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Front cover:
Dead standing black box Culturally Modified Tree along Kromelak *(Outlet Creek) (Photo: Darren Griffin)*

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Editorial note

The papers included in this ninth issue of *Excavations, Surveys and Heritage Management in Victoria* were presented at the annual Victorian Archaeology Colloquium held at La Trobe University on 1 February 2020. Once again we had over 150 participants whose attendance testifies to the importance of this fixture within the local archaeological calendar. It continues to be an important opportunity for consultants, academics, managers and Aboriginal community groups to share their common interests in the archaeology and heritage of the State of Victoria.

The papers published here deal with a variety of topics that span Victoria's Aboriginal and European past. While some papers report on the results of specific research projects others focus on aspects of method, approach, education and the social context of our work. and approach.

In addition to the more developed papers, we have continued our practice of publishing the abstracts of other papers given at the Colloquium, illustrated by a selection of the slides taken from the PowerPoint presentations prepared by participants. These demonstrate the range of work being carried out in Victoria, and we hope that many of these will also form the basis of more complete studies in the future. All papers were refereed by the editorial team. This year Elizabeth Foley managed this process and the sub-editing of this volume under the guidance of Caroline Spry. Layout was again undertaken by David Frankel.

Previous volumes of *Excavations, Surveys and Heritage Management in Victoria* are freely available through La Trobe University's institutional repository, Research Online < www.arrow.latrobe.edu.au:8080/vital/access/manager/Repository/latrobe:41999 >. We hope that this will encourage the dissemination of ideas and information in the broader community, both in Australia and internationally.

We grateful to the Colloquium's major sponsors ACHM, Ochre Imprints, Ecology and Heritage Partners and Heritage Insight; sponsors Biosis, ArchLink, Christine Williamson Heritage Consultants and Extent; and to la Trobe University for continuing support. We would like to thank them, and all others involved for their generous contributions towards hosting both the event and this publication. Yafit Dahary of 12 Ovens was, as always, responsible for the catering.

Preparation of this volume was, like so much else in 2020, undertaken during the severe restrictions imposed because of the COVID-19 pandemic. We hope that 2021 will be a better year for all and that even if we are unable to hold our Colloquium at the usual time we will be able to do so later in the year.

The editors and authors acknowledge the Traditional Owners of the lands and heritage discussed at the Colloquium and in this volume, and pay their respects to their Elders, past and present.

Investigating marsupial bone weathering: implications for understanding the taphonomy of Australian zooarchaeological assemblages

Kimberley Crabtree and Jillian Garvey

Abstract

Modern baseline data is necessary to understand the taphonomic or depositional history of a faunal assemblage. Taphonomy investigates what happens to an animal from its time of death until it becomes part of the archaeological or palaeontological record. In Australia, we have had to routinely rely on international models of bone taphonomy including Behrensmeyer's (1978) bone-weathering stages. The majority of these studies have focused on exotic placental ungulates (medium to large-sized hooved mammals such as sheep, pig and cattle) making the results difficult to apply to Australia's endemic, predominately marsupial fauna. To try and provide baseline data the 'Victorian Native Animal Body Farm' was established in the La Trobe University Wildlife Sanctuary in 2016. Currently focusing on macropods (Eastern grey kangaroo and Swamp wallaby) and wombats, this experiment is aimed at investigating bone-weathering patterns for these taxa. Whilst more time is required to generate comprehensive data, the preliminary results presented here indicate that only approximately 25% of the total experimental assemblage are consistent with Behrensmeyer's (1978) bone-weathering stages. This may be due to limited scavenger access to the carcasses, the retention of soft tissue and fur on the specimens, the cooler and temperate climate of Victoria, and/or that these are marsupials. Furthermore, there appears to be differences between the way that macropod and wombat marsupial carcasses decompose and weather. These preliminary results provide important baseline data for bone weathering specific to macropods and wombats in Victorian contexts. To further understand marsupial bone weathering, the current carcasses will continue to be monitored. This will aid in generating more Victorian specific data that can also be applied to the wider Australian zooarchaeological record to better understand site formation processes.

