration (McAdams 2008:487; McCarthy 1940:246).

McAdams (2008:344) noted variation within the repertoire of vertebrae beads. Many artefacts were associated with other beads or ornaments and the majority (33%) were decorated with colourants (McAdams 2008:344). These findings include the snake vertebrae bead from the King Leopold Ranges, which was attached to a cowry shell, with a pattern formed by arranging light and dark ('possibly stained') vertebrae. The 'two fish/shark series (Arnhem Land unprovenanced and Milingimbi) had feathers attached', with the latter painted with red ochre (McAdams 2008:344). A shark vertebrae necklace collected by W.E. Roth from the Batavia River in east Cape York also appears to be painted with red ochre. McAdams (2008:344) observed that the most highly decorated objects were collected from Arnhem Land, an area which also included the highest variety of materials used in portable art manufacture. In summary, archaeology and ethnography suggests unique social signifying behaviour in far north Australia, specifically Arnhem Land.

Conclusion

A substantive study of archaeological/ethnographic collections of portable art objects in Australia represents an important next step for Australian archaeology. On this continent we have a great opportunity to link archaeologically recovered items with vast ethnographic collections, rock art images and oral histories (e.g. McAdams 2008). We ask researchers to, where possible, retrieve items of personal adornment from their archives and articulate them to the wider archaeological discourse on this enigmatic class of material culture. In addition, studies such as Wesley and Litster (2015), show us that beads may feature in Australian archaeological sites, and as such, methodologies (e.g. sub-sampling using 1mm-mesh sieves) must be developed accordingly.

We also suggest that one way to pursue this line of research would be to investigate the viability of a study like that undertaken by Vanhaeren and d'Errico (2006) for Aurignacian personal ornamentation. The combination of ethnographic/ethno-linguistic and archaeological studies are expected to be powerful in the Australian context where significant connections exist between present and past human communities. This combined approach is likely to provide evidence for regionally and temporally discrete innovations by dynamic human communities. Such an approach may also provide information about socio-political developments connected with the emergence of ethno-linguistic (Indigenous) Nations. Based on this paper and previous research into rock art regionalisation (e.g. David 1991, 2002; Taçon 1993, 1994), it is probable that complexities (including totemic identities and socio-ceremonial pathways) behind art expression may become apparent. Establishing regional patterns in rock and

portable art will allow us to ascertain the extent to which the regional patterns outlined above reflect sampling issues associated with archaeological/ethnographic collection and research.

Importantly, and in keeping with the Western tradition of research, these data may provide invaluable insights into social signifying behaviour in Australia, demographics, cultural interaction, and the impact of past environmental changes on those who inhabited this vast country over the past 50,000 or more years. In other words, it is time to establish personal ornamentation, and portable art in the wider sense, as a subject worthy of study in the Australian archaeological literature.

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The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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