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The Contribution of Cave Sites to the Understanding of Quaternary Australian Megafauna Records.

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Abstract

Since the first discoveries of megafauna fossils in the Wellington Valley of New South Wales in the 1830s, caves have featured prominently in the study of Quaternary Australia. Today, most of the well-dated, stratified Quaternary megafauna sites are known from caves. This reflects the relatively stable preservation environment within Australian caves, where skeletal remains may lay undisturbed for hundreds of thousands of years. Sir Richard Owen described several of the most iconic megafauna species from the Wellington Caves, including the giant marsupial Diprotodon and the so-called marsupial lion *Thylacoleo carnifex*. Over the past 180 years, a vast array of megafauna species has been discovered in Australia and cave sites have now yielded most of the known Pleistocene species.

Discoveries of megafauna fossil sites and their research has been greatly enhanced over the past six decades with the systematic survey and exploration activities of caving groups. The most spectacular discoveries of Australian megafauna have been made by cavers, the most remarkable on the Nullarbor Plain in Western Australia and within the caves of Naracoorte in South Australia. In 2002, following years of systematic exploration, significant discoveries were made in the aptly named 'Thylacoleo Caves'. These caves have yielded articulated skeletons of several megafauna species including *Thylacoleo carnifex* and also the remains of new species of tree kangaroo and giant birds. The caves of the Nullarbor provide a critical insight into evolution of this vast area of Australia and the megafauna species that inhabited it during the Pleistocene.

Arguably, the jewel in the crown of Pleistocene megafauna fossil localities is the World Heritage listed Naracoorte Caves. Dozens of sites within these caves preserve an extended record of biodiversity and environment over at least the last 500,000 years. Articulated skeletons and exquisitely preserved fossils of over 20 megafauna species have greatly increased our understanding of the biology of these unique animals. Significantly, the remains of well over 100 species of mammals, birds, reptiles and amphibians are preserved alongside the megafauna, providing insight into the vertebrate community structure over a long time scale. In addition, the deposits preserve extensive palaeoenvironmental proxies within speleothems, fossil plant material, microfossils and sediments.

The cause and timing of megafauna extinctions in Australia remains a topic of debate. Caves continue to play a critical role in this discussion, with many of the key sites spanning the time of extinction (~40 to 45 ka) occurring in caves. Recent research at War-raty rock shelter in the Flinders Ranges of South Australia has revealed a reliably dated stratigraphic association of megafauna bones and human artefacts at ≥ 49 to 46 ka. There is no direct evidence from the site to suggest human hunting of megafauna as in Northern Hemisphere sites; however, it does show humans and some megafauna were contemporaneous in the arid interior during the late Pleistocene.

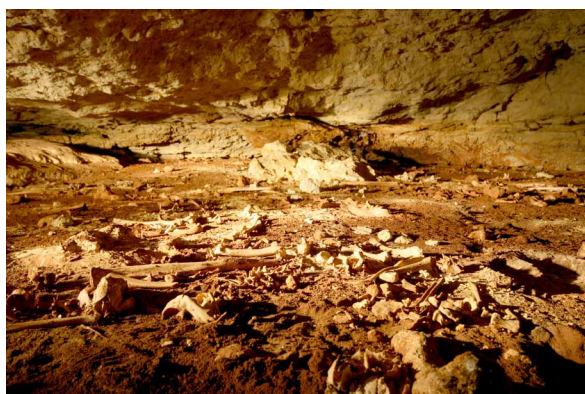


Figure 2. Upper Ossuary, Naracoorte

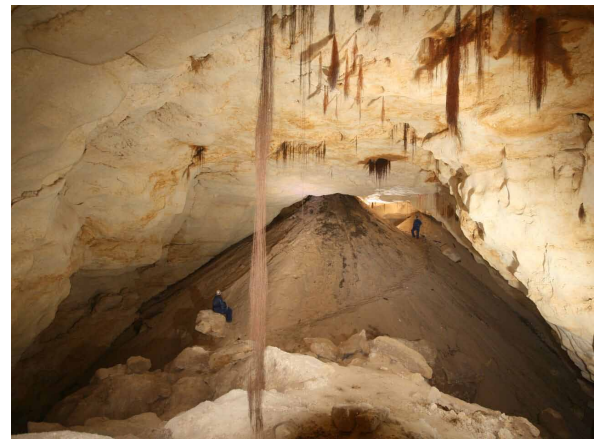


Figure 1. Sediment cones, Naracoorte

Palaeontological investigation of the Quaternary fossil record has moved beyond studies of bones to broader, multi-disciplinary studies of past environments and patterns of change over time. Caves provide a unique opportunity to provide a climate and environmental context for megafauna remains with the preservation of vegetation records, climate proxies and deep sedimentary records. New technologies are also enhancing our knowledge of the evolutionary relationships of these extinct giants. The cool temperatures and high altitude of caves of Tasmania have preserved DNA in megafauna bones, with ancient DNA sequences for the extinct kangaroos *Simosthenurus occidentalis* and *Protemnodon anak* recently retrieved from Mt. Cripps.

As cavers and palaeontologists continue to explore and research Australian cave sites, there will undoubtedly be many more spectacular discoveries that will increase our understanding of Australia's lost giants.