

INTRODUCTION: AN OVERVIEW

Ever since Captain James Cook charted the Great Barrier Reef in 1770 it has exerted a fascination that shows no sign of diminishing. Over those centuries its chequered history has moved through a sequence of phases: from a navigation hazard to be feared and then conquered, to a geological challenge and a realm of extraordinary plants and animals offering a seemingly inexhaustible range of natural resources for scientific study and exploitation.

In recent decades the Reef has come into the international spotlight as the world's greatest marine park with its listing by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 1981 as a special World Heritage Area of 'superlative natural phenomena' containing 'formations of exceptional natural beauty [with] superlative examples of the most important ecosystems'. It also was recognised as an 'outstanding example of the major stages of the earth's evolutionary history', and 'of significant ongoing geological processes, biological evolution and man's interaction with the natural environment'. Of profound relevance today is its further listing as a site of 'the foremost natural habitats where threatened species of animals or plants of outstanding universal value from the point of view of science or conservation still survive' (UNESCO 1980:22–23).

This cultural and environmental history, then, has a special objective. It takes the reader through the endlessly absorbing story of the impact of Western discovery and settlement on the Great Barrier Reef, and equally, the response of Western science to that encounter with the world's greatest living natural feature. Within that epic narrative, it also brings into focus the story of coral and coral reefs, the fear they held for early navigators, and the fascination for naturalists, scientists and tourists of recent centuries, leading, in the case of the Great Barrier Reef, to intense efforts since the 1960s to ensure its protection for the future.

An appreciation of the complex history of the Great Barrier Reef must begin with its awesome dimensions. Stretching over 2000 kilometres along the tropical northern coast of eastern Australia it is by far the largest of the world's barrier reefs and the only living structure visible from space. Its southern limit, where Cook first entered, begins at 24°6'S with Lady Elliot Island, a sand cay in the Bunker Group of islands, while the great coral masses of the barrier itself begin further north some 200 kilometres offshore in the Swain Reefs at 22°S. From there the main coral formations curve north-westerly to approach the coastline near Cape York, then swing north-easterly to reach the Gulf of Papua around 8°S latitude.

Encompassing a vast area of almost 350 000 square kilometres – an area comparable with Japan and larger than the combined landmass of Great Britain and Ireland – it contains over 2900 separate coral reefs, some fully submerged, others only visible at low tide. In structure it is not a continuous barrier but a vast and almost impenetrable assemblage of reefs: long strips of ribbon reefs, large areal spreads of patch reefs, and circular formations, known as cays, with a central lagoon and an elevated area of pulverised coral 'sand'. Many cays, like Heron Island, are vegetated and a haven for flocks of sea birds. In addition, fringe reefs surround the tips of some 200 submerged mountains that rise above water to form rocky outcrops and the larger continental islands such as the Whitsunday group and Hinchinbrook, Dunk and Magnetic islands.

When Cook encountered the 'great wall of Coral Rock' and came to grief with the *Endeavour* in what he called its 'Labyrinth', the mystery of its origins was still unresolved. If such reefs had been 'formed in the Sea by animals', as he pondered over elevated relict reefs observed during his second Pacific voyage, then, he asked, 'how came they [to be] thrown up to such a height?' (Cook 1774:438). It is still astonishing to realise that such massive structures, which provide habitat for the brilliantly coloured and teeming life of coral reefs, have been created by colonies of tiny animals – usually less than 5 millimetres in diameter – the polyps of a large range of hermatypic ('reef building') corals of the order Scleractinia.

Moreover, as confirmed by research in the mid twentieth century, polyps of these 'hard' corals are themselves dependent on a symbiotic interaction with a myriad of single-celled algae, called zooxanthellae, in their tissues. That interaction, in warm sunlit waters, can supply most of the polyps' nutrition. It also provides carbon enabling them to build their characteristic hard calcified cups, known as corallites, which over millennia can fuse together into extensive colonies and form immense buttresses rising hundreds of metres to the ocean surface. The processes of earth subsidence and sea level change which can cause this to occur, as discussed later in Part II, became a focus of geological debate throughout the nineteenth century and well into the twentieth, until the 1950s when Cook's query was finally answered.