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Introduction

Zooarchaeology focuses on the remains of animals in the archaeological record to assist with interpreting past human behaviour such as hunting, butchery patterns and use of the landscape, as well as paleoenvironmental reconstruction (Reitz and Wing 2008). In zooarchaeology, taphonomy investigates the processes that create and modify bone assemblages from the time that an animal dies until it is found in the archaeological record (Behrensmeyer and Kidwell 1985; O'Connor 2000:19). One way to better understand the taphonomic record is to study modern analogues to identify the effects of various depositional processes on bone preservation (Hill 1979). Bone weathering is one such area of taphonomic research; with the 'weathering of bones [by] the chemical and mechanical deterioration and destruction occurring over time' (Lyman and Fox 1997:293). Bone weathering can be used to describe the post-mortem changes that alter either the chemical composition or physical condition of skeletal remains. It can also be used to infer time since death, local soil conditions and chemistry, and temperature and humidity. Thus, it can generate important information regarding the time period over which bone assemblages were deposited.

Behrensmeyer's (1978) seminal research on bone-weathering stages is commonly applied to bone assemblages to ascertain the time since death and burial. Over a two year period, Behrensmeyer (1978) observed several large placental ungulate taxa, including zebra (*Equus burchelli*), wildebeest (*Connochaetes taurinus*), cow (*Bos taurus*), and Grant's gazelle (*Gazella granti*), with a known date-of-death in dense and open woodland, swamp, bush and lakebed habitats within the Amboseli Basin, Southern Kenya. She noted that these animals had six stages of distinctive weathering characteristics (**Table 1**). Despite the importance of this research, there have been limited follow-up studies conducted, primarily because the process of generating bone-weathering data takes a significant amount of time (Blau 2017).

In Australia, there has been comparatively little zooarchaeological research, particularly studies of

Stage number	Time since death (years)	Description
0	0–1	Bone surface shows no sign of cracking or flaking due to weathering. Usually bone is still greasy, marrow cavities contain tissue, skin and muscle/ligament may cover part or all of the bone surface
1	0–3	Bone shows cracking, parallel to the fibre structure. Articular surfaces may show mosaic cracking of covering tissue as well as in the bone itself. Fat, skin and other tissue may or may not be present
2	2–6	Outermost concentric thin layers of bone show flaking usually associated with cracks. The long bone edges along the cracks tend to separate and flake first. Long, thin flakes with one or more sides still attached to the bone are common in the initial part of Stage 2. Deeper and more extensive flaking follows, until most of the outermost bone is gone. Crack edges are usually angular in cross section. Remnants of ligaments, cartilage and skin may be present
3	4–15	Bone surface is characterised by patches of rough, homogenously weathered compact bone, resulting in a fibrous texture. In these patches, all the external, concentrically layered bone has been removed. Gradually the patches extend to cover the entire bone surface. Weathering does not penetrate deeper then 1.0–1.5 mm and bone fibres are still firmly attached to each other. Crack edges usually are rounded in cross-section. Tissue rarely present at this stage
4	6–15	Bone surface is coarsely fibrous and rough in texture; large and small splinters occur and may be loose enough to fall away from the bone when it is removed. Weathering penetrates the inner cavities. Cracks are open and have splintered, rounded edges.
5	6–15	Bone is falling apart in situ, with large splinters lying around what remains of the whole, which is fragile and easily broken by moving. Original bone shape may be difficult to determine. Cancellous bone usually is exposed, and when present may outlast all traces of the former more compact outer parts of the bones

Table 1. Behrensmeyer's (1978:151) bone weathering indices

bone weathering. This is likely in part a reflection of the small number of focused zooarchaeology courses, meaning that there are only a few formally trained zooarchaeological specialists compared to Europe and North America (Cosgrove 2002). Due to the scarcity of Australian-based taphonomic research, interpretations of Australian archaeological and palaeontological assemblages have had to commonly rely on taphonomic models generated elsewhere (e.g. Dortch et al. 2016; Garvey et al. 2016; Fillios et al. 2010a, 2010b; Littleton 2000). This is problematic as the application of overseas' taphonomic models, including Behrensmeyer's (1978) bone-weathering data, is difficult to apply to Australia's unique, predominately marsupial fauna, as these studies focused on placental ungulates in different geographic and environmental conditions.

