SHORT REPORT

Late Holocene edge-ground axe production and marine shell beads from Brooking Gorge 1 rockshelter, southern Kimberley

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ABSTRACT

Excavation of Brooking Gorge 1 rockshelter, located within Bunuba Country, southern Kimberley, Western Australia, demonstrates a late Holocene record of edge-grinding technology and scaphopod bead use. Excavated in 1993, we report here for the first time the summary data, radiocarbon dates and important finds. The stone tool technology from the site documents a rare focus on edge-ground axe manufacture, whereas scaphopod beads, significant in the symbolic material culture of the region, were also found.

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Edge-ground axe; personnel ornamentation; Kimberley; macrobotanics

Introduction

Here we report on the 1993 excavation of Brooking Gorge 1, a rockshelter in Bunuba Country in the southern Kimberley (Figure 1(A)). Located within Brooking Gorge Conservation Park, in the Oscar Napier Range, the site is 50 m above Brooking Creek, which today holds water during the dry season. The Oscar Napier Range is part of the Devonian Reef formation, which extends across much of the southern Kimberley (Playford et al. 2009). Limestone rockshelters within this formation include Carpenters Gap 1 (Maloney et al. 2018) and 3 (O'Connor et al. 2014) first occupied in the Pleistocene; as well as sites with Holocene records such as Djuru (Maloney et al. 2016; O'Connor et al. 2008), and Mount Behn (Maloney et al. 2017b). Excavation of these sites has revealed evidence for edge-ground axe manufacture from around 46,000 cal. BP (Hiscock et al. 2016) continuing into the Holocene (Maloney et al. 2016, 2017b). However, sandstone outcrops preserving axe-grinding grooves are rare in this region.

A test pit was excavated in 1993 as part of a survey and excavation program by O'Connor in the Oscar and Napier Ranges. The research aimed to investigate Pleistocene occupation in this region and to determine if the gorges of the limestone ranges were refugia for people during the Last Glacial Maximum. Subsequent analysis of cultural materials

from the tested sites thus focused on the older occupation sites, located close to the Lennard River in Windjana Gorge NP (Maloney et al. 2018). We are now attempting to make the radiocarbon dates and content data for all sites excavated during this program available to other researchers.

Results

Brooking Gorge 1 is a limestone rockshelter, approximately 6 × 5 m, with a large outcrop of sandstone embedded in the rear wall (Figure 1(B,D)). Almost every exposed surface of this sandstone has been modified, including ledges several metres above the deposit surface (Figure 1(C)). Grinding grooves are typically 25–50 cm long, 5–8 cm wide and 2–4 cm deep (Kennedy 1996:7). These dimensions are consistent with edge-ground axe morphologies in the Kimberley, which can vary from 4 to 18 cm in width (Akerman 2014; Akerman and Bindon 1984:361), creating a depression bordered by two margins in the sandstone. No pigment art was noted among these grinding grooves or throughout the rockshelter (Kennedy 1996:17).

A 1 m² excavation was placed in the centre of the exposed archaeological deposit, close to the sandstone outcrop (Figure 1(B)). The stratigraphic profile (Figure 2) shows three strata, each separated by a weak boundary, ceasing at ~90 cm, without hitting bedrock in all areas. The sediment was primarily a

Figure 1. (A) North Western Australia showing site location of Brooking Gorge 1 rockshelter. (B) Brooking Gorge 1 site plan showing the location of the square and grinding grooves. (C) Profile of shelter. (D) Photograph of shelter and testpit, looking west.

Figure 2. Stratigraphic profile of Brooking Gorge 1 rockshelter.

Table 1. Radiocarbon dates from Brooking Gorge 1.

Lab no	Spit	Material	Delta c13	PMC	Radiocarbon age	cal. BP (2 sigma)	Curve
ANU-10785	10	Charcoal	-24.0 ± 2.0	-	1350 ± 70	1345–1336 (0.7%) 1321–1063 (94.7%)	SHCal13
OZD599	15	<i>Melo</i> sp.	0.0	78.83	1910 ± 60	1554–1270 (95.4%)	Marine2013
OZD600	25	<i>Celtis</i>	-14	84.34	1370 ± 40	1310–1177 (95.0%) 1126–1122 (0.4%)	SHCal13

Dates were calibrated using OxCal v4, using the southern hemisphere curve [SHCal13] for charcoal (Hogg et al. 2013) and the marine curve [Marine13] (Reimer et al. 2013) for the shell. A ΔR correction of 54 ± 37 was applied to the shell date (O'Connor et al. 2010).

