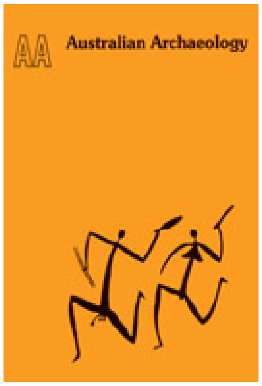
View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Flinders Academic Commons

Australian Archaeology



Archived at Flinders University: dspace.flinders.edu.au

Full Citation Details:
Pate, F.D. McDowell, M.C. Wells, R.T. & Smith, A.M. 2002. Last recorded evidence for megafauna at Wet Cave, Naracoorte, South Australia 45,000 years ago. 'Australian Archaeology', no.54, 53-55.

Archived at Flinders University: dspace.flinders.edu.au

SHORT REPORTS

LAST RECORDED EVIDENCE FOR MEGAFAUNA AT WET CAVE, NARACOORTE, SOUTH AUSTRALIA 45,000 YEARS AGO

F. Donald Pate
Department of Archaeology, Flinders University, Adelaide, SA 5001, Australia
Matthew C. McDowell and Rod T. Wells
School of Biological Sciences, Flinders University, Adelaide, SA 5001, Australia
Andrew M. Smith
Australian Nuclear Science and Technology Organisation, PMB 1, Menai, NSW 2234, Australia

Over 85 percent of Australian terrestrial vertebrate genera with a body mass greater than 44 kg became extinct during the late Pleistocene. These included all marsupials exceeding 100 kg (19 species) and 22 of the 38 species between 10 and 100 kg. Dwarfing occurred in many other species (Flannery 1990; Miller et al. 1999). The larger of these extinct animals have been categorised as megafauna.

Roberts et al. (2001) provide chronometric evidence for a continent-wide extinction of these megafauna at about 46,000 years ago. Others argue for regional variability in the timing of Australian megafaunal extinctions and the survival of some species to much later periods, e.g. *Genyornis newtoni*, *Diprotodon* sp. and *Sthenurus* sp. present from 36-27 ka BP at Cuddie Springs in northwestern New South Wales (Field and Dodson 1999; Horton 2000; Wroe and Field 2001).

To address the timing of megafaunal extinctions in the arid Lake Eyre Basin of inland northeastern South Australia, Miller et al. (1999) employed a range of dating techniques on more than 700 eggshells of the extinct ostrich-sized flightless bird *Genyornis newtoni*. These included amino acid racemisation (AAR), accelerator mass spectrometry (AMS) radiocarbon and thermal ionization mass spectrometry (TIMS) uranium series analyses. In addition, optical stimulated luminescence (OSL) was employed on associated sediments. Uranium series and OSL dates indicated that *Genyornis* was common in the Lake Eyre Basin until extinction occurred at 50 ± 5 ka cal BP. Radiocarbon measurements on carefully treated eggshell carbonate gave much younger ages with an effective maximum at 46 ka cal BP, which the authors concluded corresponded to the limit of radiocarbon dating for this type of sample. As the bones of *Genyornis* are associated with some of the youngest stratigraphic levels containing megafaunal remains, it is argued that the extinction of the Australian megafauna in general is likely to be coinicident with *Genyornis* extinction (Tedford and Wells 1990).

The large number of stratified fossil bearing karst caves in the Naracoorte region of southeastern South Australia provide a natural laboratory to address the timing of megafaunal extinctions in southern temperate Australia. Uranium thorium dates on speleothems, luminescence dates on quartz, and electron spin resonance (ESR) dates on megafaunal tooth enamel indicate sedimentary accumulation in the Naracoorte caves over the past 500 ka (Ayliffe et al. 1998; Moriarty et al. 2000).

Evidence suggests that large mammal carcasses and individual bones entered the caves from the above ground surface via pitfall entrances. Thus a majority of the faunal remains at Naracoorte have accumulated in sedimentary cones and associated fans immediately below pitfalls. As the cave accumulations sit above the local groundwater table (in the vadose zone), the bone deposits have been subjected to minimal re-working by water flow and remain relatively closely associated. Some slight re-working has been caused by runoff water flowing through the pitfall entrances redistributing sediments from the cones to distal fans (Wells et al. 1984; Brown and Wells 2000; Moriarty et al. 2000). Coring across the cones and associated fans was employed to demonstrate stratigraphic continuity and to provide further

Table 1. AMS radiocarbon results for charcoal samples from Wet Cave, Naracoorte, South Australia.