This scarcity highlights the necessity to create baseline data for marsupial bone to assist in understanding the zooarchaeological record in Victorian contexts. In response to this issue, the 'Victorian Native Animal Body Farm' was established in 2016 (Crabtree 2017). This project aimed to investigate the decomposition, disarticulation and initial stages of bone weathering, in order to compare the results with Victorian bone assemblages containing macropod and wombat bones. Macropods and wombats were chosen for the investigation of bone weathering as both species are commonly found as road-kill in south-eastern Australia (Butt 2016), there has been limited research on both species, and modern macropods and wombats can potentially be used as analogues for their extinct larger relatives. Further, macropods and wombats, although the latter is not as common, are both found in Aboriginal sites, and macropods sometimes occur in historical assemblages (Fillios and Blake 2015).

This paper presents the preliminary results of bone weathering for the first (almost) 3.5 years of the project. This baseline data has the potential to assist with the analysis and interpretation of Victorian palaeontological and archaeological assemblages.

Methods

The Victorian Native Animal Body Farm is located in the La Trobe University Wildlife Sanctuary in Bundoora, 19 km north of the Melbourne CBD, Victoria. Four macropods (three Eastern grey kangaroos *Macropus giganteus,* EGK #1, EGK #2 and EGK #3, and a Swamp wallaby *Wallabia bicolor* SW #1) and two Common wombats (*Vombatus ursinus,* CW #1 and CW #2) specimens were collected as fresh roadkill from Victorian public roads under research permit 10006756 under the *Wildlife Act 1975* (VIC) (**Table 2**).

The carcasses were stored in a chest freezer at La Trobe University until enough samples had been collected to begin the experiment. The animals were laid out at the same time (13/05/2016) to ensure they were subjected to the same environmental and temperature

Species	*Macropus giganteus*	*Macropus giganteus*	*Macropus giganteus*	*Wallabia bicolor*	*Vombatus ursinus*	*Vombatus ursinus*
Common name	Eastern Grey Kangaroo	Eastern Grey Kangaroo	Eastern Grey Kangaroo	Swamp Wallaby	Common Wombat	Common Wombat
Field ID	EGK #1	EGK #2	EGK #3	SW #1	CW #1	CW #2
Sex	Male	Female	Female	Female	Male	Female
Age	Adult	Juvenile	Juvenile	Adult	Adult	Adult
Date of collection	14/04/2016	15/05/2016	29/04/2016	20/10/2015	6/05/2016	6/05/2016
Collector	Kimberley Crabtree	Kimberley Crabtree	Kimberley Crabtree	Jillian Garvey	Kimberley Crabtree	Kimberley Crabtree
Weight (kg)	34	9	8.5	23	26	17
Cause of death	Vehicle trauma	Vehicle trauma	Vehicle trauma	Vehicle trauma	Vehicle trauma	Vehicle Trauma
Area	Hesket	Hurstbridge	Craigieburn	North Warrandyte	Macedon	Macedon
Coordinates	-37.2923 114.7455	-37.639895 145.215004	-37.601661 144.957405	-37.729481 145.229835	37.392686 144.592461	-37.359412 144.585603

Table 2. Information regarding the specimens as required by research permit 10006756

conditions. An initial bone-weathering experiment conducted in the La Trobe Wildlife Sanctuary by JG in 2015 was abruptly terminated after the animal carcasses were completely scavenged by foxes. To avoid this happening again, homemade chicken-wire cages were placed over the carcasses.

Over approximately 3.5 years (between 13/05/2016 and 15/10/2019), the carcasses were inspected 29 times. Initially, the carcasses were monitored once every few days. Then, as the decomposition and weathering process slowed, monitoring occurred less often. Table 3 indicates that the weathering on the bones was not recorded until more than 8 months after the experiment commenced, on Recording Day 21. Prior to this the carcasses were recorded as undergoing the initial stages of decomposition including bloating, active decay, dehydration, skeletonisation and insect activity (**Tables 3** and **5**).

