

# Megafauna at Keilor and the timing of their extinction

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The Keilor archaeological area is located approximately 16 km northwest of Melbourne near the confluence of Dry Creek and the Maribyrnong River (Figure 1). In 1940 a human cranium was discovered in the locality and later the area was excavated by Alexander Gallus and teams from the Victoria Archaeological Survey and La Trobe University (Bosler 1975, Mulvaney 1998). This paper details the results of a faunal analysis conducted on materials recovered from the later excavation (Duncan 1998). Its focus is the lower stratigraphic layers known as the D-Clay and the underlying Older Dry Creek Alluvium (ODCA).

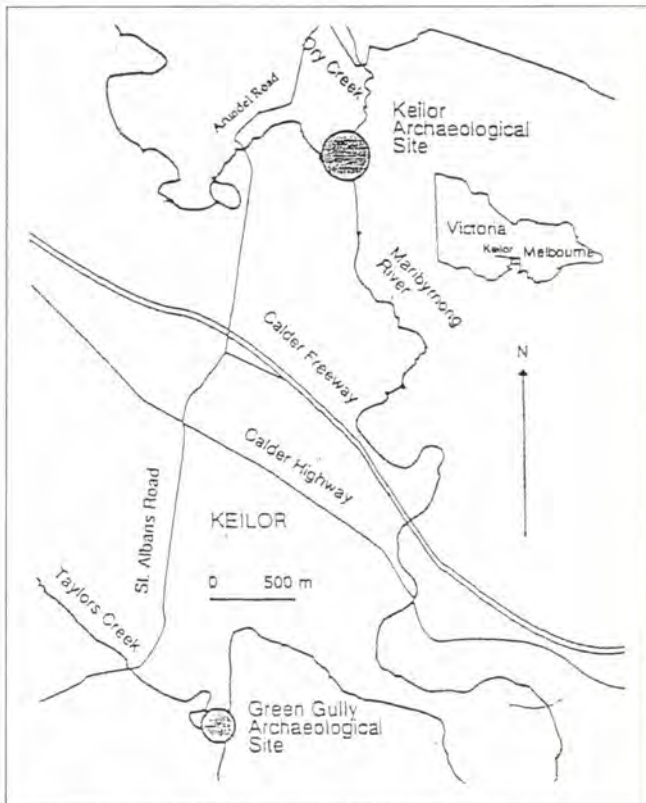


Figure 1 The Keilor Archaeological Area (from Burke 1990:2).

technical developments of hominids in Australia. Marshall's (1974) analysis of the faunal remains recovered from those digs showed that extinct megafaunal species were present at Keilor, perhaps as recently as 20,000 years ago. This faunal analysis aims to test the validity of claims made by Marshall by comparing the results of his study with the results of the VAS/LTU excavation faunal analysis. The results reaffirm Keilor's importance to Australian archaeology, and are relevant to the megafauna extinction debate.

## Geological setting

The Keilor Archaeological Area is associated with three major river terraces of the Maribyrnong River valley. The Maribyrnong Terrace is the most recent of the three terraces. Radiocarbon dates suggest that it was deposited between 2000 and 5000 years ago (Bowler 1970). The next oldest is the Keilor Terrace or Dousta Galla Silt. It began forming around 20,000 years ago (Bowler 1970, Anderson 1972, Joyce and Anderson 1976). Gill (1966) identified a prominent horizontal diastem in this deposit. Radiocarbon dates suggest that the break happened some 15,000 years ago (Anderson 1972:65, Simmons and Ossa 1978).

The earliest in the sequence is the Arundel Terrace which comprises all pre-Keilor Terrace layers. Three separate phases of deposition are recognised (Table 1). Phase C, which includes the Older Dry Creek Alluvium (ODCA) Gravel Complex, Mottled Clay and Channel "X" layers, represents the base of the Arundel Terrace. These layers consist of point bar sands (80%), channel gravels and some overbank silts. Phase B, represented by the D-Clay layer, consists of silty, fine-grained overbank silts. Phase A (Chocolate Clay and Channel "Y"), consists of channel and point bar sediments with only a minor overbank silt component (Anderson 1972, Joyce and Anderson 1976).

The two layers of the Arundel Terrace excavated by the VAS/LTU teams are the D-Clay and the ODCA. No radiocarbon dates have been obtained from either layer but Joyce and Anderson (1976) estimated ages of 25,000 – 40,000 years BP for the D-Clay and 40,000 – 50,000 years BP for the

Terrace	Phase	Above Ford	Below Ford
Keilor Terrace		Keilor Terrace Material Basal Keilor	
Arundel Terrace	Phase A		Channel Y Chocolate Clay
	Phase B	D-Clay	
	Phase C	Older Dry Creek Alluvium (ODCA) Gravel Complex	Channel X Mottled Clay

Table 1 Sedimentary layers for the Arundel terraces in order of descending age (adapted from Anderson 1972:64).