Sample No.	Lab No.	C Mass (ug)	% Modern C	Conventional Age (yr BP)	Depth (cm)	Sedimentary Stratigraphy	Munsell Soil Colour
WeC 36	OZE 539	2570	91.2	740 ± 40	42	brown clayey sand	7.5 YR 3/2
WeC 4	OZD 504	1320	17.6	13,920 ± 130	134	yellow-brown sand	10YR 5/6
WeC 25	OZD 714	1380	2.2	30,500 ± 400	233	brown sand	7.5 YR 4/6
WeC 27	OZD 717	1950	0.6	40,900 ± 850	268	top of brown sandy clay with megafauna	7.5 YR 4/6
WeC 35	OZE 538	1360	0.4	45,200 ± 1800	277	near bottom of brown sandy clay with megafauna	7.5 YR 4/6
WeC 16	OZD 506	1640	0	>45,000*	358	red clay with abundant megafauna	2.5 YR 2/5/4

* not distinguishable from background

Archived at Flinders University: dspace.flinders.edu.au

support for minimal re-working of sediments and associated bones (McDowell 2001).

Dating of charcoal associated with faunal bone from these stratified sequences should provide improved correlations between chronologies for charcoal and megafaunal deposition. Sequential dates for charcoal samples from the top to the bottom of the deposits will provide additional evidence for minimal post-depositional disturbance of the sediments and allow portions of the stratigraphic sequences that have been re-worked to be identified.

This paper reports the results of AMS radiocarbon dating of six charcoal samples obtained from a deeply stratified sequence in one of these caves, Wet Cave (5U10), located in the Naracoorte World Heritage Area approximately 300 km southeast of Adelaide, South Australia.

Methods

A total of 36 samples of charcoal were collected from a 3.5 m stratigraphic sequence in two adjacent excavation pits (Pit 1 and Pit 2) in Wet Cave from which with fossil material had been recovered. Sampling was restricted by the availability of charcoal pieces that were of sufficient size for AMS radiocarbon dating. Thus, samples could not be taken at regular intervals down the profile. Where possible, charcoal samples were collected at levels that represented obvious changes in the sedimentary stratigraphy. Due to the small size of the charcoal deposits in Wet Cave, backup samples were taken for the various levels.

Charcoal samples were submitted to the Australian Nuclear Science and Technology Organistaion (ANSTO) AMS dating facility (Lawson et al. 2000). Standard elemental carbon extraction procedures involving acid-base-acid pretreatment and bulk combustion were employed. In order to further minimise dating errors associated with contamination from younger carbon, AMS radiocarbon results for charcoal samples with extracted carbon masses of less than 100 mg were discarded. To correct for carbon isotope fractionation by the plant, $\delta^{13}C$ determinations were made on all samples with extracted carbon masses of greater than 500 mg.

Radiocarbon ages associated with strata containing megafauna were converted to calendar ages using the equation Calib Age = -5.85×10^{-6} (Conv ^{14}C Age)^2 + 1.39 (Conv ^{14}C Age) − 1807 following Miller et al. (1999). This calibration equation is based on paired U-series and radiocarbon dates from corals.

Results

Conventional radiocarbon ages range from 740 ± 40 BP near the top of the sequence to > 45 ka BP at the base (Table 1). A conventional radiocarbon age of 40.9 ± 0.85 ka BP, corresponding to a calendar age of 45.3 ± 0.85 ka cal BP, was obtained for a sample of charcoal located just above the stratum where at least four species of megafauna disappear. These include associated remains of *Protemnodon brehus, Sthenurus brownei, Thylacoleo carnifex* and *Zygomaturus trilobus*. In addition to these taxa, *Sarcophilus laniarius* and *Sthenurus* sp. cf. S. newtonae occur in underlying sediments bracketed by conventional radiocarbon ages of 45.2 ± 1.8 ka BP above and > 45 ka BP below. The latter date expresses the fact that the radiocarbon content of the sample was not distinguishable from background.

Discussion

The date of 40.9 ± 0.85 ka BP, corresponding to a calendar age of 45.3 ± 0.85 ka cal BP, provides a probable indicator of the timing of extinction of at least four species of megafauna, *Protemnodon brehus, Sthenurus brownei, Thylacoleo carnifex* and *Zygomaturus trilobus*, in the Naraccorte region of mainland southeastern South Australia. An additional two taxa in the Wet Cave sequence, *Sacrophilus laniarius* and *Sthenurus* sp. cf. S. newtonae, are last seen in sediments with a calendar age of 49.1 ± 1.6 ka BP. A range of extant taxa including large macropods, eg *Macropus* spp., were recovered from all layers in the upper levels of the cave sediments (McDowell 2001).