Bone weathering was monitored via visual inspection by the senior author. Large and easily identifiable skeletal elements including the long bones, pelvis, crania and mandibles were individually inspected for weathering. Alternatively, the smaller, more compact, and hence difficult to individually identify and record elements such as the ribs, metacarpals, metatarsals, carpals, tarsals, phalanges and vertebrae were grouped according to their specific body part. Each of these smaller groups were then analysed as an 'elemental unit' (**Table 4**). Therefore, as outlined in Table 4, using this method the 180 individual bones per macropod and the 184 individual bones per wombat, have been reduced to 41 element units per individual. It should be noted that one of the macropods (EGK#2) had only 38 element units recorded as it was missing the distal part of its lower right hind leg. Therefore, the total 'element unit' NISP for this assemblage was calculated from the three complete macropods EGK#1, EGK#3 and SW#1 (3x 41 = NISP 123), the 2 complete wombats CW#1 and CW#2 (2x 41 = NISP 82), and the incomplete macropod EGK#2 (NISP 38) with a total NISP of 243 (123 + 82 + 38). For the remainder of this paper the reduced NISPs that include the elemental units outlined in Table 4 will be used.

The carcasses were photographed, and the temperature and rainfall data were logged. Insect activity and the stages of decomposition were also recorded. Behrensmeyer's (1978) six-stage weathering system was used to measure the stages of bone weathering (**Table 1**).

Results

Over the 3.5 years of the experiment, weathering was observed on approximately 25% of all skeletal elements, or 61 bones of the total element unit NISP of 243 (this is derived from the element units of the macropods and wombats outlined in **Table 4**) from the six carcasses.

These results are similar to Behrensmeyer's (1978) observations where ungulate bones displayed Stage 1 weathering after three or four years of exposure. For example, as indicated in **Table 3**, after eight months only one of the macropod bones had reached Weathering Stage 1, and after almost three and a half years only 45 (28%) of the macropod bones had reached Weathering Stage 1. This was predominately observed on the long limb bones which exhibited cracking parallel to the fibre

Recording day	Date	Time elapsed	Changes observed
1	13/05/2016	0 days	EGK#2, EGK#3, SW#1 – Stage 1 of decomposition. EGK#1, CW#1, CW#2 – Stage 2 of decomposition.
2	14/05/2016	1 day	
3	18/05/2016	5 days	EGK#2, EGK#3, SW#1 – Stage 2 of decomposition
4	22/05/2016	1 week, 2 days	
5	26/05/2016	1 week, 6 days	CW#1 – Stage 3 of decomposition
6	28/05/2016	1 week, 8 days	
7	02/06/2016	2 weeks, 6 days	EGK#3 – Stage 3 of decomposition
8	09/06/2016	3 weeks, 6 days	EGK#2 – Stage 3 of decomposition
9	16/06/2016	1 month, 3 days	
10	27/06/2016	1 month, 14 days	
11	06/07/2016	1 month, 23 days	
12	18/07/2016	2 months, 5 days	EGK#2 – Transitioning between Stage 3 and Stage 4 of decomposition, joint disarticulation begins. SW#1 – Transitioning between Stage 2 and Stage 3 of decomposition CW#1 – Stage 4 of decomposition
13	02/08/2016	2 months, 20 days	EGK#1 – Transitioning between Stage 2 and Stage 3 of decomposition EGK#2 – Stage 4 of decomposition SW#1 – Stage 3 of decomposition
14	22/08/2016	3 months, 9 days	EGK#1 – Stage 3 of decomposition
15	19/09/2016	4 months, 6 days	EGK#1 – Joint disarticulation begins EGK#3 – Stage 4 of decomposition CW#1 – Transitioning between Stage 3 and Stage 4 of decomposition CW#2 – Joint disarticulation begins
16	17/10/2016	5 months, 4 days	CW#1 – Stage 4 of decomposition SW#1 – Transitioning between Stage 3 and Stage 4 of decomposition EGK#1 – Joint disarticulation begins
17	31/10/2016	5 months, 18 days	SW#1 – Stage 4 of decomposition
18	15/11/2016	6 months, 2 days	
19	01/12/2016	6 months, 18 days	SW#1 – Joint disarticulation begins
20*	21/12/2016 23/12/2016	7 months, 8 days 7 months, 10 days	
21*	16/01/2017 18/01/2017	8 months, 3 days 8 months, 5 days	CW#1 – Joint disarticulation begins All specimens display joint disarticulation
22	08/02/2017	8 months, 26 days	EGK#1 – Transition between Stage 3 and Stage 4 of decomposition EGK#2 – Transitioning between Stage 4 and Stage 5 of decomposition
23*	28/02/2017 03/03/2017	9 months, 15 days 9 months, 18 days	EGK#1 – Stage 4 of decomposition EGK#2 – Stage 5 of decomposition
24*	26/03/2017 28/03/2017	10 months, 13 days 10 months, 15 days	
25	19/04/2017	11 months, 6 days	
26	13/05/2017	1 year	EGK#3 – Stage 5 of decomposition SW#1 – Stage 5 of decomposition
27	24/06/2018	2 years, 1 month and 11 days	EGK#1, CW#1, CW#2 – Stage 5 of decomposition All specimens have reached Stage 5 of decomposition
28	25/03/2019	2 years, 10 months and 12 days	
29	15/10/2019	3 years, 5 months and 2 days	

