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RESEARCH ARTICLE

Pleistocene occupation of Yellabidde Cave in the northern Swan Coastal Plain, southwestern Australia

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ABSTRACT

Evidence for human occupation of Western Australia's northern Swan Coastal Plain derives mainly from Holocene coastal midden sites. Here, we present preliminary results from archaeological investigations at Yellabidde Cave, located 9 km inland from the present coast. Excavations in the limestone cave's sandy floor deposit revealed cultural and palaeontological materials dating from c. 25,500 cal. BP to the 19th C. These provide the first evidence for Pleistocene occupation in the region, indicating that Yellabidde Cave was intermittently occupied throughout the late Pleistocene and Holocene, and reflecting dynamic human-environment relationships in present near-coastal to littoral environments.

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Western Australia;
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Introduction

Southwestern Australia has a long record of human occupation, with sites in the Leeuwin-Naturaliste and Perth regions demonstrating occupation from about 45 ka (Balme 2014; Dortch 2004; Pearce and Barbetti 1981). In the northern Swan Coastal Plain (NSCP), there is limited comparable evidence for human activity before the Holocene. Archaeologists working on the NSCP have focused on coastal midden sites (Dortch et al. 1984; Monks et al. 2015; Morse 1982), but investigations of NSCP caves suggest that these sites can also provide detailed evidence for past human activities in inland ecosystems (Baynes 1979; Hallam 1974; Lundelius 1960). We report preliminary results from recent investigations at a newly identified cave site in the NSCP, which contributes to ongoing research into past human interaction with diverse coastal plain environments.

Yellabidde Cave (Australian karst index number 6E-30) is located 230 km north-northwest of Perth in the country of the Amangu people, who named it following the discovery of emu (*yellabidde*) eggshell throughout the deposit. The cave lies roughly midway between two chains of lakes in the NSCP, 9 km from the present coastline (Figure 1). The landscape is characterised by low limestone ridges (containing caves), sandplains, and biodiverse heathland of a type known as kwongan (Beard 1976). Yellabidde Cave's west-facing entrance, at the east end of a shallow doline, is easily accessible to humans and large mammals.

Two 1 × 1 m squares, located 9 m apart, were excavated in the front chamber (Figure 2), revealing well-preserved archaeological and palaeontological deposits. Excavation was guided by visible stratigraphy, but, due to deep stratigraphic units, was executed in arbitrary excavation units (XUs) 2 to 2.5 cm thick. UWA Occupational Health and Safety policy requires the use of shoring if excavation walls exceed 1.5 m, which was beyond the budget and scope of this initial excavation. Excavation ceased at 155 cm below surface (XU65) in Square 1 (where decomposing limestone was also identified at the base of the northern and eastern walls), and at 150 cm below surface (XU72) in Square 2. Cultural materials (including stone artefacts, charcoal, and bone) were found in both squares and recorded *in situ* where possible. Charcoal was also plotted and collected during section drawing. All excavated materials were dry-screened on site through nested 5 mm and 1.5 mm wire mesh sieves.

Stratigraphy and radiocarbon age determinations

Nine stratigraphic units (SUs) were observed in section in Square 1, each comprising loosely compacted sandy deposits with angular limestone clasts, distinguished mainly on colour and texture (Figure 3). Square 2 also revealed nine SUs which were relatively damp, containing a large organic component with minimal limestone clast inclusions. There is no