The geophysical origins of the Reef began with tectonic plate activity more than 50 million years ago that broke up the great southern landmass of Gondwanaland and moved

the Australian plate northwards. Around 17 million years ago it reached the tropic zone, where reef-building corals had become established, as revealed in the world fossil record, more than 200 million years earlier, during the Triassic geological period. Over the ensuing periods, the continental shelf of eastern Australia became consolidated as deposits from terrestrial degrading and carbonate sediments were laid down, forming the substrate for extensive coral formations in tropical waters, predecessors of the present Great Barrier Reef. In recent geological times, at least as early as 50 000 years ago, a broad land platform appeared north of the continent, supporting open forest growth and connected to New Guinea. Then came sea level fluctuations during the last of the Ice Ages, around 11 000 years ago, which began to close the land bridge, perhaps finally by 8000 years ago. As the sea progressively inundated the coastal plain, forming the present Torres Strait, it created at the same time the submarine platform on which the coral communities of today's Reef system, in their thousands of species, were able to grow.

The relatively recent formation of the present Reef within the last 10 000 years is dwarfed, however, by the formidable time span of Aboriginal settlement on the continent, estimated to date back more than 50 000 years, with recent archaeological research in the Cape York region reporting dates ranging from 29 000 to 13 000 years ago (Morwood 1993:175–76). Given that the Torres Strait land bridge region, like the now submerged shelf of the Barrier Reef, largely disappeared around 8000 years ago, evidence of earlier settlement in those areas remains severely constricted. It must be with such awareness that the Australian continent and the entire Great Barrier Reef province is to be understood as having had a long period of settlement by Aborigines and Torres Strait Islanders prior to, and continuing in sadly diminished form alongside, European involvement. For them, many regions of the Reef remain significant heritage cultural landscapes, rich in associative values. The recording of that experience, however, is beyond the scope of this work and requires a major study in itself. Only with that caveat in mind, then, can we speak in the following pages of a European 'discovery' of Australia and the Great Barrier Reef.

Forming a barrier to coastal shipping and to the pounding waves of the Pacific Ocean, the great Reef became a source of dread to early sailors as the millennia of indigenous occupation were followed by Western exploration and settlement. With the arrival of Europeans the Great Barrier Reef also became an intriguing natural realm that demanded investigation, as did the entire continent of Australia. That process is examined here within the wider context of the ferment of ideas throughout Western science. With Cook's charting of the Reef, his claiming of 'New South Wales' for Britain, and the explorations of those who came after him, it seemed that here was found yet another New World. Unlike the Americas, Australia was so curiously different that at first it was considered a separate Creation. What sense could be made of the strange biota, especially the unique egg-laying monotremes, the platypus and echidna? The 'opossum' and the kangaroo gave London scientists considerable taxonomic difficulty, while the platypus when it first arrived there was considered a cunningly contrived hoax. As more new plants and animals were found,

the traditional acceptance of the earth as a Divine Design, already under severe strain as the Biblical account of an unchanged Creation was increasingly questioned, threw natural science into even greater turmoil.

Indeed, so perplexing was the natural landscape that Barron Field, Supreme Court judge and Australia's first poet, wrote in the poem 'Kangaroo' that the country, although a 'fifth part of the Earth' was so bizarre that it 'would seem an after-birth, not conceived in the beginning' but later as a result of Original Sin, 'When the ground was therefore crust, And hence this barren wood'. And the kangaroo itself was so peculiar, Field jested, that it must have been created while God was resting on the Seventh Day:

Join'd by some divine mistake
 None but Nature's hand can make
 Nature in her wisdom's play
 On Creation's holiday. (Field 1819:3)

Even a century after Cook, when publishing *The Naturalist in Australia* (1897) for a British readership, Reef scientist William Saville-Kent could write in the Preface that 'Australia is, *par excellence* . . . the land of topsy-turveydom. Christmastide is a mid-summer festival; the swans are black; cherry stones grow outside the fruit; flies eat the spider, and oysters grow on [mangrove] trees, along with many other things' (vi).

