

## **Chapter 3 Australias geological heritage a national inventory**

**for future geoparks and geotourism**

# **From Geotourism: the tourism of geology and landscape**

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# Geotourism: The Tourism of Geology and Landscape

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Edited by

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Design and setting by P.K. McBride

# 3 Australia's geological heritage: a national inventory for future geoparks and geotourism

Bernard Joyce, University of Melbourne, Australia

## Introduction

Australia has a coastline of around 32,000 km, with varying rock types and structure, coastal types and climate. Outstanding and representative coastal sites form a significant part of the Australian inventory. Major terrains include inland deserts (for example the Simpson Desert dune field), northern tropical savannah (the Kakadu World Heritage Region), glacial and periglacial uplands in the far south (southwest Tasmania), broad inland riverine plains (Murray-Darling river system), and the young volcanic provinces of southeastern Australia and northeastern Australia. There are also many karst and cave sites (for example the Nullarbor Plain), and many palaeoweathering landforms in central Australia (for example Uluru) as well as representative stratigraphic sites, rock and mineral sites, and structural and tectonic sites. Viewpoints are also included in this list, and also sites related to the history of geology, for example Charles Darwin and the Blue Mountains near Sydney (Figure 3.1). Important fossil sites range from the Proterozoic stromatolites of the Pilbara of northwestern Australia to the World Heritage Tertiary mammal fossils of Riversleigh and Naracoorte, and the Devonian fossil fishbeds of Canowindra in New South Wales (Figure 3.2).

Australia is often referred to as 'the oldest continent'. Zircons dated between 4300 and 4200 million years have been found in the Archaean rocks of the Mt Narryer area of Western Australia, and the microfossils and stromatolites of the Pilbara, also in Western Australia, are amongst the earliest known life on earth. The old shield which forms a major part of the Australian continent is mainly a flat and low-lying plateau, tectonically quiet and with one of the lowest erosion rates known. Deep weathering profiles dating to the Mesozoic and even earlier have survived over long periods of geological time, as have relics of corresponding ancient landscapes (Joyce 1999). This contrasts with the northern hemisphere continents, where late Tertiary and Quaternary uplift and extensive glacial erosion have given very different landscapes. Only in Tasmania and the higher parts of the southeastern Australia mainland can landscapes similar to those of much of Europe be found.

The study of geological heritage in the former Gondwana continents such as Africa, South America, India and Australia may well need a different approach to that used elsewhere (Joyce 1999). Following the Permian Gondwana glaciation, the Australian



**Figure 3.1:** World Heritage Area of the Blue Mountains, near Sydney, New South Wales; a site of historic geological interest, visited by Charles Darwin in January 1836. On seeing the steep-sided valleys, Darwin first suggested the striking erosional landforms had been formed by the sea, but later began to argue that fluvial erosion over long periods of time could have been sufficient to produce the striking landscape, although finally and reluctantly he accepted 'the marine denudation explanation' following the ideas of his mentor Charles Lyell in the book *Principles of Geology* (Nicholas and Nicholas, 2002, pp. 36-43) Major lookouts provide viewpoints to spectacular valleys, scarps and plateaus developed in Triassic fluvial sandstone. (Photo E.B. Joyce).



**Figure 3.2:** Devonian fossil fish beds outside the small town of Canowindra in New South Wales, with its excellent Age of Fishes Museum (Photo E.B. Joyce).

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continent had a long period of weathering and limited erosion, and was little affected by Quaternary glaciation, so that deep weathering mantles and leached soils are widespread. Thus the thematic frameworks commonly used to select global geosites may also need to be different to those used in Europe and elsewhere.

For Australia it is important to have an agreed listing of major geological sites (Joyce 2005, 2006b), sometimes referred to as geosites, as in the UNESCO Global Geosites program (Joyce 2007). The Geological Society of Australia, as the major organisation in this field for over 40 years, is a body well placed to set up and maintain such a database.

### Australian geological heritage studies

Geological heritage studies in Australia go back more than 40 years to the first work by local Geological Society of Australia (GSA) groups in Queensland and South Australia in the 1960s. Even earlier, efforts had been made in promoting local reserves, and setting up notice boards and signs on individual sites.

In the mid-1960s, divisions of the Society (corresponding to the Australian states and territories) organized subcommittees of interested geologists and began a programme of seeking out and promoting individual sites. Correspondence and visits to the UK by Maud McBriar of South Australia and other workers helped provide new ideas. In the mid-1970s, with the aid of government grants, programmes of identifying, documenting, evaluating and recommending management of sites began across Australia (see historical review in Joyce 1994c). Joyce (1980 and 1995b) provides further details of work in Australia, as do papers from two international conferences, the first held at Digne in France in 1991 and the second at Malvern in the UK in 1993 (McBriar 1991; McBriar and Hasenohr 1994; Joyce 1994a, b).



