

Introduction

Not so long ago, in geological ‘time-speak’, Australia’s fauna was much more diverse than it is now. As well as familiar kangaroos, wallabies, koalas, possums and bandicoots, many much larger marsupials roamed the forests, woodlands and inland plains of Australia 50,000 years ago. The first human inhabitants of the continent shared the land with wombats the size of a cow, ‘diprotodons’ as big as a bison and sturdy short-faced kangaroos that stood over two metres tall. Those giant herbivores, and the first humans, also had to contend with large predators such as a lion-sized marsupial ‘lion’, a goanna bigger than a Komodo dragon and a huge snake the size of the biggest boa constrictor. We have known about these giant animals, the megafauna, for over 150 years and speculated on the reason for their extinction, but even now, well into the 21st century, there is dispute and division among scientists who are trying to explain the disappearance of such a significant component of our fauna.

Extinction is now a familiar concept in biology, but around two hundred years ago, at the time of Australia’s first settlement by Europeans, the idea that species of large animals had just disappeared from the planet forever was quite revolutionary. The first extinct giant ground-sloth from South America was described by Georges Cuvier (sometimes referred to as the Founder of Palaeontology) in 1796 and the first dinosaur was described from English rocks by William Buckland in 1824. Because everything about its natural history was excitingly different, Australia became a focus for scientists – perhaps then better described as ‘natural philosophers’ – who were looking for ‘facts’ to test new hypotheses about the origin of rocks and living species on the Earth in a period of changing paradigms. The ebb and flow of different, fiercely contested ideas greatly stimulated efforts to collect and describe the extinct fauna of Australia during the rest of the 19th Century. The list of extinct species became longer and longer, but as it did, the mystery of the timing and reason for their disappearance became deeper and deeper.

To understand when, why and how these beasts finally became extinct it is necessary to delve deeply into the tunnels of time to look at ecosystems of the past. This book traces the history of that endeavour in Australia, showing how the sciences of vertebrate palaeontology, palaeoecology and palaeobiology are now being applied to discover how the fauna and ecosystems changed during the five-million-year period leading up to and then immediately following the arrival of humans on the continent. Natural systems, like the weather, can appear to either fluctuate wildly or vary very little when only a short timeframe is viewed. But over a long period, trends are revealed that show the real direction of change. In geological time what is meant by a ‘long period’ can be very long indeed and great ingenuity, patience, sophisticated technology and even luck are needed to reveal

those trends. Palaeo-scientists from many disciplines are now working together to reveal these long-term trends in the evolution of Australia's unique flora and fauna. With this long perspective the continuing ecological impact of human occupation of the continent can be evaluated, assisting our efforts to manage and hopefully conserve what's left of its fascinating native flora and fauna for the health of the environment and for the future.

Part 1 of this book deals with the first 100 years of exploration, discovery and interpretation of the pre-history of Australia's unique fauna. It is interesting to look back and see how our ability to find answers, to satisfy our curiosity, is constrained – first by the resources available, and secondly, by the prevailing intellectual (or cultural) paradigm – the 'lens' through which we see. Scholars and philosophers sought to interpret the evidence they found in the varied contexts of their times and while many of their early interpretations seem laughable today, it is clear that they were arrived at using earnest intellectual effort.

During the 19th Century the paradigm that framed the interpretation of fossil bones changed to an extraordinary degree - from biblical 'Creationism' to 'Darwinian evolution'. This change was accompanied by heated disagreements and controversy between scholars across the world, but it was just this controversy that stimulated great support for exploration and investigation. This was the era dominated by collection, description and classification of the plants, animals and fossils that make up the Australian biota. By the end of that period nearly all the living species and a large proportion of the extinct 'megafauna', had been discovered and described – but the intellectual stimulus had almost run its course. Chapter 2 describes the first 50 years of the 20th century as the 'doldrum years' for vertebrate palaeontology in Australia but reveals a glimpse of changes that were to come.

Part 2 deals with the period from around 1950 to the end of the 20th century. After nearly 150 years of collecting and classifying both living and fossil plants and animals, despite museums in Australia and across the world filling up with specimens, in 1950 this island continent was still a biological enigma, a large and important piece that could not be fitted into the jigsaw puzzle of the biogeography of the world. Why were the Australian flora and fauna so different? Where did their ancestors come from and, since many clearly had close relatives overseas, how did they reach this remote island? How and when did the first human inhabitants get here? How was Australia affected by the Ice Ages that had engulfed North America and Eurasia during the last part of the Pleistocene era? What had caused the extinction of Australia's "megafauna"? The answers to all these questions lie in the geological past, and are preserved in the sediments and fossils found in caves, dry lake beds and river banks across the continent. The next 50 years would see international and local research to find answers, much of it focussed on the past history of Australia's vertebrate fauna, particularly its unique marsupials. As Australian scientists learned to apply new technologies and analytical approaches that were being developed overseas, it was realised that many caves contained not

only fossil bones, but archives (or snapshots) of successive ecological systems as they changed through time. Between the 1970s and the end of the 20th century several Australian cave systems would prove to be treasure-chests of clues, between them spanning more than 25 million years of ecological history. The stories revealed by caves such as those found at Riversleigh in north Queensland, Wellington in New South Wales and Naracoorte in South Australia played a large part in lifting Australian palaeoecology out of the dark ages. By the turn of the new century Australia's reputation as the 'different continent' was attracting scientific interest across the world.

Part 3 of this book takes us into a new millennium. The birth of the 21st Century came with increasing worldwide awareness of and controversy about human induced climate change, its impact on biodiversity, ecosystem disruption and, more pressingly, its impact on humans. These are issues that involve long time scales, where pre-history must be added to history to reveal the trends and patterns that have led to the current situation. Now it is not simple curiosity that is driving research into ecosystems of the recent past across the planet. It is now necessity, if we are to work out how we can modify human impact and so protect the biotas that we ultimately depend on. The subject of extinction inevitably raises its ugly head, and the search for the cause or causes of megafaunal extinction across all continents is crucial to our understanding of the cause of modern extinctions. Australia is at the forefront of this debate, as this is now the continent with the highest rate of modern mammal extinctions.

This section of the book traces the most recent developments in research into the paleoecology of the Australian Pliocene and Pleistocene eras (roughly the past five million years) and sketches out the picture that has emerged so far. We can now see long-term trends in faunal change and have much greater insight into the past five million years, but we still have much to learn about Australian biogeographic patterns and causative factors. New techniques are being applied, newly discovered cave deposits are being explored and new insight is emerging, some of it quite surprising. It is clear that we are living in an interesting time – perhaps one of the most significant in the history of humanity. Looking back over the changing paradigms that have shaped our view of the world we live in, it seems that we are entering an era (some even say a new geological epoch) where the *sapiens* (meaning 'wise', 'wisdom') part of the scientific name for a member of the human species should be more relevant than ever. Hopefully we can apply that description of our species to shape a new paradigm through which we view our place in nature.