During the late 1960s and early 1970s Gallus (1971, 1972, 1974, 1983) conducted a series of excavations at Keilor which were driven by his quest to find evidence of the earliest

ODCA. Radiocarbon dates obtained by Gallus from the top of the Chocolate Clay (Phase A) and Mottled Clay layers (Phase C) returned ages of 31,600 +1100 - 1300 (ANU 65) and 24,000 +1300 - 5700 (ANU 81) respectively (Anderson 1972:66). However, ANU 81 is slightly lower in the profile than ANU 65. This led Anderson (1972:66) to suspect that at least one

sample is likely to be contaminated by younger carbon. Until more dates are obtained from Keilor, the D-Clay and ODCA layers can only be assumed to be greater than 31,000 years old.

### The VAS/LTU excavation

From 1977 to 1982 a team of archaeologists from VAS and a team of staff and students from La Trobe University directed by Paul Ossa, excavated at the Keilor site. The excavation consisted of three pits each measuring 3m x 3m, and labelled Z, A, and B from north to south. The pits were divided into squares labelled 1- 9. Each pit measured 1m x 1m. The pits were dug in spits, usually 10cm in depth. Where possible, the natural stratigraphy was followed. Excavation continued over a period of six years, from 1977 to 1982, but only Pit B was dug to sterile layers. Pit A was dug to a depth of around 3m, Pit Z to around 1.7m, and Pit B to around 7.2m (Burke 1990).

### Stratigraphy and chronology of the excavated deposits

The upper 80cm of excavated deposit, referred to as the Ploughzone Layer, is a chernozem soil heavily disturbed by recent agricultural practices (Witter and Simmons 1978:46). There is also evidence of burrows (as much as 2m wide in some places) and fine root intrusions in this layer and the underlying Douтта Galla Silt (Witter and Simmons 1978:46). Artefacts belonging to the Small Tool Tradition have been recovered from the Ploughzone layer, suggesting that this layer is no older than 5-6000 years (Mulvaney 1975:215, McCarthy 1976, Munro 1997:28). No radiocarbon dates have been obtained from the ploughzone.

The only radiocarbon date obtained from the VAS/LTU excavation was on charcoal from the Douтта Galla Silt (Keilor Terrace). This was dated to 13,300 +1100/-900 BP (SUA 2215). The charcoal was taken from one of two hearths located in the Douтта Galla Silt, close to the horizontal diastem (Figure 2, Simmons and Ossa 1978:64-66, Burke 1990:6-17, Munro 1997:30). Stone artefacts, particularly those made from common opal, cluster around the hearths. This indicates vertical stability within the Douтта Galla Silt despite cracking caused by seasonal swelling and shrinking (Munro 1998).

The D-Clay layer comprises fine-grained overbank sediments deposited by frequent floods at low velocity. Such low flow velocities are unlikely to have washed artefacts into the deposit and they are probably *in situ*. Munro (1998) has shown that the lithic assemblage in the D-Clay resembles the assemblage in the Douтта Galla Silt. Both assemblages reflect a full reduction process, suggesting that the stone tools were manufactured on-site. However, common opal was not encountered in any of the D-Clay spits. This is further evidence of the vertical stability of the site (Munro 1998).

The ODCA layer is a high-energy fluvial deposit composed of point bar sands and channel gravels. Excavated material from this layer is likely to be redeposited. Only seventeen pieces of stone artefact debris (angular fragments and chips), five whole flakes, and one quartzite core were recovered from the ODCA layer. All of the flakes display edge damage and abrasion, suggesting that rolling occurred during redeposition (Munro 1997:91).