*Table 3. Recording days, date, time elapsed and changes observed over almost three and a half years for EGK #1, EGK #2, EGK #3, SW #1, CW#1 and CW #2. Stage 1 of decomposition is classified by fresh decay, Stage 2 by bloating, Stage 3 as active decay, Stage 4 by dehydration and Stage 5 as skeletonisation (Goff 2009). *indicates that this 'recording day' was conducted over 2 to 3 days due to time constraints*

Element or Body Part	Symmetry	Macropods EGK#1, EGK#3 and SW#1		EGK#2		CW#1 and CW#2	
		Individual bones	Element Unit	Individual bones	Element Unit	Individual bones	Element Unit
Crania	Midline	1	1	1	1	1	1
Mandible	Left	1	1	1	1	1	1
	Right	1	1	1	1	1	1
Clavicle	Left	1	1	1	1	1	1
	Right	1	1	1	1	1	1
Scapula	Left	1	1	1	1	1	1
	Right	1	1	1	1	1	1
Humerus	Left	1	1	1	1	1	1
	Right	1	1	1	1	1	1
Ulna	Left	1	1	1	1	1	1
	Right	1	1	1	1	1	1
Radius	Left	1	1	1	1	1	1
	Right	1	1	1	1	1	1
Carpals	Left	5	1	5	1	5	1
	Right	5	1	5	1	5	1
Metacarpals	Left	5	1	5	1	5	1
	Right	5	1	5	1	5	1
Phalanges (Manus)	Left	14	1	14	1	14	1
	Right	14	1	14	1	14	1
Cervical vertebrae	Midline	5	1	5	1	5	1
Thoracic vertebrae	Midline	12	1	12	1	12	1
Lumbar vertebrae	Midline	6	1	6	1	6	1
Caudal vertebrae	Midline	19	1	19	1	19	1
Ribs	Left and right combined	24	1	24	1	24	1
Sacrum	Midline	1	1	1	1	1	1
Pelvis	Left and right combined	1	1	1	1	1	1
Sternum	Midline	1	1	1	1	1	1
Femur	Left	1	1	1	1	1	1
	Right	1	1	1	1	1	1
Tibia	Left	1	1	1	1	1	1
	Right	1	1	1	1	1	1
Fibula	Left	1	1	1	1	1	1
	Right	1	1	1	1	1	1
Patella	Left	1	1	1	1	1	1
	Right	1	1	1	1	1	1
Tarsals	Left	5	1	5	1	5	1
	Right	5	1	-	-	5	1
Metatarsals	Left	4	1	4	1	4	1
	Right	4	1	-	-	4	1
Phalanges (Pes)	Left	12	1	12	1	14	1
	Right	12	1	-	-	14	1
TOTAL		180	41	159	38	184	41

Table 4. The individual bones per animal and the element unit grouping of bones used in this experiment