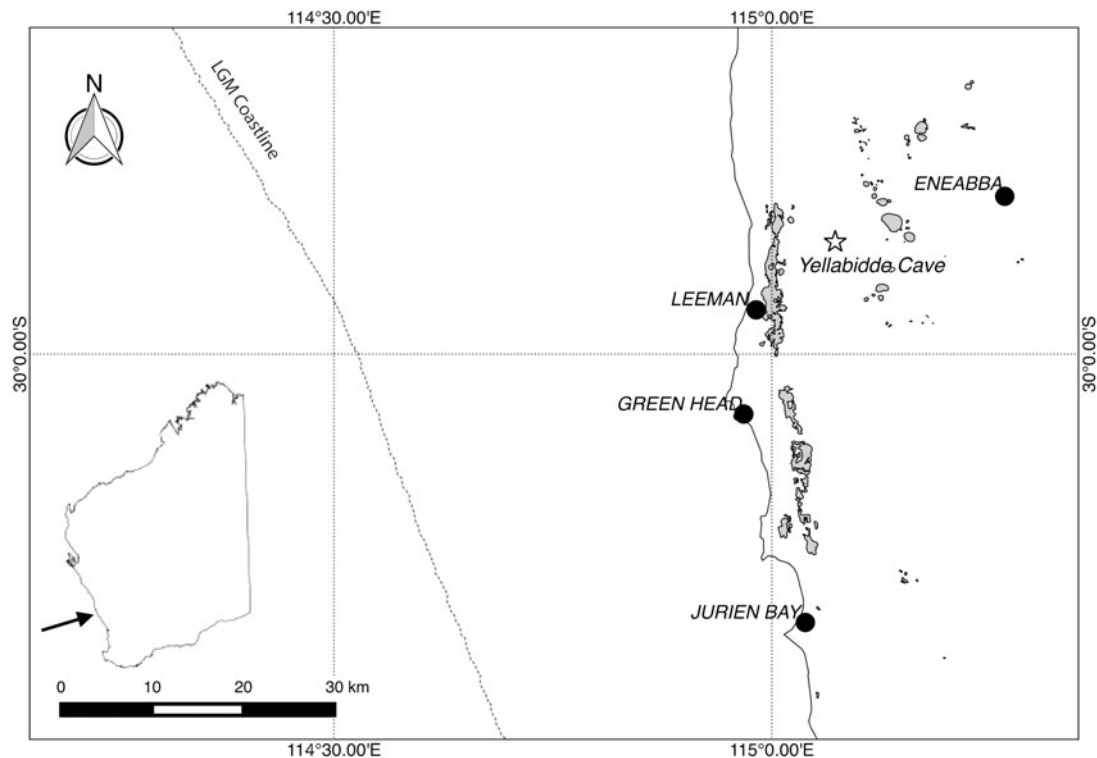


Figure 1. Overview map showing location of Yellabidde Cave, approximate position of the coastline at the LGM, and the location of lakes (shaded) in the study area.