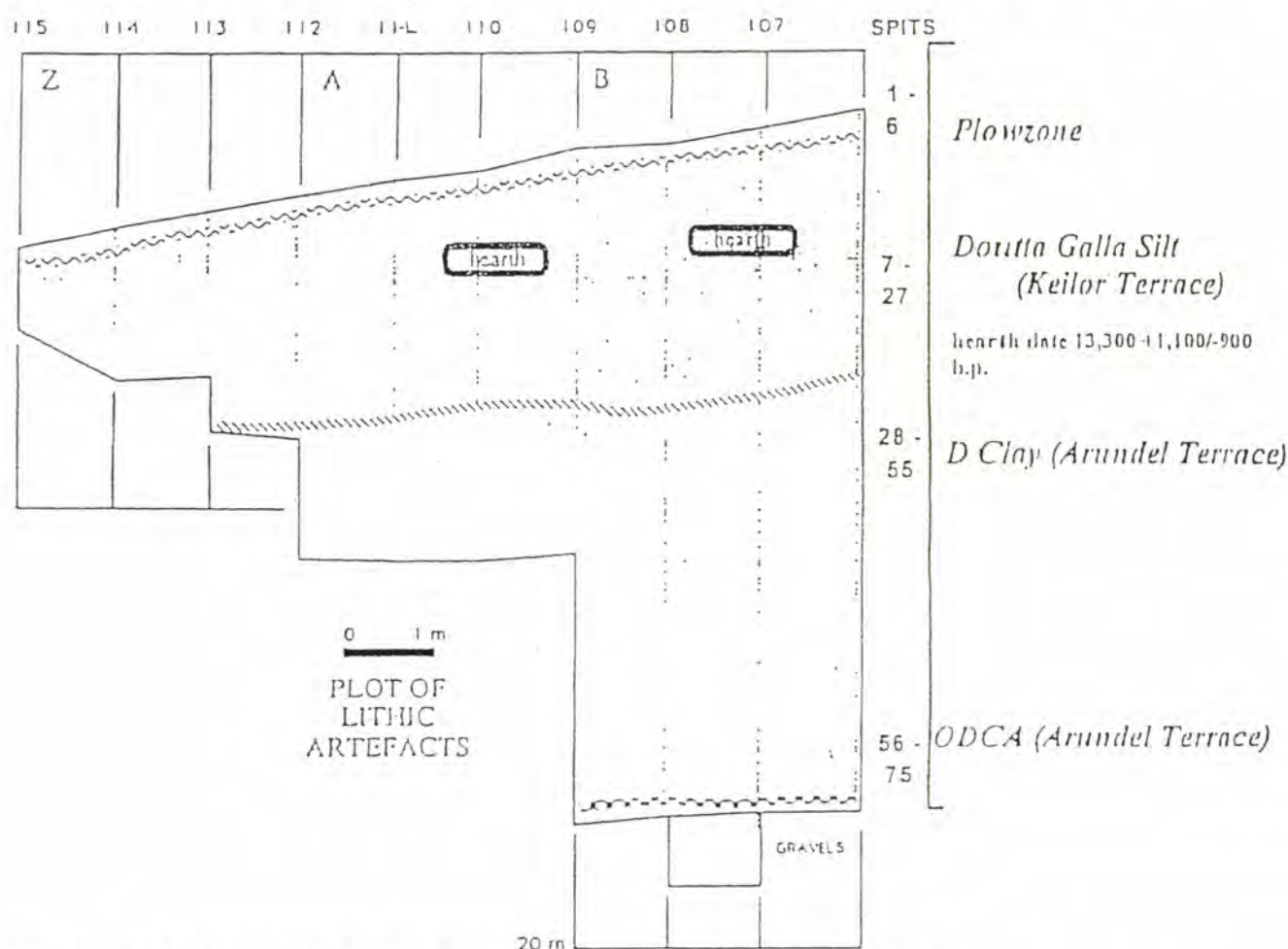


Figure 2 The Keilor excavation pits (from Burke 1990:6). No other section drawings were available for this study.

D CLAY - Number of Identified Specimens Present (NISP)	
Spits	28 29 30 31 32 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 Total
MODERN SPECIES	
<i>Antech/Smin</i>	2
Large Macropod	1 1 2 1 2 1
Large Marsupial	2 32 4
<i>M. giganteus</i>	1
<i>M. fuscus</i>	1 11 50 14 2 8 5 3 2 1
Medium Macropod	1 2 2
Rodent	1 1 3 2 3 1 1 1 2
Small Mammal	1
<i>Protemnodon sp.</i>	1
Unid. Taxon	3 3 7 1 1 1 13 25 22 3 9 10 15 46 10 27
Total	1 3 3 9 1 1 1 3 12 54 17 5 9 5 3 3 15 29 26 5 9 11 49 51 12 27 366

Table 2 Number of identified specimens present for the D-Clay.

ODCA - Number of Identified Specimens Present (NISP)	
Spits	56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 Total
MODERN SPECIES	
Large Macropod	2 1 2 1 1 7 3 4 7 3 2 1
Large Marsupial	1 2 1 1 5 2 26 1 1 3 3 4 4 4 13 57 17 19
<i>M. giganteus</i>	3 1 1
Medium Macropod	1
Medium Marsupial	1 2
Small Macropod	1
Small Mammal	1
MEGAFUNA	
Megafauna (unid.)	2 1 1
Megafaunal Macropod	1 1
<i>Protemnodon sp.</i>	1
<i>Z. trilobus</i>	1
Unid. Taxon	33 96 39 6 9 6 8 26 9 12 2 2 4 18 52 16 150 209 37 30
Total	35 100 40 6 13 11 12 53 11 12 3 5 7 22 64 23 171 278 59 54 3 982

Table 3 Number of identified specimens present for the ODCA.