Day	Stage 0			Stage 1			Stage 2		
	EGKs	SW	CW	EGKs	SW	CW	EGKs	SW	CW
1	100	100	100	0	0	0	0	0	0
2	100	100	100	0	0	0	0	0	0
3	100	100	100	0	0	0	0	0	0
4	100	100	100	0	0	0	0	0	0
5	100	100	100	0	0	0	0	0	0
6	100	100	100	0	0	0	0	0	0
7	100	100	100	0	0	0	0	0	0
8	100	100	100	0	0	0	0	0	0
9	100	100	100	0	0	0	0	0	0
10	100	100	100	0	0	0	0	0	0
11	100	100	100	0	0	0	0	0	0
12	100	100	100	0	0	0	0	0	0
13	100	100	100	0	0	0	0	0	0
14	100	100	100	0	0	0	0	0	0
15	100	100	100	0	0	0	0	0	0
16	100	100	100	0	0	0	0	0	0
17	100	100	100	0	0	0	0	0	0
18	100	100	100	0	0	0	0	0	0
19	100	100	100	0	0	0	0	0	0
20	100	100	100	0	0	0	0	0	0
21	99	100	100	1	0	0	0	0	0
22	99	100	100	1	0	0	0	0	0
23	99	100	100	1	0	0	0	0	0
24	99	100	100	1	0	0	0	0	0
25	99	100	100	1	0	0	0	0	0
26	99	95	100	1	5	0	0	0	0
27	85	93	98	13	7	2	2	0	0
28	73	90	95	21	10	5	6	0	0
29	58	85	95	32	15	5	10	0	0

Table 5. Percentage of specimens displaying bone weathering for Eastern grey kangaroos (EGKs), Swamp wallaby (SW) and Common wombat (CW)

structure (**Figure 1**). Behrensmeyer (1978) recorded similar observations with parallel cracking occurring on ungulate long bones.

A small proportion of the macropod bones (NISP = 2, 1%) began to display Weathering Stage 2 after two years (Recording Day 27). After almost three and a half years, just 12 (7%) macropod bones exhibited characteristics consistent with Behrensmeyer's (1978) Weathering Stage 2. This was common on elements such as the metatarsals, tibia, fibula, humerus, crania, femur, pelvis, radius and ulna of the macropods. These bones had incipient flaking that was typically associated with longer cracks that had developed during Stage 1 (**Figure 1**). Behrensmeyer (1978) noted that Stage 2 occurred on her ungulate bones after two to six years of exposure.

Interestingly, several macropod skeletal elements were first recorded being at Stage 2 (skipping Stage 1): flaking of cortical bone was observed on the skull of EGK #2; and on the pelvis, sacral vertebrae, metatarsal, radius and ulna of EGK #1. Overall, a higher percentage of bone weathering was observed on the macropod elements (NISP = 57, 35%) compared to the wombat (NISP = 4, 5%). Furthermore, bone weathering was more commonly observed on the Eastern grey kangaroo specimens compared to the Swamp wallaby. No wombat bones reached Stage 2 weathering at the end of this

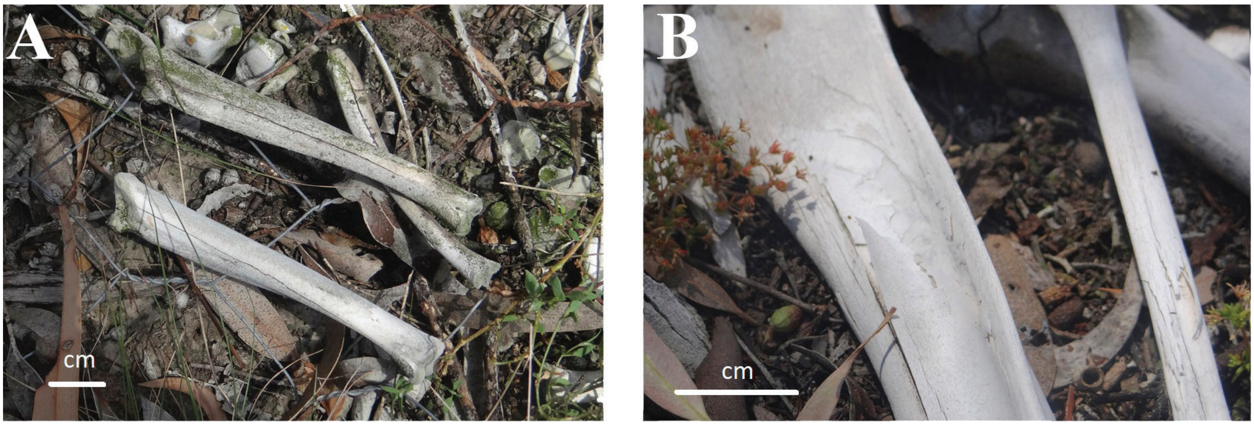

Figure 1. The progression of weathering on the macropods: A) Weathering Stage 1 on EGK#3 on the fourth metatarsal on Recording Day 29; B) Weathering Stage 2 on the tibia of EGK#1 on Recording Day 29

experiment (Recording Day 29) (**Table 5**), and both carcasses still retained much of their thick pelts. Overall, it was noted that decomposition and skeletonisation was a slow process, with only the macropods becoming fully skeletonised after 3.5 years (**Table 3**). Skeletonisation is the final stage of decomposition where the last remnants of soft tissues disappear, and the skeleton is exposed.