Throughout the nineteenth century, as the continent was mapped, explored and opened to European settlement, the Reef became a phenomenon of major world interest. As its biota were described and its geology explored, major contributions to world science accumulated. In geology, coral reefs became central to new theories of terrestrial formation as the challenging hypotheses of Charles Lyell and Charles Darwin helped undermine the foundations of the received tradition. Equally important was the impact of Darwin's theory of evolution by natural selection that eventually triumphed over the Creationist beliefs of early gentlemen naturalists and cabinet collectors. By the twentieth century the so-called heresies of Lyell and Darwin became the orthodoxies of our present era. In discussing these developments, the narrative ranges widely to an informative account of the broader context within which the Reef, its values, exploration, scientific research and heritage values were considered through time.

The history of the Reef, however, encompasses much more than the ferment in natural history as it evolved into more rigorous science. It provides yet another international example of the heedless exploitation of natural resources and indifference to nature that were leading to its despoliation, even though voices of protest were raised at the time. That too is an important theme traced throughout, finding its most eloquent advocates in 'Beachcomber' Banfield, Charles Hedley and the later activists of the 'Save the Reef' campaign of the 1960s and 1970s, Australia's most politically vigorous and successful early environmental protest movement. From those efforts the Reef came to be designated

by the Australian government as a marine park in 1975, and internationally protected in 1981 as a World Heritage Area.

Today the concept of ‘heritage’, moreover, as it relates to the Reef, has become much wider than the earlier conventional definition that identified only natural features and cultural artifacts. Heritage now recognises the significance that localities can hold for communities through association with their daily lives, past and present, and Reef management is sensitive to the value of such continuing and associative landscapes. That expanded concept also enables a greater understanding of the perceptions of indigenous peoples in their close identification with their lands (Cotter, Boyd & Gardiner 2001).

At the same time, it is important to understand that the Great Barrier Reef Marine Park, which covers most of the Reef province, to the tip of Cape York, is necessarily managed according to the principle of multiple use. It contains an international shipping route used by 25 per cent of Australia’s overseas shipping commerce, while its waters support a large fishing industry. In addition, management has to contend with problems from increasing agricultural and urban residue pollution, while tourism, now exceeding 2 million visitor-days a year, imposes tremendous pressure. Indeed, this book traces in dramatic form the pattern of Western impact on the Reef from the enchanting ‘other Eden’ of Cook’s day to the markedly changed environment by the beginning of the twenty first century.

Even so, the Reef maintains its powerful, enduring mystique, and that, too, is of central interest in this study. In response to the pressures of modern living we have come to appreciate the importance of places that inspire a sense of awe and mystery and offer the simple joy of the contemplation of nature. In a world of increasing technologically driven development, alienation from nature and the dehumanisation of so much in everyday life, the preservation of such places is vital. Too often, however, they are seriously endangered, and can easily be destroyed. Public awareness of this was aroused only in the late twentieth century with the emerging recognition that humans and nature are all part of one great ecosystem, which must be considered and managed as an inseparable whole. It was, therefore, one of the great advances of recent decades, as worldwide environmental destruction gathered momentum and began to leave a devastating swathe across the natural landscape, that communities and governments came to see the need for more effective management and protection of natural environments. Reinforcing that view, the emergence of ecological perspectives and complexity theory in science has led to a more comprehensive understanding of coral reef ecosystems, the manifold interrelations involved in their development over time, the problems of management, and the consequences of human interaction: all essential knowledge if reefs are to be secured for the future, not only for human enjoyment but for their value as natural systems.