The quartzite core was excavated from 7m below the surface (see Munro 1998:31, Figure 8). The core weighed 58.5 grams and had at least four battered removals detached from the same striking platform. Two removals run the full depth of the flaked surface while shorter ones had stepped terminations (Munro 1997:85-87, 1998). It is clearly cultural in origin and in excess of 31,000 years old. Consequently, Keilor is the oldest known Aboriginal site in Victoria.

**VAS/LTU Faunal Analysis**

Nine taxonomic categories are represented in the D-Clay and eleven in the ODCA. One megafaunal element (*Protemnodon sp.*) was identified in the D-Clay whereas eight megafaunal elements were identified in the ODCA. These eight comprised the categories *Protemnodon sp.*, *Z. trilobus*, megafauna, and megafaunal macropod. Some of these elements are clearly megafaunal (indicated by their very large size) but due to heavy calcite encrustation could not be identified to species.

Tables 2 and 3 show the taxonomic range identified from individual excavation spits. Numbers represented are the calculated Number of Identified Specimens Present (NISP) for each taxon, as well as those bone specimens that could

not be securely assigned to species. These were assigned to the broader categories large marsupial, medium marsupial, small mammal, large macropod, medium macropod, small macropod, megafaunal macropod, megafauna (unidentified), and rodent. Marsupial mice were incorporated into the broader category *Antechinus/ Sminthopsis*.

To identify the relative abundance of each animal, NISPs were calculated by counting all of the bones identified in each layer to each taxon category. The Minimum Number of Individuals (MNI) was calculated by counting the number of the most commonly occurring (left or right) complete skeletal element for each animal per spit. Cranial, teeth and rib elements were not included in MNI counts. Due to the fragmentary nature of the faunal remains, few left or right complete elements could be recorded. MNI counts for all taxa are shown in Tables 4 and 5.

Owl pellets comprising rodent and marsupial mice bones dominate the faunal assemblage of the D-Clay. Small numbers of macropod remains (mostly teeth) are distributed throughout the D-Clay in variable quantities.

Two fourth metatarsals belonging to the extinct genus *Protemnodon sp.* were identified. One was located in spit 52 of the basal D-Clay layer and another was found in spit 73 of the ODCA. It is unlikely that the *Protemnodon sp.* bone from the D-Clay layer was deposited as a result of fluvial

Spits	<i>Protemnodon</i>		<i>M. giganteus</i>		Large macropod		Large Marsupial		Med. Macropod		<i>M. fuscus</i>		Small Mammal		Rodent		<i>Anlech/Smin</i>										
	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.						
28													1	1	0.1												
29																											
30																											
31																			2	1	0.2						
32						1	1	0.3																			
33																											
34																											
35																1	1	0.1									
36						1	1	0.3																			
37									1	1	0.1	1	1	0.2													
38												6	3	1			6	1	0.9								
39												8	2	1			45	1	4								
40												2	1	0.2			14	1	1.2								
41																	5	1	0.5								
42												3	1	0.3			6	1	0.4								
43												1	1	0.1													
44												3	1	0.2													
45												1	1	0.1													
46						2	1	2.6																			
47						1	1	1.1			2	1	0.3				1	1	0.1								
48						2	1	0.2	2	1	0.3																
49																2	1	0.2									
50																											
51												1	1	0.1													
52	1	1	499	1	1	140			32	1	550																
53									4	1	31.7																
54											2	1	0.2														
55																											
Total	1	1	499	1	1	140	7	5	4.5	38	3	582	5	3	0.6	26	12	3.2	1	1	0.1	84	9	7.7	2	1	0.2

Table 4 NISPs, MNIs and weights for taxon represented in the D-Clay.

Spits	<i>Protemnodon</i>		<i>Z. trilobus</i>		Megafauna		Mega. Macropod		Large Macropod		Large Marsupial		<i>M. giganteus</i>		Med. Marsupial		Med. Macropod		Small Macropod		Small Mammal						
	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.	NISP	MNI	WT.			
56											1	1	0.1														
57									2	1	0.3	2	1	38													
58											1	1	512														
59																											
60						2	1	1941			1	1	36														
61												5	1	1232													
62									2	1	166	2	1	1894													
63									1	1	3.1	26	1	579													
64									1	1	188	1	1	138													
65																											
66												1	1	491													
67												3	1	272													
68												3	1	296													
69												4	1	922													
70						1	1	1995			7	1	8.8														
71									3	1	0.3	4	1	169													
72									1	1	1075	4	1	104													
73	1	1	207	1	1	1445			2	1	947	6	1	1.2													
74						1	1	0.5			3	1	57.7	17	1	493	1	1	0.4								
75									2	1	0.3	19	1	568	1	1	0.4	2	1	15							
76									1	1	0.2										1	1	0.1	1	1	0.1	
Total	1	1	207	1	1	1445	4	3	3937	3	2	2022	33	12	530	164	18	11739	5	3	1	3	2	18	1	1	0.1

Table 5 NISPs, MNIs and weights for taxon represented in the ODCA.

processes (Figure 3). Bones found in such fine-grained overbank deposits are usually autochthonous. This particular bone was initially encased in a fine-grained carbonate matrix (removed by acid treatment), very unlike the coarse lithic and carbonate matrix present on the bones from the ODCA. All bones recovered from the basal D-Clay have this distinguishing feature.