Discussion

The results from this experiment provide important preliminary baseline data on how marsupial bones weather in Victorian contexts and suggest that different skeletal elements can produce different weathering patterns. For example, flaking on macropod bone, which is typically associated with Weathering Stage 2, is more common on the flat and irregular shaped elements such as the crania, vertebrae and pelvis. It is also a minor component of the long skeletal elements before Weathering Stage 1. Cunningham et al. (2011) also observed differences of weathering between skeletal elements in their study of juvenile pigs (*Sus scrofa*). The results indicated that specific skeletal elements (metacarpals, metatarsals and phalanges) were more prone to flaking of the outer layers of cortical bone, whilst the long bones, vertebrae and ribs were more likely to have loss of bone at the articular facets. In addition to variations of weathering patterns on different skeletal elements, differences of bone weathering can also be due to placental versus marsupial bones, juveniles versus adults, sexual dimorphism, as well as ecological and climatic variation. Future research into these variables would be beneficial.

Behrensmeyer (1978) observed that ungulate bones reached Weathering Stage 1 between 0 to 3 years, thus implying that the entire skeleton underwent some degree of weathering during this time. This contrasts with this experiment where 75% of the total number of skeletal elements (NISP = 109, 68% of the macropod bones and NISP = 78, 95% of the wombat bones) did not exhibit any weathering (Stage 0) after three and a half years. This difference may be due to the cooler and more temperate Victorian climate, limited scavenger access, and the retention of soft tissue and fur on the specimens, especially the wombats.

Previous studies suggest that environment and climate can affect the appearance of weathered bones (Blau 2017; Marden et al. 2013). Cooler temperatures have been found to slow the process of decomposition (Bunch 2009; Carter and Tibbet 2008) and can have a significant effect on skeletonisation (Rodriguez and Bass 1983). Overall, Victoria has a milder climate than other Australian mainland states (Menkhorst 1996), and this experiment commenced in late autumn. Typically, the earlier stages of decomposition occur quite rapidly (Carter and Tibbett 2008), however, this may have been hindered by the cooler temperatures. Additionally, as mentioned earlier, weathering may have been slowed by the use of protective cages, as previous Australian research has indicated that scavengers influence carcass breakdown (e.g. Brown et al. 2006; Cameron 2008; O'Brien et al. 2007; Reed 2001). Together these characteristics may have slowed the decomposition and skeletonisation of the carcasses, leading to slower rates of bone weathering due to reduced periods of aerial exposure.

Furthermore, the observed differences in weathering between macropods and wombats may be explained by their anatomy and morphology. Wombats retained their fur thick pelt after almost three and a half years, whilst the macropods had typically skeletonised (**Figure 2**). The average thickness of wombat pelts from mainland Australia ranges between 3.88 and 5.02 mm, weighing between 1.18 and 3.75 kg; fat around the body is evenly distributed (Garvey et al. 2016). In contrast, macropods are leaner, with a smaller amount of body fat (Garvey 2010:148). The anatomical and morphological variation between these two groups could have affected decomposition rates, and subsequent skeletonisation,