The historical trail for this research – through rare books, archives, interviews with significant individuals and active field investigation – has identified three main themes: the history of European engagement and colonisation, the scientific study of coral reefs, and rising concern over the last century for their heritage value and protection. The approach adopted here aims to identify and present those strands as an interacting complex of contemporaneous events, producing as it were, a composite portrait. Moreover, since the Reef, from its first discovery by Europeans, has never been isolated from world affairs, this account has been set within an international context of exploration, scientific debate, commercial pressures and political action.

Part I, *Navigators and Naturalists in the Age of Sail*, begins with chapters covering the early voyages of discovery and charting of the dangerous Reef waters in the task of locating safe passages to develop secure lines of communication between Britain and the new colonies. Proceeding in parallel with those early surveys are accounts of the naturalists who sailed aboard the naval vessels from the late eighteenth century, initially under British Admiralty instructions to find new raw materials, both botanical and mineral, in the service of economic imperialism.

Those chapters are followed by an account of the subsequent foundation and expansion of the new colony of Queensland and the rapid, and in many cases disastrous, exploitation of natural resources in the later nineteenth century and the early decades of the twentieth. As the focus of Reef activities moved from discovery to European settlement and exploitation, a changed emphasis is evident in natural science as it moved from cabinet collecting into applied research for commercial benefit.

Part II, *A New Era in Reef Awareness*, in a departure from strict chronology, returns to examine Darwin's epochal study of coral reef formation presented in the years from 1839 to 1842, and to trace the ensuing international controversy over the origin and structure of coral reefs that continued until the mid twentieth century. Concurrently, the rise of ecological theory, research and conservation ideals is explored in the compelling works of 'Beachcomber' Banfield and his predecessors, and in Mayor's paradigm ecological surveys of coral reefs in Torres Strait and Samoa (1913–20). Following those surveys a considerable advance in Reef biological research was achieved with the British expedition to the Low Isles in 1928–29.

Despite those developments in biological investigation, however, geological issues continued to dominate the scientific agenda throughout the 1920s and 1930s under the influence of Henry Richards, Professor of Geology at the University of Queensland. Although such early reef geology, which involved deep drilling of several reef sites, was ostensibly aimed at resolving fundamental issues of coral reef formation, concern grew that economic interests were involved. Indeed, public alarm that the Great Barrier Reef had become a prime target for petroleum exploration precipitated the conservation controversy of the 1960s and 1970s.

That significant movement is examined in the context of the simultaneous development of interest in the Reef as a tourist destination and its promotion, stimulated by Banfield

earlier in the century, as a magic wonderland far removed from the banalities of everyday life. When from that heightened awareness the vigorous public campaign for the protection of the Reef as a national marine park was successful in 1975, it created a management problem of the greatest magnitude. After some difficult negotiation that task was undertaken jointly by the Commonwealth and Queensland governments. Responsibility for formulating management policy under the Commonwealth *Great Barrier Reef Marine Park Act 1975* was to be the prime function of the new Great Barrier Reef Marine Park Authority (GBRMPA), with day-to-day field operations to be discharged by the Queensland Government through various agencies, mainly the Queensland Parks and Wildlife Service, the Queensland Fisheries and Boating Patrol and the Queensland Fisheries Service (as they are now designated). All these responsibilities make increasing demands on scientific support and effective policy development and implementation. The present account, then, looks at the conservation challenge that lies ahead in providing effective heritage management, maintenance and remediation, consistent with the revolutionary social awareness in our own time that coral reefs and their ecosystems must be protected as structures of incredible complexity, beauty and fragility.