**Figure 3.3:** Well-studied lunette and palaeolake floor of Lake Mungo, in the Willandra Lakes Region World Heritage Area, New South Wales, showing the 40,000 BP burial sites of the oldest human remains in Australia. (Photo J.M. Bowler).

Douglas (2006) has recently provided insight (Box 3.1) about geological heritage, concentrating on three landscapes in Australia – Adelaide's Hallett Cove, inland South Australia's Lake Callabonna Fossil Reserve and the World Heritage listed Willandra Lakes of western New South Wales (Figure 3.3). Once thought of as 'wasteland, desert, forsaken, degraded, unproductive and isolated' such features have now become of 'world renown' or 'classic ground'. Douglas points to an evolving methodology of geological heritage in Australia, citing the work of the GSA and the AHC. An extensive bibliography on heritage and geology in Australia is included.

### **Box 3.1 Geological heritage in Australia**

The scarcity of navigable rivers and elevated mountain ranges in Australia encourages an aesthetic fashioned by the monumental scale represented by deep-time landscapes and objects instead of geography. This study seeks to construct a theory of geological heritage and the redemptive or recuperative power of material remains of the deep past, concentrating on three landscapes.

The South Australian Division of the Geological Society of Australia has played a central role in the preservation of geological heritage in that state since 1966 when the glacial pavements of Adelaide's Hallett Cove became the movement's flagship. The 44,800-hectare Lake Callabonna Fossil Reserve, a dry lake in the state's arid far east, has been celebrated by vertebrate palaeontologists as a significant landscape since the 1890s. The dry Willandra Lakes of western New South Wales were inscribed on the World Heritage List in 1981 for their cultural, archaeological and geological significance. These three celebrated areas have been variously described as wasteland, desert, forsaken, degraded, unproductive and isolated. Geological perspectives provide a new lexicon for the appreciation of Australian landscapes as the deep past is mobilised to turn them into regions of 'world renown' or 'classic ground'.

Extract derived from Douglas (2006)

Douglas (2006: 275) writes 'Despite its philosophical links to eco-tourism and World Heritage, the language of Geoparks, at least in Australia, is still notably utilitarian, again focused on finance, education, training and sustainability rather than aesthetics.' In her conclusion, Douglas (2006) notes that geological heritage in Australia can be hard to divorce from tourism, politics and nationalism, and that landscapes may need more than their geological significance to be celebrated, and gives as an example the World Heritage nomination of the Willandra Lakes, which had to harness archaeology, patrimony, landscape aesthetics and cultural heritage to ensure the preservation of important geological features.

## **The growth of geological heritage work in Australia**

By the 1970s, each division had an active subcommittee, with work being carried out in each of the six states and also the Australian Capital Territory and Northern Territory. The establishment of the National Estate Grants Program in 1973 and the Australian Heritage Commission (AHC) in 1975 provided the first of a long series of Australian Government grants for the study of features of Australia's National Estate, and nomination of these to the then newly established Register of the National Estate. Grants totalling more than \$320,000 over the next 25 years resulted in more than 30 substantial volumes of documentation.



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A standing committee of the GSA was established in 1974 under Dr Colin Branch (Joyce 1994c) to help with the exchange of ideas between the seven subcommittees operating at that time – Queensland, New South Wales, Australian Capital Territory (with Northern Territory), Victoria, Tasmania, South Australia and Western Australia. Later the formation of a separate GSA Division in the Northern Territory, and so a new subcommittee, brought the number of subcommittees to eight. The history of the standing committee has been reviewed by Joyce (1994c) and a related timeline published (Joyce 2006a).

The state-based subcommittees each developed their own approaches to heritage studies. Some produced overall inventories in one volume while other systematically worked across their state producing a series of volumes. Some volumes were printed in hundreds of copies and distributed and sold widely, while others were only in a few reference copies, for example in South Australia only 16 copies of each report were printed, but with photocopies of appropriate sections sent to selected state government and local government bodies. A list of reports by the subcommittees and the standing committee is given in Appendix 5 in Joyce (1995b). A full list of ‘Geological monuments in South Australia’ (Parts 1 to 9, with details of 432 sites) has recently been issued on DVD (Hiern and Cowley 2008). Some subcommittees have made many nominations to the Register of the National Estate in Canberra, while others have made few. Where state registers are available, they have sometimes been used to register geological sites.

Books and leaflets on local geology, including geological heritage information, have been produced in Queensland and other states (Joyce 2007). Recent guidebooks sponsored by the Geological Society of Australia on scenery in National Parks in southern Queensland are part of a series prepared and published by the Queensland Division of the Geological Society of Australia. For the recently-declared World Heritage area of the Blue Mountains in NSW, a 34-page A4 colour booklet has been prepared by the NSW Department of Mineral Resources, in conjunction with the Geological Society of Australia, NSW National Parks and Wildlife Service, and the University of Sydney (Pickett and Alder 1997).

