Bennett’s wallaby marrow quality vs quantity: Evaluating human decision-making and seasonal occupation in late Pleistocene Tasmania

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Archaeology of Late Pleistocene SW Tasmania

- First site identified during the late 1970s- **KUTIKINA CAVE**.


- Followed by the Southern Forests Archaeological Project in 1990s by La Trobe University (Richard Cosgrove, Jim Allen and colleagues) excavated several more caves. e.g. Nunamira, Bone Cave, Warreen, Pallawa Trounta.

- In 2005 the Kutikina faunal assemblage was analysed.

- Recent Bennett’s wallaby teeth annuli studies indicate seasonal use of the landscape (Pike-Tay, Cosgrove & Garvey 2008 JAS).
SW Settlement Pattern & Chronology (Uncal 14C)
35,000-10,000BP

Warreens 34,780-18,630
Parmerpar Meethaner 34,000 - 750
ORS 7 30,840 - 2,500
Nunamira 30,420 - 11,630
Bone Cave 29,000 - 13,700
Pallawa Trounta 29,800 - 13,410
Kutikina Cave 19,770 - 14,840
Mackintoshosh 17,000

Southwest Tasmania characterised by:
- >950,000 bones analysed
- Bennett’s wallabies dominate
- Preference for the larger hindlimbs
- Femora and tibiae always split open
Kutikina Cave excavated 1981

Kutikina Cave:
• 1m² wide, 1.3m deep excavated

• Volume 0.583 cubic metres, wet sieved (3mm)

• 11 C14 dates - 22,000-15,000 (LGM)

• Only published paper on Kutikina excavation or analysis was preliminary report in 1983 *Nature*: approx 250,000 bones & 30,000 stone tools.

• Unpublished preliminary report on faunal sample by Geering 1983.

Tasmania was joined to mainland Australia during the late Pleistocene.
“The specific targeting onto reindeer by the European hunters bears comparison with the similar emphasis on wallabies by subsub-Antarctic palaeo-Tasmanians” (Kiernan et al. Nature 1983:31).
Bennett’s wallaby (*Macropus rufogriseus*)

- Also known as the Red-necked wallaby
- Small wallaby weighing 10-15kg
- Found in SE mainland Australia & Tasmania
- In Tasmania:
  - Seasonal breeders
  - Widespread distribution
- Common in zoos and as pets in Europe & Nth America:
  - Quiet nature
  - Easy to breed
  - Excellent lawnmowers

Male Red kangaroo (70kg) with female grey (45kg)

Female (10kg) Bennett’s wallaby

Kangaroo skeleton

Tamar wallaby (8kg) with joey
Typical spit from Kutikina- Bennett’s wallaby dominates.
2005-2007 Kutikina results

- 269,459 bone fragments, weighing 46.11kg were analysed (Garvey 2006).

- 28,210 or 12% identified to taxon &/or element.

- 21 species identified, 13 of which are potential human prey taxa (identified by Cosgrove & Allen 2001).

- Of the potential prey BW >92% (MNI 44), Wombats <7% (MNI 10), minor medium elements.

- Emu and grey kangaroo identified.
Kutikina Cave

Taphonomic history

- small mammals
- medium mammals

- bones relatively complete = owls
- humans? - devil, thylacine or quolls?
- natural death?

- humans selected whole animals
- humans selected certain elements such as the lower long bones
- humans selected entire wombats

- Wombat (7%) kangaroo & emu

Bennett’s wallaby ( >75%)

Images from Van Dyck & Strahan 2008
Bennett’s wallaby represents <92% of the identified fauna

MNI 44 (per Unit)

- Hindlimb dominates.
- Axial and manus under represented.
- Numerous cut marks on hindlimbs.
- Tibiae and femora always smashed open.
- 4\textsuperscript{th} and 5\textsuperscript{th} metatarsals, large phalanges, calcaneum often smashed open.
Kutikina wallaby bones

- cut marks
- bone point
- chop? marks
- access marrow

A- distal tibia
B- fibula
C- pes phalange
D- distal humerus

Garvey 200x

size range

cut mark location
Why the dominance of Bennett’s wallaby split hindlimb longbones?

1. Marrow/meat quality?
   and/or
2. Marrow/meat quantity?
   and/or
3. Processing time?
Marrow and meat quantity: economic utility

- Marrow and meat quantity was evaluated by Garvey 2010 *Quaternary International* 211(1-2):144-156.