These results provide a chronology for the disappearance of megafauna in the Naracoorte region of southeastern South Australia that is similar to that demonstrated by Miller et al. (1999) for the extinction of *Genyornis* and other associated megafauna in the Lake Eyre Basin of inland northeastern South Australia at about 50 ± 5 ka BP. Thus, the AMS radiocarbon dates from Wet Cave, Naracoorte provide additional evidence for the disappearance of megafauna in South Australia at or beyond the effective limits of radiocarbon dating.

Acknowledgements

This research was funded by Special and Collaborative AMS Quaternary Science grants from the Australian Institute of Nuclear Science and Engineering (AINSE) and the Australian Research Council (ARC). The authors thank Kevin Moriarty, School of Chemistry, Physics and Earth Sciences, Flinders University for assistance with the initial stages of the research program.

References

Ayliffe, L.K., Marianelli, P.C., Moriarty, K.C., Wells, R.T., McCulloch, M.T., Mortimer, G.E. and Hellstrom, J.C. 1998 500 ka precipitation record from southeastern Australia: Evidence for interglacial relative aridity. *Geology* 26:147-150.

Brown, S.P. and Wells, R.T. 2000 A Middle Pleistocene vertebrtae fossil assemblage from Cathedral Cave, Naracoorte, South Australia. *Trasactions of the Royal Society of South Australia* 124:91-104.

Field, J.H. and Dodson, J.R. 1999 Late Pleistocene megafauna and archaeology from Cuddie Springs, southeastern Australia. *Proceedings of the Prehistoric Society* 65:275-301.

Flannery, T.F. 1990 Pleistocene faunal loss: Implications of the aftershock for Australia's past and future. *Archaeology in Oceania* 25:45-67.

Horton, D. 2000 *The Pure State of Nature: Sacred Cows, Destructive Myths and the Environment.* St Leonards, New South Wales: Allen and Unwin.

Lawson, E.M., Elliott, G., Fallon, J., Fink, D., Hotchkis, M.A.C., Hua, Q., Jacobsen, G.E., Lee, P. Smith, A.M., Tuniz, C., and Zoppi, U. 2000 AMS at ANTARES- The first 10 years. *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 172:95-99.

McDowell, M.C. 2001 The Analysis of Late Quaternary Fossil Mammal Faunas from Robertson Cave (5U17, 18,19) and Wet Cave (5U10, 11) in the Naracoorte World Heritage Area, South Australia. Unpublished M.Sc. thesis, School of Biological Sciences, Flinders University, Adelaide, South Australia.

Archived at Flinders University: dspace.flinders.edu.au

Miller, G.H., Magee, J.W., Johnson, B.J., Fogel, M.L., Spooner, N.A., McCulloch, M.T. and Ayliffe, L.K. 1999 Pleistocene extinction of *Genyornis newtoni*: Human impact on Australian megafauna. *Science* 283:205-208.

Moriarty, K.C., McCulloch, M., Wells, R.T. and McDowell, M.C. 2000 Mid-Pleistocene cave fills, megafaunal remains and climate change at Naracoorte, South Australia: Towards a predictive model using U/Th dating of speleothems. *Palaeogeography Palaeoclimatology Palaeoecology* 159:113-143.

Roberts, R.G., Flannery, T.F., Ayliffe, L.K., Yoshida, H., Olley, J.M., Prideaux, G.J., Laslett, G.M., Baynes, A., Smith, M.A., Jones, R. and Smith, B.L. 2001 New ages for the last Australian megafauna: Continent-wide extinction about 46,000 years ago. *Science* 292:1888-1892.

Tedford, R.H. and Wells, R.T. 1990 Pleistocene deposits and fossil vertebrates from the 'dead heart of Australia'. *Memoirs of the Queensland Museum* 28:263-284.

Wells, R.T., Moriarty, K. and Williams, D.L.G. 1984 The fossil vertebrtae deposits of Victoria Cave, Naracoorte: An introduction to the geology and fauna. *Australian Zoologist* 21:305-333.

Wroe, S. and Field, J. 2001 Mystery of megafaunal extinctions remains. *Australasian Science* 22:21-25.

BUANG MERABAK: EARLY EVIDENCE FOR HUMAN OCCUPATION IN THE BISMARCK ARCHIPELAGO, PAPUA NEW GUINEA.