Duncan (1998, see Plates 3.1, 3.2, 3.3, 3.4, 3.5 and 3.6) shows how distinctive these carbonate encrustations are in thin section. One was taken from a calcite-encrusted bone fragment recovered from the basal D-Clay layer. The calcite is composed of clays from the river and feldspar derived from the weathering of the basalt. It formed uniformly around the bone while beneath the water table (John Webb, pers. comm.).

Another thin section was taken from part of a femur recovered from the ODCA layer. The femur probably belonged to a *Zygomaturus trilobus* or at least a member of the Diprotodontidae family. Two distinct layers of calcite formation were revealed. The inner layer is brown calcite, thicker on one side, suggesting that it probably formed when the bone was above the water table. Overlying this is an outer, clear calcite layer of uniform thickness, formed when the bone was below the water table. The uniformity of the calcite layers suggests that the bone probably remained stable after deposition. Within this outer layer are sub-layers of calcite representing discrete phases of deposition. These may be climatically driven, and have the potential for laser ablation uranium series dating (John Webb, pers. comm.).

The faunal evidence from the VAS/LTU analysis demonstrated that in the time interval between the deposition of the ODCA and the D-Clay, the megafaunal species *Zygomaturus trilobus* disappeared and the species *Macropus titan* underwent a reduction in size. Interestingly, the megafaunal genus *Protemnodon* continues into the basal D-Clay layer. From spit 51 only modern species are present in the site.

**Analysis of the Gallus Faunal Remains**

Marshall (1974) conducted an analysis of the faunal material from Gallus' 'D', 'A', 'KA', 'KAA' and 'Y' excavations. Of these, the 'D' excavation was the closest to the VAS/LTU pits (parallel to and only a few metres away) and within the same sedimentary layers (Figure 4, Coutts and Cochrane 1978). Marshall

(1974) identified five species of extinct megafauna and four species which experienced Late Pleistocene dwarfing from the D-Clay. He collated these remains into a series of chronological and stratigraphic layers. The bones had initially come from different layers within different excavation pits. Marshall labeled the earliest Layer I, and the most recent Layer XI (Table 6). However, he could not be certain that the chronological order in which he positioned the remains was correct.

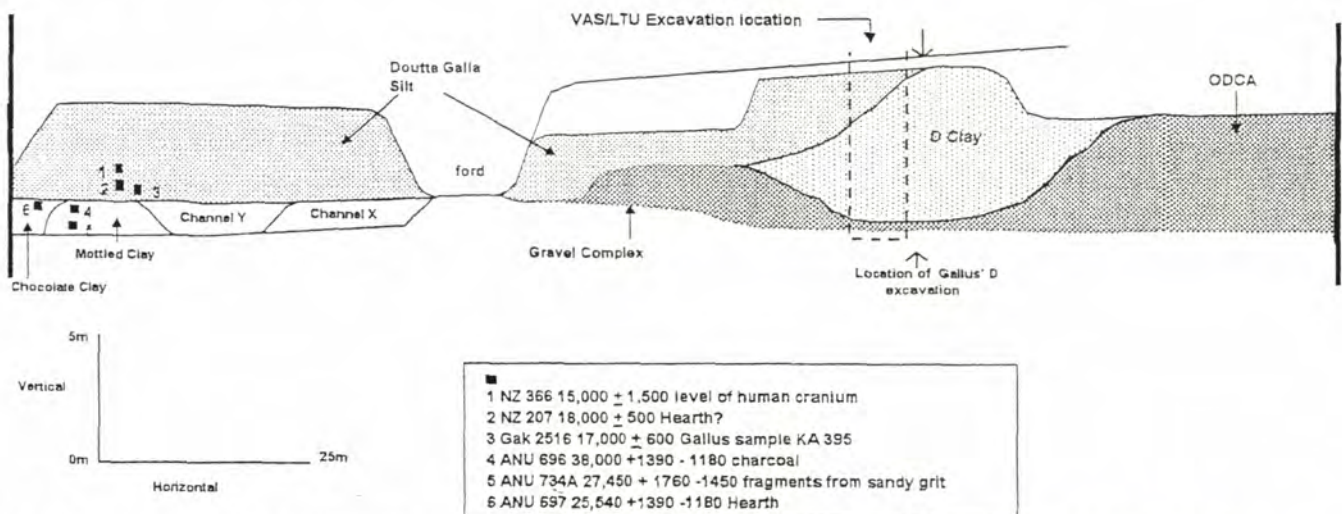
Marshall (1974) demonstrated that the D-Clay contained a discrete faunal assemblage different from the Doutta Galla Silt fauna. Marshall's 'Dry Creek Local Fauna' (D-Clay layer) consisted of the extinct species *Zygomaturus trilobus*,



**Figure 3** a) *Protemnodon* sp. fourth metatarsal from the D-Clay. b) *Protemnodon* sp. fourth metatarsal from the ODCA. c) *Macropus titan* fourth metatarsal from the Gallus' D Excavation. d) *Macropus giganteus* fourth metatarsal (Department of Archaeology, La Trobe University reference collection).