In that task the value of an understanding of Reef history becomes clear when current needs for base data are considered. An outstanding case occurred in 1998 when, after twenty years of stewardship, the GBRMPA conducted a thorough assessment of the condition of the Reef to confirm that it was continuing to meet UNESCO's exacting World Heritage classification criteria. The disturbing conclusion reached was that 'for most environmental categories, it is not possible to say with certainty if they are in a satisfactory or unsatisfactory condition' (Wachenfeld et al. 1998:1). Any meaningful understanding of the Reef's current state and projected trends cannot be based simply on short term data over one or two decades. To assess long term changes, we will benefit enormously from evidence in the journals of Cook, Banks and those who continued after them, such as Jukes, MacGillivray, Saville-Kent, Hedley, Banfield, Mayor and Yonge.

While the primary focus of this account is on the Great Barrier Reef, it also provides a case study of the generation of those relentless pressures on the world environment that are leading to international conferences and conventions for remediation. Coral reefs, in effect, are early warning indicators of global imbalance, now evident in serious biodiversity loss, ecological and water disturbance and, on reefs worldwide, persistent coral bleaching, an ominous signal of world climate change. Still relatively well preserved, the Great Barrier Reef forms a stark contrast to the damaged Caribbean and seriously degraded Southeast Asian coral reefs where unremitting human impact has devastated them, at least within a human time frame, perhaps irreversibly. With the further threat, then, that global warming could accelerate damage to coral reefs worldwide, it will be vital in this century for management to consider a greatly extended range of available data, beginning with the fossil record, and traced through succeeding periods as revealed in palaeoecological studies, indigenous oral history and historical records of colonial and

recent periods, to the present global phase shift. Use of such resources is now being urged by numerous forward-looking scientists and managers (Jackson et al. 2001).

No such extended range of data was available to the early GBRMPA planners, nor, possibly, was it thought necessary. Perhaps, in the tradition of current scientific positivism, such historical knowledge was considered irrelevant to understanding the ‘real condition’ of the Reef. Yet, within the journals and narratives of early investigators we have accounts of the Reef environment at given occasions before and after European colonisers began processes of unrelenting change. A fundamental requirement for Reef managers and scientists, especially at the higher decision-making levels, should be at least a clear understanding of the progress of scientific knowledge and the historical processes of Reef disturbance at human hands over the past two centuries. And for us all, access to these rich sources of information promotes an enduring awareness of the Great Barrier Reef as an essential feature of the Australian National Estate and the World Heritage, requiring the greatest care in its management as a uniquely valuable part of our heritage to transmit to future generations.

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James Bowen and Margarita Bowen

Excerpt

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PART ONE

NAVIGATORS AND
NATURALISTS IN
THE AGE OF SAIL

CHAPTER 1

QUEST FOR THE GREAT SOUTH LAND

The Great Barrier Reef burst suddenly into European consciousness in 1773. In that year the sensational account of James Cook's amazing voyage and discovery was released to the public as part of a huge three volume edition entitled *An account of the voyages undertaken by order of his present Majesty for making discoveries in the southern hemisphere*. Two years earlier, when he returned to England on 13 August 1771 after a three year voyage around the world, Cook reported that he had discovered and traversed the eastern and northern shores of the mysterious Great South Land which for centuries had been a quest for navigators. What became a central feature of the voyage was his description of a reef that beggared belief at the time: 'a wall of Coral Rock rising all most perpendicular out of the unfathomable Ocean . . . the large waves of the vast Ocean meeting with so sudden a resistance make a most terrible surf breaking mountains high'.

By Cook's time coral reefs had already become well known and had acquired an extensive folklore, but nothing in the literature equalled the account of his nightmare travel through dangerous waters unmatched anywhere else in the world. For two years his journals were embargoed by the Admiralty to preserve their sensitive commercial information, especially from the French who were anxious to beat the British in the race to create an overseas empire. For both nations, the aim of creating a colonial network was one of economic imperialism: the search for new lands and new resources for manufacturing and trade. Yet, when Cook's discoveries were popularised in the impressive 1773 publication edited by John Hawkesworth, it was not the economic possibilities that intrigued the reading public, but accounts of exotic peoples with strange customs, and the