M.G. Leavesley
School of Archaeology and Anthropology, The Faculties, Australian National University, Canberra, ACT 0200, Australia
M.I. Bird
Research School of Earth Sciences, Australian National University, Canberra, ACT 0200, Australia
L.K. Fifield, P.A. Hausladen, G.M. Santos, M.L. di Tada
Department of Nuclear Physics, Research School of Physical Sciences and Engineering, Australian National University, Canberra, ACT 0200, Australia

This paper reports new radiocarbon estimates for the age of human occupation of Buang Merabak, an archaeological site in central New Ireland, Papua New Guinea (Fig. 1). Previously, the oldest radiocarbon date for human occupation in New Ireland was 35,410 ± 430 BP (Leavesley and Allen 1998:80). The radiocarbon determinations reported here, although preliminary, may extend the first evidence of human occupation in New Ireland to beyond 40,000 BP (uncalibrated) and indirectly support the evidence presented by Groube et al. (1986) and Chappell et al. (1994), for the occupation of the Huon Peninsula at a similar antiquity.

Background

The archaeological potential of the Buang Merabak cave site was first identified by Allen et al. (1984:13) and later excavated under the auspices of the Lapita Homeland Project (Allen and Gosden 1991). The mouth of the cave is ca.10 m wide and the roof is ca. 8 m high. The cave extends back ca. 30 m and is joined to a second larger chamber by a small passage. It is situated at the base of a series of transgressive fringing coral terraces formed during the lower Miocene to Pliocene, known as the Lelet limestone (Hohnen 1978:2). The initial excavations indicated a substantial deposit of midden material and stone artefacts directly on top of the corroded limestone bedrock, 165 cm below the present ground surface (Rosenfeld 1997). There was no culturally sterile deposit between the cultural material and the bedrock. A radiocarbon determination on shell previously collected from the site, ANU-6614, returned an age of 31,990 ± 830 BP for the lowest level of human occupation (Balean 1989). A subsequent conjoin analysis of midden bone fragments tested the integrity of the deposit and determined that, although the uppermost layer of the site was disturbed, the Pleistocene layers were largely intact (Leavesley and Allen 1998). The analysis concluded that much of the deposit remained relatively free of the post-depositional processes that might have caused the vertical redistribution of the cultural material.

The 2000 excavation

The site was re-excavated by Leavesley as part of a project to investigate the nature of Pleistocene colonisation and subsequent economic developments and interactions in the Bismarck Archipelago. The re-excavation was undertaken utilising 5 cm spits and bedrock was identified at a depth of 2 m. The excavation identified a deeper deposit and a potentially richer midden than the previous 1985 excavation. This allowed for the dating of cultural material at a depth not previously possible. Two shell samples collected from the prehistoric midden deposit were submitted for radiocarbon determination. The shells explicitly fit the criteria described elsewhere as shell midden material. Gosden and Robertson (1991) describe the nature of a southern New Ireland shell midden as containing larger individuals of the larger available taxa in the earliest layers of occupation (Gosden and Robertson 1991, Rosenfeld 1997). The pattern of midden shell deposition is repeated at both Matenkupkum and Buang Merabak (Spriggs 1997:37) and the shells utilised for this analysis were consistent with it. The determinations reported here were from shells excavated from Spit 40, immediately above the bedrock.

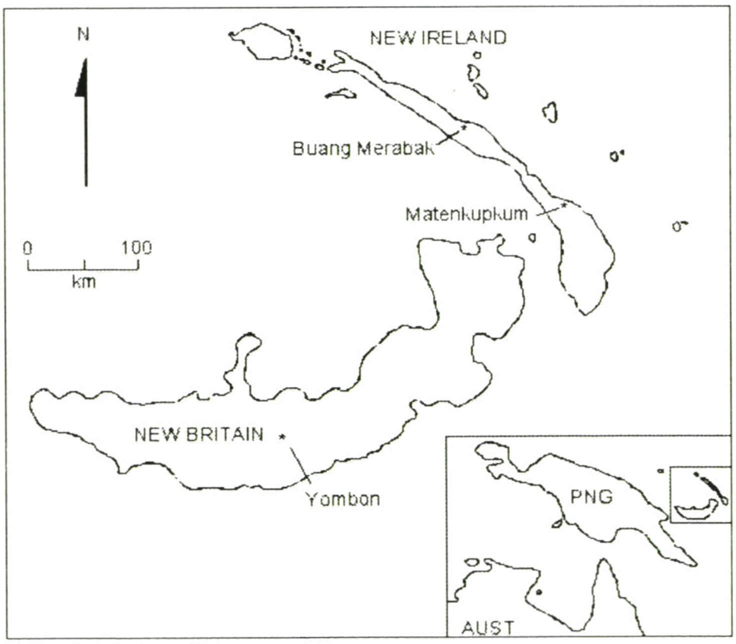


Figure 1 Map indicating sites mentioned in the text.