*Thylacoleo carnifex* and *Protemnodon* sp., the larger ancestors of extant species, including *Macropus titan*, and three other extant species (*Vombatus ursinus*, *Macropus rufogriseus*, *Perameles nasuta*. His 'Maribyrnong Local Fauna' (Doutta Galla Silt) consisted of *Megaleia rufa*, *Macropus giganteus*, *Mastacomys fuscus*, *Pseudomys cf. gracilicaudatus*, and *Pseudomys cf. australis*. Marshall (1974) placed this faunal transition at around 20-25,000 years ago, coincident with a change in the local climate and environment.

When Marshall's D-Clay assemblage analysis is compared with the results of the VAS/LTU analysis the species



**Figure 4** Longitudinal cross section drawing of the Maribyrnong River terraces at dry Creek, Keilor (adapted from Joyce and Anderson 1976:55).

Species	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	Total
<i>Sarcophilus lanianus</i>	-	-	-	1	11	1	-	-	-	-	-	1
<i>Thylacynus cynocephalus</i>	-	-	-	-	-	1	-	-	-	-	-	1
<i>Parameles rasuta</i>	-	-	1	-	-	-	-	-	-	-	-	1
<i>Vombatus ursinus</i>	-	-	2	1	-	-	-	-	-	-	-	2
<i>Thylacoleo carnifex</i>	-	-	-	-	-	-	-	-	-	-	1	1
<i>Protemnodon anak</i>	-	-	-	-	1	-	-	-	-	-	1	2
<i>Protemnodon brehus</i>	-	-	1	-	-	-	-	-	1	-	-	1
<i>Protemnodon sp.</i>	-	-	1	-	-	1	-	-	1	1	-	-
<i>Macropus rufogniseus</i>	-	-	-	1	1	1	1	-	-	-	1	3
<i>Macropus agilis</i>	-	-	-	3	1	1	1	-	-	-	-	5
<i>Macropus titan</i>	-	1	3	2	2	3	3	2	1	1	3	13
<i>Macropus cf. terragus</i>	-	-	1	-	-	-	-	-	-	-	-	1
<i>macropodid</i>	-	2	1	2	2	1	-	1	1	1	1	-
<i>Zygomaturus trilobus</i>	1	1	-	-	-	-	-	-	-	-	-	2
<i>diprotodontid</i>	-	-	-	-	-	-	-	1	-	-	1	-
Total	1	4	10	10	8	9	5	4	4	3	8	33

Table 6 Specimens identified in Marshall's analytical levels (adapted from Marshall 1974:65, table 1).

composition of the two assemblages is similar. However, a significant difference in the timing of the megafaunal extinctions emerges. The evidence from the VAS/LTU excavation points to extinction occurring during the deposition of the D-Clay, underlying the Dousta Galla Silt, whereas Marshall (1997) places this event at the boundary of the Dousta Galla Silt and D-Clay.

In 1998, a stratigraphic section of the Gallus' 'D' excavation was uncovered in the Palaeontology Department of the National Museum of Victoria (Figure 5). This drawing is dated 1969 and shows the location of Gallus' 'D', 'B', 'A', and 'KA' excavations. The drawing is a memo addressed to Tom Darragh, and possibly a page from a field diary of Gallus' 'D' excavation. This drawing indicates that the megafaunal remains probably came from the ODCA, and possibly others from the basal D-Clay. It shows that the megafaunal remains were not distributed throughout the D-Clay, but probably at the boundary of the D-Clay and ODCA within a sandy band and a gravel band. These bands are not characteristic of the fine-grained D-Clay.

Examination of the faunal assemblage from Gallus' 'D' excavation also lends support to this theory. Most of the remains are, or initially were, encased in a heavy layer of carbonate, which is also a strong distinguishing feature of the VAS/LTU faunal remains excavated from the ODCA. Similarities can also be seen in the composition of species from the two assemblages, with the species *Z. trilobus*, *M. titan* and *Protemnodon sp.* present in each assemblage.