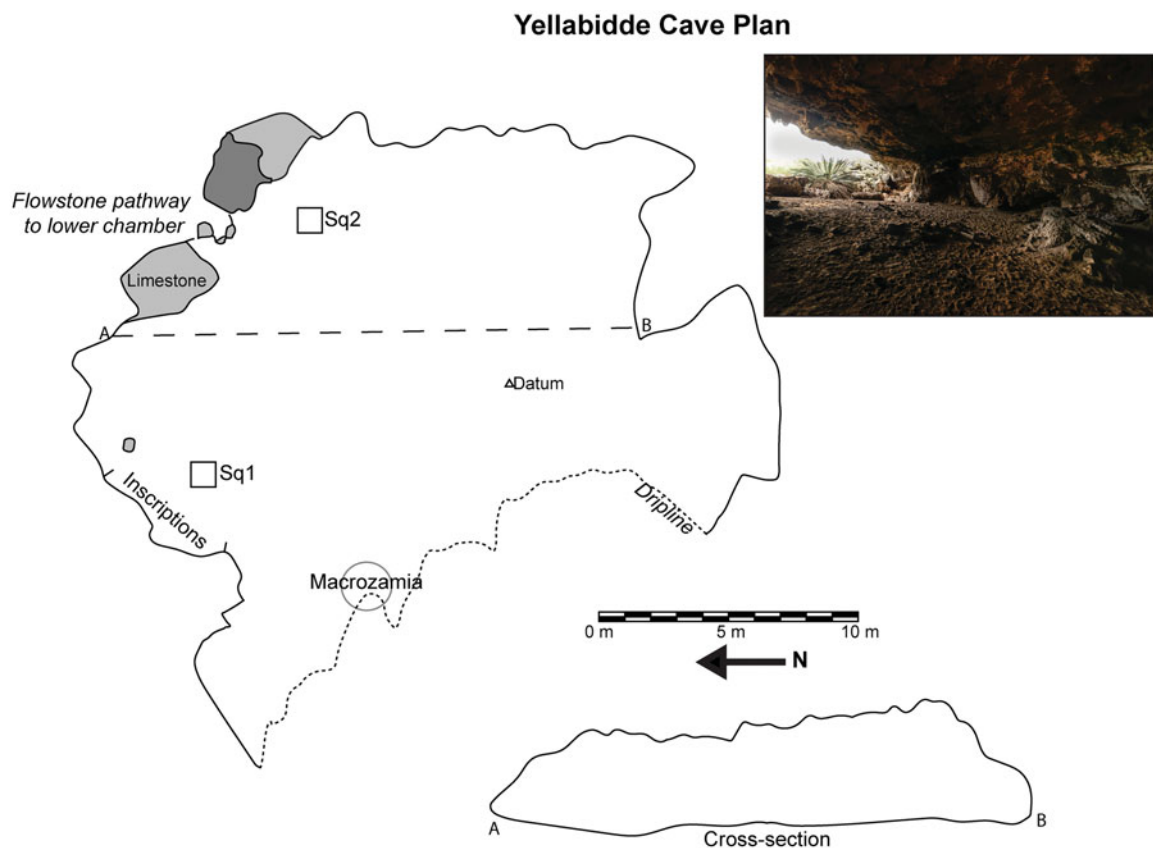


Figure 2. Plan of the main chamber of Yellabidde Cave, showing locations of excavated squares. Photo (inset) by Ian McCann.

apparent correlation between the sediments in the two squares, suggesting the cultural deposits formed under different conditions.

Samples for radiocarbon dating were selected from charcoal recovered *in situ*, except in the lower

SUs (Table 1), where paucity of charcoal made it necessary to date charcoal from sieve residues. All charcoal samples were AMS dated.

With the exception of the lowest date from Square 1 (OZT017), which appears to be intrusive,