- It seemed that humans were not under selective pressure concerning which parts of the animals they transported.

- Ignored some of the larger ‘meaty’ elements such as the sacrum, preferring the hindlimbs which were found to not only carry large amounts of flesh but also the greatest volume of bone marrow.
Bennett’s wallaby economic utility: Meat Utility Index (MUI)

The %MUI for the 4 wallabies and the mean. indicates the highest body part.

Accounts for the possibility of riders: other body parts selected along with preferred elements (Binford 1978, pp. XX). Where RED- high in meat/marrow & common in Kutikina; BLUE- those high in meat/marrow & rare in Kutikina.


Marrow and meat quality: marrow composition

- Fatty acid analysis, in particular oleic acid (a monounsaturated omega-9 fatty acid), argued to be a good indicator of unsaturated fat quality (Binford 1978).

- It has been found that in caribou, and ungulates in general, unsaturated fats increase as you move away from the body core temperature or the heart (Meng et al. 1969; West and Shaw 1975).

- High % unsaturated fatty acids in the distal limbs causes lowering a of melting temperature and oiler marrow (Irving et al. 1957; Morin 2007).

- While extensive work has occurred on ungulates, there has been no analysis of marsupial bone marrow.
  - Test to see if a similar pattern occurs in the Bennett’s wallaby.
  - How does age, sex, altitude, and season effect bone marrow quality?
Marrow and tissue composition

- Total Fat (FOLCH) and Fatty Acid Profile (FAMES) determined.
- 14 fatty acids measured per sample.
- Fatty acid concentration of wallaby bone marrow decreased in saturated fats distally
- Largest fatty acid changes occurred in the monounsaturated Oleic acid (C18:1) and Palmitoleic (C16:1) both increased distally
- Saturated Palmitic acid (C16:0) and Stearic acid (C18:0) both decreased accordingly
- These results are similar to that identified in caribou *Rangifer tarandus* (Meng et al. 1969), Dall sheep *Ovis dalli* (West and Shaw 1975), and in the desert bighorn sheep *Ovis canadensis cremnobates* (Turner 1979).
Distribution of unsaturated fatty acids in the Bennett’s wallaby

after Meng et al. 1969;
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Note: the dark red saturated fat in the femur marrow, with the unsaturated marrow very pale in the distal tibia, i.e. increase in unsaturated fatty acids as you move away from the body core temperature or the heart.
Wallaby Collection Areas

Western Tiers
- 900-1300 m.a.s.l.
- alpine grasslands & herbfields
- cool summers & cold winters

Buckland
- 90-150 m.a.s.l.
- open dry sclerophyll
- variable climate
- warm to hot summers
- cool to cold winters

Maydena
- 190-240 m.a.s.l.
- wet sclerophyll
- high rainfall
- warm summers & cool winters

Tissue samples collected per wallaby (where possible):
1) tibia marrow
2) brain tissue
3) femur tissue

Seasonal variation:
1) Summer collection- February 2008
2) Autumn collection- May 2008
3) Winter collection- July 2008
4) Spring collection- October 2008

Note: the same 3 control areas as wallaby seasonal teeth annuli study by Pike-Tay, Cosgrove & Garvey 2008, JAS
Collecting road kill

27 individual wallabies tested:
- 8 Buckland (4M & 4F)
- 9 Maydena (4M & 5F)
- 10 Western Lakes (5M & 5F)

3 samples per wallaby (where possible)
- Brain tissue
- Hindlimb muscle
- Distal tibia marrow
Fatty acid results for the three collection areas

- mean max temperature (°C)
- mean min temperature (°C)
- mean rainfall (mm)

S- summer  A- autumn
W- winter  Sp- spring

Numbers on graph bars refer to individual wallabies
Preliminary conclusions

- Bennett’s wallaby remained stable and reliable resource throughout the year irrespective of:
  - Season
  - Rainfall
  - Temperature
  - Sex
  - Age
Future work

Then how do we explain hunting, butchery and seasonal patterns observed in late Pleistocene SW Tasmania?

Future work:

- Processing time & butchery practices
  - Ethnographic
  - Experimental

- Other commodities
  - Bone tools
  - Fur

- Bone Density
  - Scientific evaluation
  - However tiny complete rodent bones indicates excellent preservation

- Human physiology & the role of fatty acids
  - Environmental stress
  - Sex, age, pregnancy, breastfeeding, etc

Photo: R. Cosgrove
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References