When the VAS/LTU and Gallus faunal assemblages are combined with respect to their proper sedimentary contexts they now appear to tally. The 'Maribymong Local Fauna' of Marshall (1974) consists of five species (*Megaleia rufa*, *Macropus giganteus*, *Mastacomys fuscus*, *Pseudomys cf. gracilicaudatus*, and *Pseudomys cf. australia*) representative of the Dousta Galla Silt. The D-Clay layer now consists of the species *Antechinus*, *Sminthopsis*, *Macropus giganteus*, and *Mastacomys fuscus*, and *Protemnodon sp.* The 'Dry Creek Local Fauna' of Marshall (1974) consists of the species *Zygomaturus trilobus*, *Thylacoleo carnifex*, *Protemnodon sp.*, *Macropus titan*, *Vombatus ursinus*, *Macropus rufogniseus*, and *Perameles nasuta* and are representative the ODCA.

#### Keilor's place in the 'great megafauna extinction debate'

Flannery (1999) states "that there is currently no unequivocal evidence for the survival of any Australian megafauna after 40,000 years ago", but there are sites with

megafaunal remains which date to within the period of human occupation. The megafauna recovered from Spring Creek, Victoria have a minimum age of around 35,000 years BP (White and Flannery 1995). At Cuddie Springs in northern N.S.W., the evidence points to megafauna surviving up until 30-35,000 years ago (Dodson et al. 1993, Furby 1995, Fullagar and Field 1997, Field and Dobson 1999). The Lancefield Swamp megafauna survived until sometime between 30,000 and 60,000 BP (van Huet et al. 1998). New evidence from Lake Mungo shows a co-existence of humans and megafauna, possibly between 40,000 and 50,000 years BP (Bowler 1998).

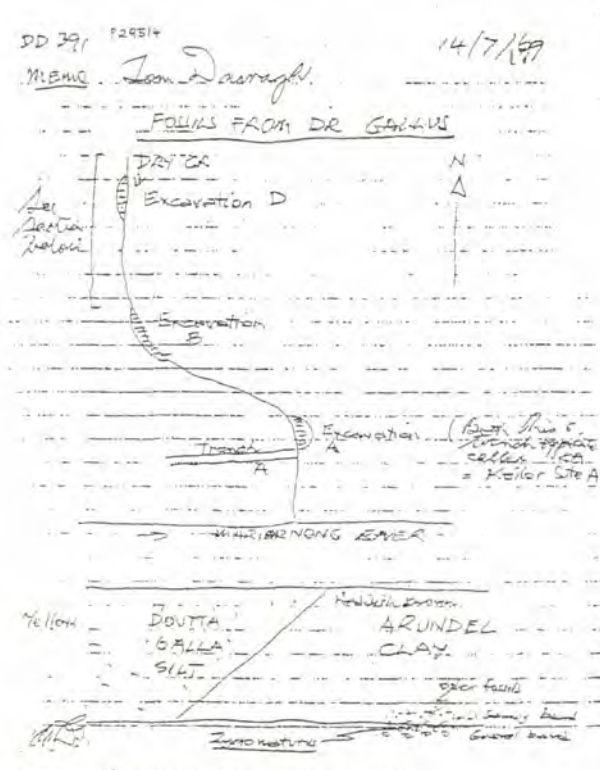


Figure 5 Memo concerning Gallus' excavations.

Unfortunately, there is no clear understanding of the relationship between the megafaunal remains from these deposits and their associated cultural materials. Keilor is no different. The megafaunal remains and stone tools from the ODCA layer were fluvially transported to the site. It is also

likely that the megafaunal remains are considerably older than the deposit in which they came to rest.

Evidence of co-existence at Keilor comes from the fourth metatarsal of the extinct *Protemnodon sp.*, found within the basal D-Clay. This megafaunal bone was found in a layer above stone artefacts in the ODCA. These artefacts were fluvially transported and cannot be explained by vertical slippage. Their presence within the ODCA demonstrates that the overlying D-Clay layer was deposited after the arrival of humans. The real problem is that the *Protemnodon sp.* metatarsal was the only megafauna bone recovered from the D-Clay.

Inevitably, critics will quite justifiably question whether an argument for co-existence can rest on the evidence of only one bone within an undated layer. Yet many faunal remains were recovered from the Gallus excavations including some very large and unusual bones from the apparently more recent Chocolate Clay layer, all of which require identification and further study. More dates are also needed on the bones and terrace deposits.

#### Acknowledgements

This paper presents the results of research conducted as part of a BA (Hons) thesis conducted at the Department of Archaeology, La Trobe University. I would like to thank the following people who helped me with my project while in production.

Thanks to Betty Thompson and Tom Rich from the Museum of Victoria for allowing me access to their collection of megafauna. Thanks to the Wurundjeri Aboriginal Community, in particular Bill Nicholson Senior for allowing me to conduct research on the Keilor materials. I am indebted to Aboriginal Affairs Victoria for providing funding for acid etching materials. Thanks to John Webb, Department of Earth Sciences, La Trobe University for providing the thin sections of the Keilor bones. Also thanks to my supervisors Phillip Edwards and Richard Cosgrove of the Department of Archaeology, La Trobe University. Also thanks to Tim Stone, Department of Earth Sciences, University of Melbourne, for helpful comments on a draft version of this paper.