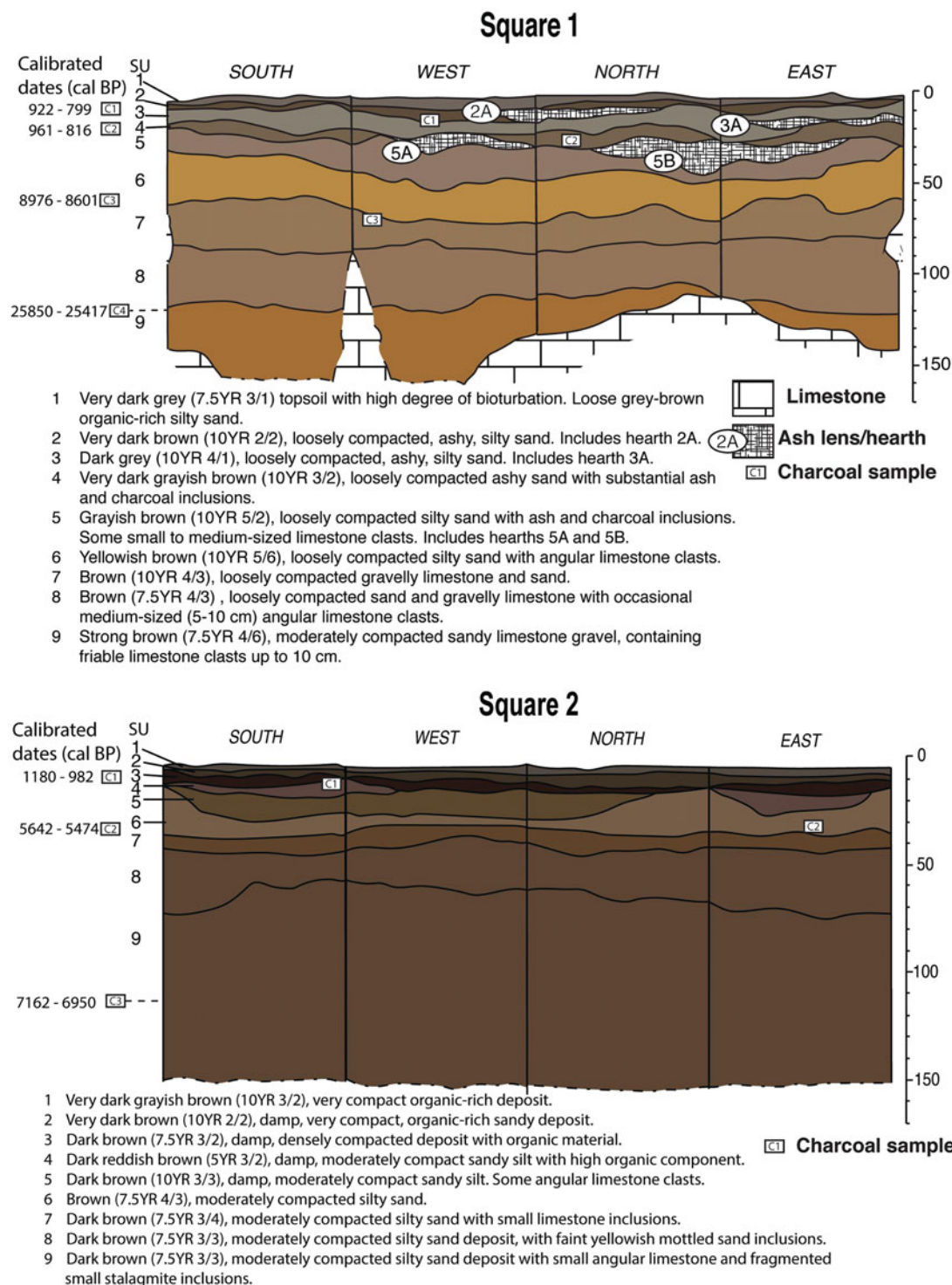


Figure 3. Stratigraphic profiles for Squares 1 and 2 in Yellabidde Cave.

the age determinations are in stratigraphic order (Table 1). They reveal periodic human occupation of the site from before the Last Glacial Maximum (LGM) to near present. The oldest date from Square 1, ca 25,500 cal. BP (OZT016), was obtained from a charcoal sample recovered from sieve residues in SU9, 133 cm below the surface. The deposit in Square 2 evidently accumulated more rapidly, with 1.5 m of deposit accumulating in less than 8,000 years. Square 1 probably represents relatively slow natural sedimentation topped by occupation

surfaces, while Square 2 contains more rapidly accumulated sediments probably washed downslope from the front of the cave.

Results and discussion

The Yellabidde Cave deposit contains cultural material, including burnt and unburnt bone, emu eggshell, stone artefacts, and charcoal, throughout the deposit (Table 2). Other cultural material, including ochre and plant remains, was found in small quantities in

Table 1. AMS radiocarbon determinations from Yellabidde Cave.

Square	SU	Depth (cm)	Laboratory ID	$\delta^{13}\text{C}$ (‰)	Percent Modern Carbon (1 σ error)	14C age, years BP	Calibrated age range, cal years BP (2 σ)
Square 1	2 ^a	16	OZT010	-23.8 ± 0.1	88.38 ± 0.27	995 ± 25	922–799
	4 ^a	24	OZT011	-25.4 ± 0.1	87.69 ± 0.26	1055 ± 25	865–816
							961–903
	7 ^a	66	OZT012	-24.8 ± 0.1	36.96 ± 0.14	7955 ± 30	8797–8601
							8869–8827
							8976–8881
Square 2	9 ^b (upper)	119	OZT016	-22.7 ± 0.3	7.02 ± 0.07	21340 ± 80	25850–25417
	9 ^b (lower)	140	OZT017*	-23.5 ± 0.1	88.53 ± 0.27	980 ± 25	921–790
	4 ^a	8	OZT013	-25.5 ± 0.1	85.90 ± 0.28	1220 ± 30	1032–982
							1180–1046
	6 ^a	31	OZT014	-23.0 ± 0.1	54.55 ± 0.16	4870 ± 25	5550–5474
							5613–5573
							5642–5631
	9 ^b	115	OZT015	-24.2 ± 0.3	46.26 ± 0.16	6195 ± 30	7162–6950