Table 2. Brooking Gorge 1: summary of stone artefacts according to raw material groups.

Spit	Excavated deposit Volume (l)	TNA (total number of artefacts)	Artefacts per litre	Crystal quartz	Volcanic			Chert	Silicified limestone	Quartzite	Silcrete	Glass	Biface	Adze tula	Ground sandstone
					Edge-ground flake	Non-edge ground	Chalcedony								
0	25	59	2.36	4	4	27	6	5	3			9	1		
1	15	23	1.53		4	9	1	3	3			3			
2	36	73	2.03	2	6	35	9	10	3			8			
3	25	54	2.16	6	6	32	1	3	4			2			
4	28	53	1.96	1	3	34	9	1	4						1
5	24	48	2.00	5	10	20	5	1	6	1					
6	24	57	2.38	10	2	22	8	5	10						
7	19.5	47	2.41	2	1	15	17		12						
8	16.5	44	2.67	5		27	6	1	5						
9	42.9	42	0.98	5		20	9		7					1	
10	44.5	60	1.35	6	5	26	2	6	14						1
11	22	90	4.09	20	6	38	18	8							
12	32	28	0.88	2		12	13	1							
13	48	218	4.54	40	7	86	67	13	5						
14	46.5	198	4.26	119	17	61					1				
15	44	271	6.16	137	9	42	44	37		2					
16	33	224	6.79	81	16	32	69	24	2						
17	28.5	282	9.96	139	11	45	55	28		3					1
18	33	188	5.70	91	6	41	41	9							
19	29	137	4.72	78	1	17	27	13		1					
20	41	120	2.93	64	4	17	21	14							
21	37	99	5.86	60		9	2	12			16				
22	43	47	1.09	33		8	3	3							
23	22	7	31.00	3			3		1

Figure 3. (A) Stone artefact frequency and raw material use by spit, Brooking Gorge 1 rockshelter. (B) Non-lithic materials (g) by spit, Brooking Gorge 1 rockshelter.

Table 3. Brooking Gorge 1: summary data of excavated materials, combining materials from 6 mm and 3 mm sieve fractions.

Spit	Bone (g)	Charcoal (g)	Ochre (g)	Seeds (g)	Uncharred wood (g)	Wood shavings (g)	<i>Lortella froggatti</i> (g)	Egg Shell (g)	<i>Melo amphora</i> (g)	Scaphopod beads (n)
0	1.15	32.11		17.05	9.80		0.01			
1	0.86	16.17		9.31	5.21			0.02		
2	28.2	58.33		38.82	25.16		0.13	0.38		
3	2.46	84.14		17.23	20.61		2.39	0.29	0.42	
4	0.57	102.1	0.15	6.13	12.00	0.01	0.23	0.02		
5	1.87	79.5		17.64	8.94		0.75	0.17		
6	1.60	59.4		12.55	4.59	0.01	0.45		0.33	
7	0.16	31.16		7.01	1.011		0.18	0.07	1.34	
8		33.4					0.15	0.05	1.77	
9	0.17	15.2		1.22					6.7	
10	3.20	2.17	0.32	2.22	0.17				0.46	
11	25.53	4.42		2.27						
12	0.05			0.66				0.08		
13	5.02	7.09		2.59	0.01		0.05	0.07	5.28	1
14	3.86	5.02	0.61	1.89				1.48	7.99	
15	10.3	1.851		2.63			0.22	0.28	2.68	3
16	4.88	0	4.61	0.90			0.10	1.16	1.19	
17	4.21	1.35		2.89	0.02		0.08	0.51	1.07	1
18	2.21	1.35		2.13	0.14		0.07	0.73	0.49	1
19	1.77	0.15						0.49		
20	0.50	1.38		1.70				0.43		
21	0.53	1.08	4.99	1.23			4.99	0.53		
22	0.01	0.12		1.97	0.01		0.01			
23			0.46	0.03						
24	0.10			0.05				0.01		
25	0.001	0.03		0.24				0.13		
26	0.24	32.11								
27		16.17								
28		58.33								

soft, sandy silt (10YR 5/4–4/4). Because of the poorly defined stratigraphy, the deposit was excavated in 2 cm spits (a total of 34 and average of 2.95 cm), except for two hearths, which were removed separately. The lower 24 cm, comprising 11 spits, were noted as lacking cultural materials but contained clasts of decomposing bedrock. Sediments were sieved through nested 6 and 3 mm screens, except for bulk sediment samples taken from each spit.