#### References

- Anderson, J.R. 1972 The Quaternary geology and sedimentology of the Gallus Sites at Keilor, Victoria. Unpublished B.Sc. (Hons.) Thesis. School of Geography, University of Melbourne.
- Bosler, W. 1975 The Keilor archaeological sites: an historical survey. Unpublished B.A. (Hons.) Thesis. Department of Prehistory and Anthropology. Australian National University.
- Bowler, J.M. 1970 Alluvial terraces in the Maribyrnong valley near Keilor, Victoria. *Memoirs of the National Museum of Victoria*, 30:15-58.
- Bowler, J.M. 1998 Willandra Lakes revisited: environmental framework for human occupation. *Archaeology in Oceania* 33:120-155.
- Burke, C. 1990 *Analysis of the lithic assemblage from the Keilor archaeological sites*. Occasional Report No. 30, Victoria Archaeological Survey, Ministry for Conservation.
- Coutts, P.J.F. and Cochrane, R.M. 1977 *The Keilor Archaeological Area*. Victoria Archaeological Survey, Special Publication, Ministry of Conservation.
- Dodson, J.R., Fullagar, R., Furby, J., Jones, R. and Prosser, I. 1993 Humans and megafauna in the Late Pleistocene environment from Cuddie Springs, northwestern New South Wales. *Archaeology in Oceania* 28:94-99.
- Duncan, J. 1998 Investigations of the co-existence of humans and megafauna at Keilor, Victoria. Unpublished B.A. (Hons.) Thesis, Department of Archaeology, La Trobe University.
- Field, J. and Dodson, J. 1999. Late Pleistocene megafauna and archaeology at Cuddie Springs, southeastern Australia. *Proceedings of the Prehistoric Society*. 65:1-27.
- Flannery, T.F. 1999 Debating extinction. *Science* 283:182-183.
- Fullagar, R. and Field, J. 1997 Pleistocene seed-grinding implements from the Australian arid zone *Antiquity* 71:200-207.
- Furby, J. 1995 Megafauna under the microscope: Archaeology and palaeoenvironment at Cuddie Springs. Unpublished PhD Thesis, School of Geography, University of New South Wales.
- Gallus, A. 1971 Excavations at Keilor: Report No. 1. *The Artefact* 24:1-12.
- Gallus, A. 1972 Excavations at Keilor: Report No. 2. *The Artefact* 27:9-18.
- Gallus, A. 1974 A summary of the results of the excavations by the Archaeological Society of Victoria at Keilor. *The Artefact* 33:1-9.
- Gallus, A. 1983 Excavations at Keilor, Victoria. Report No. 3. Excavations in the D Clay. *The Artefact* 8(1-2):11-41.
- Gill, E. 1966 Provenance and age of the Keilor cranium: oldest known human skeletal remains in Australia. *Current Anthropology* 7:581-4.
- Joyce, E.B. and Anderson, J.R. 1976 Late quaternary geology and environment at the Dry Creek archaeological sites near Keilor, Victoria, Australia. *The Artefact* 2:47-74.
- Marshall, L.G. 1974 Late Pleistocene mammals from the Keilor cranium site, Southern Victoria, Australia. *Memoirs of the National Museum of Victoria* 13:79-81.
- McCarthy, F.D. 1976 *Australian Aboriginal Stone Implements*. Sydney: Australian Museum Trust.
- Mulvaney, D.J. 1975 *The Prehistory of Australia*. Harmondsworth: Penguin.
- Mulvaney, D.J. 1998 Dr Gallus and Australian Archaeology. *The Artefact* 21:4-8.
- Munro, M. 1997 An analysis of stone material from the Keilor site. Unpublished B.A. (Hons.) Thesis, Department of Archaeology, La Trobe University.
- Munro, M. 1998 The stone artefact assemblage from Keilor. *The Artefact* 21:19-34.
- Simmons, S. and Ossa, P. 1978 Interim report on the Keilor excavation - May 1978. *Records of the Victoria Archaeological Survey*. No. 8, Ministry of Conservation.
- van Huet, S., Grün, R., Murray-Wallace, C.V., Redvers-Newton, N. and White, J.P. 1998 Age of the Lancefield megafauna: a reappraisal. *Australian Archaeology* 46:5-10.
- White, J.P. and Flannery, T. 1995 Late Pleistocene fauna at Spring Creek, Victoria: a re-evaluation. *Australian Archaeology* 40:13-16.
- Witter, D. and Simmons, S. 1978 The Keilor excavations: first season 1977/78 *Records of the Victoria Archaeological Survey*. No.8, Ministry of Conservation.