Calibrated using Calib 7.1 (Stuiver et al. 2005) with SHCal13 (Hogg et al. 2013).

^aSample collected *in situ* during excavation.

^bSample collected from sieve residue.

NB: *Sample OZT017 appears intrusive, probably dropped in to the square from one of the hearth features in the upper units. During excavation it was noted that there appeared to be no charcoal preservation, and the dated fragment was selected from sieve residues after attempts to date bone from that SU failed.

Table 2. Weights and counts for material classes (5 mm sieve fraction only) in Squares 1 and 2 in Yellabidde Cave.

SU	Excavated deposit (kg)	Stone artefact count	Mollusc shell weight (g)	Fish weight (g)	Emu eggshell weight (g)	Bone weight (g)	Charcoal weight (g)
Square 1							
1	137.5	65	0.00	0.00	9.28	792.09	676.87
2	83	41	0.00	0.00	8.99	32.05	978.30
3	100.5	144	0.00	0.00	9.43	114.53	1179.62
4	85.5	57	0.61	0.00	3.95	66.99	133.94
5	233	42	0.00	0.00	3.81	57.09	90.14
6	348.5	50	1.02	0.00	7.53	444.80	45.32
7	196	38	0.00	0.00	12.40	80.91	20.92
8	525	20	0.00	0.00	1.14	570.85	4.99
9	248	26	0.00	0.00	0.19	627.31	1.76
Square 2							
1	37	5	0.48	0.00	0.15	10.11	6.72
2	35.5	5	0.00	0.00	0.63	32.42	11.07
3	44	5	0.00	0.00	0.46	13.45	70.29
4	54	4	0.00	0.00	0.27	30.80	102.85
5	154.5	11	0.51	0.14	1.28	111.21	256.57
6	191.5	0	0.00	0.13	1.16	141.5	74.85
7	120	1	0.00	0.25	0.16	91.45	7.00
8	284	0	0.02	0.42	1.49	297.90	4.01
9	1008	23	0.00	0.00	5.52	1404.20	10.89

the late Holocene units of Square 1, and is associated with the hearth features. Stone artefacts are primarily manufactured from quartz and limestone; few appear to be complete flakes, most being fragmented flakes or flaked pieces, probably resulting from people making or modifying tools.

While analysis of faunal material is ongoing, bones from terrestrial vertebrates are abundant throughout the deposit (Table 2). Mammals make up the majority of the faunal assemblage, and preliminary assessments indicate accumulation by humans, owls, and carnivores including chuditch (western quoll), Tasmanian devil, thylacine, and dingo. A small quantity of fish bone and marine mollusc shell mostly dates from the middle to late Holocene, coinciding with the onset of midden formation along the NSCP coastline, and possibly continuing after these midden sites stopped being used (Dortch et al. 1984; Monks et al. 2015).

The archaeological evidence from Yellabidde Cave represents a sequence of intermittent occupation of the site from before the LGM through the terminal Pleistocene and the Holocene. Use of the site appears to have been heaviest during the Holocene, but the presence of stone artefacts and other cultural material associated with a pre-LGM date substantially extends the demonstrated antiquity of occupation in the NSCP. Future analysis will focus on better understanding the significance and extent of the late Pleistocene deposit in Yellabidde Cave, and the nature and intensity of land and resource use on the NSCP during the Holocene.

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Disclosure statement

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

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