Three radiocarbon dating samples collected from sieve residues reveal a late Holocene age for the excavated deposit (Table 1). These dates were calibrated using OxCal v4, with the southern hemisphere curve [SHCal13] for charcoal (Hogg et al.

2013) and the marine curve [Marine13] (Reimer et al. 2013) for the shell. A ΔR correction of 54 ± 37 was applied to the shell date (O'Connor et al. 2010).

The stone artefact assemblage ($n = 2,473$) is summarized in Table 2 by raw material type. The assemblage is dominated by crystal quartz ($n = 913$), a prolific stone resource throughout Bunuba Country (Maloney 2015:42–45), but also contained volcanic flakes and fragments ($n = 793$). The volcanic flakes included 118 with clear signs of edge grinding prior to being detached, indicating maintenance of ground-edge axes occurred within the shelter at varied states of polish or grinding. Kennedy (1996) identified this material as rhyodacite. Glass flakes were recovered in the upper three

Figure 4. Scaphopod beads from Brooking Gorge 1. Inset boxes indicating wear accrued through use. Scale bar = 1 mm.

spits and on the surface indicating that the site was used into the European contact period. A concentration of artefacts occurs between spits 22 and 13 and the upper 12 spits are dominated by volcanic artefacts (Figure 3(A)), although these discard trends are less pronounced relative to excavated volume per spit (Table 2), it is a significant trend using a Wilcoxon signed-rank test for both total number of volcanic flakes ($Z = -3.713$, $p = .001$) and volcanic flakes relative to excavated volume ($Z = -4.106$, $p = .001$). This trend may suggest that while axe grinding was always a key aspect of site use, its importance increased in more recent times. Three pieces of ground sandstone were recovered within the deposit. Other notable artefacts include a tula adze in spit 9, which together with several other such tools recovered from archaeological sites within this region (Maloney et al. 2017a:183, 2017b:49), confirms tula distribution into the southern Kimberley Ranges (Akerman and Bindon 1984:358). A single broken biface was recovered from the surface, probably associated with Kimberley Point manufacture (Maloney et al. 2014).

Unlike the stone artefact assemblage, most bone and charcoal are concentrated above spit 12 (Figure 3(B)). The peak in charcoal is probably associated with two hearths (Figure 2). Detailed faunal analysis has not been conducted, although the assemblage includes medium-sized macropods, bandicoot, possum and murids. The fauna is summarised by weight in Table 3. Freshwater mussel

shell remains (*Lortietta froggatti*) were also found throughout the sequence. This freshwater mollusc has been recovered in all sites throughout the southern Kimberley region (Maloney et al. 2017a, 2017b; 2016:82; O'Connor et al. 2014:18).

Preliminary analysis of macrobotanical remains shows preservation of charcoal, seeds, wood shavings and uncharred wood. Major seeds include *Celtis* cf. *strychnoides*, *Terminalia* spp., and *Vitex* cf. *glabrata*. These species have been recovered from other archaeological sites in the southern Kimberley (Dilkes-Hall 2014; McConnell and O'Connor 1997) and are well documented in ethnobotanical literature available for the region as important economic plants (Crawford 1982; Scarlett 1985; Smith and Kalotas 1985).

Six scaphopod beads (Figure 4), of a type found throughout the southern Kimberley during the Holocene (Balme and O'Connor 2016), were recovered. These marine shell beads are ~300 km from the current coastline and display use wear characteristic of being strung into the long necklaces observed in recent times (Balme et al. 2018). In addition, 15 fragments of *Melo amphora* (northern baler) were recovered from spit 18 upward (Table 3).

Conclusion

Brooking Gorge 1 was occupied from c. 1,500 years ago and into the European contact period. The shelter is unusual in containing abundant evidence for

edge-ground axe manufacture and resharpening, whereas most other Kimberley excavations recover much smaller samples, typically only one or two flakes (Hiscock et al. 2016; Maloney et al. 2017b:49; O'Connor et al. 2014:18). Although overall artefact numbers decrease over time, the raw material frequencies suggest a shift in the later part of the sequence towards increased axe manufacture at the site. It appears that the rare sandstone outcrop inside the shelter combined with proximity to permanent freshwater in the gorge was the likely driver of site use throughout the occupation. Like the other southern Kimberley shelters investigated, it contains scaphopod segments with evidence for use as beads (Balme and O'Connor 2016). While faunal analysis has not yet been conducted, the site preserves a variety of small to medium-sized fauna and freshwater mussel shell, a consistent food resource in the inland Kimberley archaeological record (Maloney et al., 2016, 2017a; O'Connor et al. 2014).

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Disclosure statement

No potential conflict of interest was reported by the authors.

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