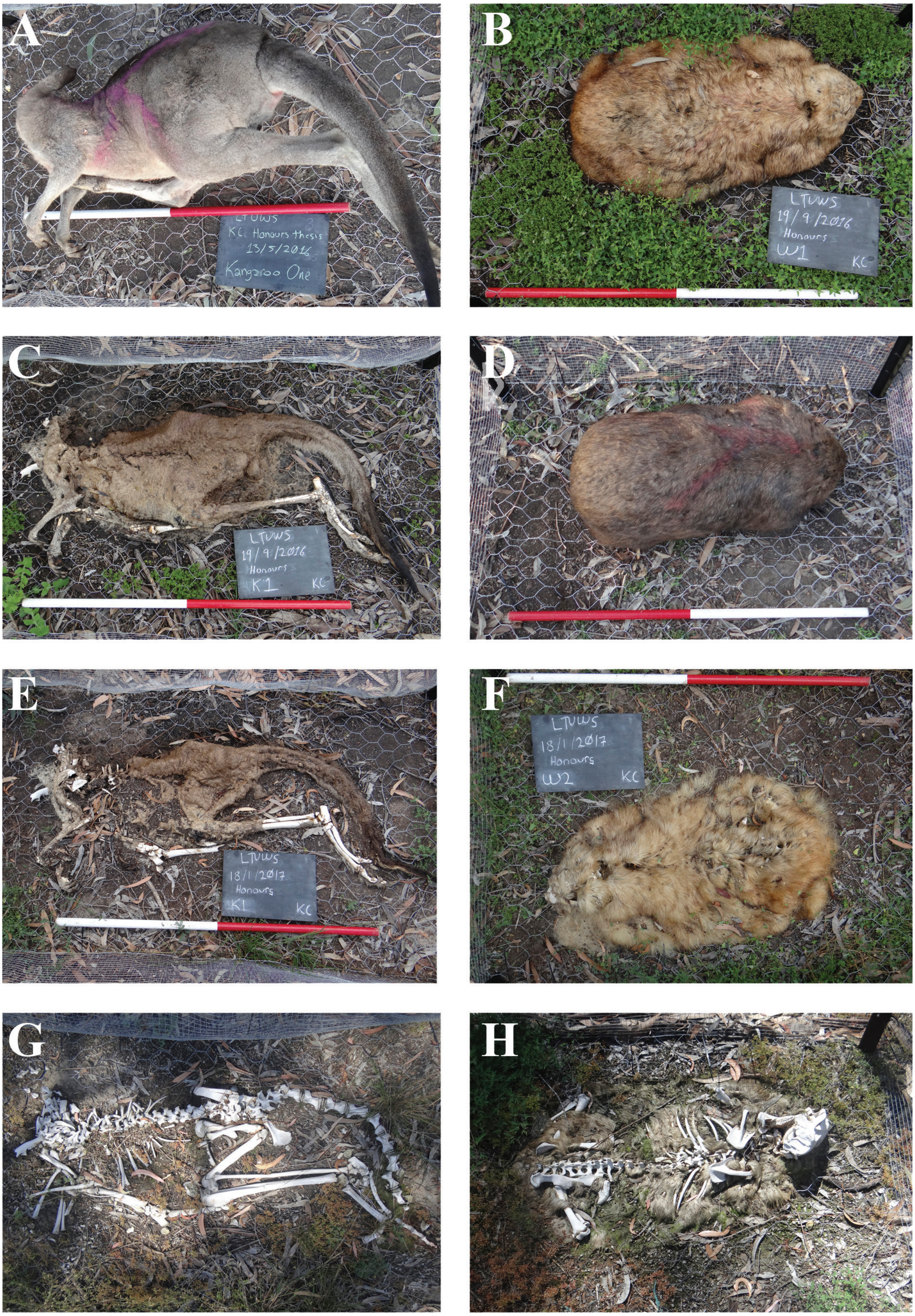

Figure 2: The differences in skeletonisation of EGK #1 (left) and CW #1 (right); A and B on Recording day 1; C and D on Recording day 15; E and F on Recording day 21; and G and H on Recording day 29

producing a slower rate of bone weathering for the wombats.

Conclusion

This bone-weathering experiment is ongoing, with monitoring occurring several times a year. It is also anticipated that other native species will be added. The experiment is also being utilised as a teaching resource for zooarchaeology students in the Department of Archaeology and History at La Trobe University. These preliminary results indicate that Behrensmeyer's (1978) bone-weathering indices are not a uniform measure of how much time has elapsed between death and burial, with variation dependent on species, skeletal elements, and climate and ecological conditions. There may also be differences between juvenile and adult bones, and female and male specimens, however more research is needed to test these variables. The preliminary results discussed here suggest that it is important to develop taxon- and climate-specific baseline weathering data to accurately measure the time since death and the burial of archaeological assemblages. Therefore, this research has the potential to provide important data for bone weathering specific to Victorian contexts and can assist archaeologists in the interpretation of faunal remains.

Acknowledgements

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