The major icons of central Australia, Uluru and Kata Tjuta, listed as World Heritage in 1987, have a detailed geological account as the first in a number of publications by the Australian Geological Survey Organisation (now Geoscience Australia). This series includes the relatively newly-recognized Bungle Bungle Range, in the East Kimberley of Western Australia, only proclaimed as the Purnululu National Park in 1987. With the Geological Society of Australia as a sponsor, a guide for the World Heritage area of Kakadu and Nitmiluk National Parks, in the Northern Territory of Australia, was published in 2000, and covers rocks, landforms, plants, and animals, the Aboriginal culture of the region, and the effects of human impact.

## Methodology used in geological heritage studies in Australia

Initially GSA subcommittees in each state of Australia independently developed methods of identifying, documenting and determining the significance of a geological heritage site or feature. Methods of assessing significance, from local or regional to national or international level, were also developed by the Australian Heritage Commission for the Register of the National Estate, building in part on the expertise of the GSA subcommittees. The AHC approach to the classification and assessment of natural sites, using a detailed set of criteria, in turn exerted its influence on Society work. Techniques developed by the UK’s Nature Conservancy Commission were also an important influence on GSA

work in Australia. For a review of early Australian geoheritage work and its background up to 1980 see Joyce (1980).

Each Australian state and territory GSA subcommittee also looked to some extent at the work of subcommittees in other parts of Australia, and in two workshops sponsored by the Australian Heritage Commission (AHC) and held in Canberra in 1982 and 1984, discussions were held between the subcommittees in an attempt to achieve some degree of uniformity. However state and territory subcommittees continued largely to follow their own methods. The two workshops however did lead to the preparation of a report on sites of international and national significance in Australia. This report summarized the approaches used up to that time by each GSA subcommittee, and provided a consolidated list of Australian sites of international and national significance, drawn from published and unpublished subcommittee documentation (Cochrane and Joyce 1986).

### **GILGES**

In 1991, a list of 28 geological sites of possible World Heritage significance was prepared by Joyce (1991) for the meeting of a UNESCO group in Paris in February 1991 to discuss the Global Indicative List of Geological Sites (GILGES) (see Table 3.1). GILGES was an initiative of UNESCO and ICSU to prepare a list of geological sites which might be considered for adding to the then current list of 30 geological sites on the World Heritage List (Cowie and Wimbledon 1994). The GILGES programme was replaced in 1995 by the UNESCO Global Geosites programme (Joyce 2007). Following discussion at the Paris meeting, a revised list of 26 sites for Australia appeared in the report by Cowie (1991). A related but more detailed list of 16 sites also appeared in McBriar and Hasenohr (1994).

The following list of sites is based on detailed work carried out in Australia by regional subcommittees of the Geological Society of Australia over more than 15 years. The list was prepared on 12 December 1990 in Canberra in discussions between Bernie Joyce, Federal Convener of the Geological Monuments Committee of the Geological Society of Australia, and Wanda Filsell, Jo Mummery and Phil Creaser, of the Department of the Arts, Sport, the Environment, Tourism and Territories. Since then Lake Callabonna has been added at the request of Maud McBriar, Convener of the S.A. Subcommittee.

**Table 3.1:** Global Indicative List of Geological Sites (GILGES) for Australia: extract from Joyce (1991: 2-4).

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**All the sites in this first list are documented elsewhere for the Working Group use.**

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1. Devonian reef complexes and Gogo fossil fish sites, W.A.
2. Ediacara Fossil Reserve, S.A.
3. Koonwarra Cretaceous fossil locality, Vic.
4. Lake Acraman meteorite crater and related depositional sites in Bunyeroo-Brachina Gorge, Flinders Ranges, S.A. Two separate localities.
5. Lake Callabonna, S.A.
6. Lord Howe Rise, N.S.W. On World Heritage List.
7. Macquarie Island, Tas. Being nominated to World Heritage List.
8. Mt Narryer and Jack Hills, W.A.
9. Naracoorte, S.A. Major fossil vertebrate site in Victoria Fossil Cave.
10. Archaean Microfossils and Stromatolites of the Pilbara, W.A. Includes North Pole site.
11. The Raak and Boinkas of the Sunset Country, Victoria.



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12. Riversleigh, Qld. Cenozoic fossil sites.
  13. Shark Bay, W.A. Being nominated to the World Heritage List.
  14. Uluru (Ayers Rock), N.T. On World Heritage List.
  15. Undara Crater and lava tubes, Qld.
  16. Willandra Lakes, N.S.W. On World Heritage List.
- 

### **Further possible sites - not proposed above - have been suggested by others.**

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17. Heard Island. Forms part of the Territory of Heard Island and McDonald Islands, and thus of the area recognized as Australian Territory; an oceanic island on the Antarctic plate. The largely Holocene cone of Big Ben is a currently active volcano, with a small lava lake at Mawson Peak, small cones along the coast, fringing moraine deposits, coastal plains, and outcrops of underlying Cainozoic limestone and volcanic deposits.
  18. Blue Mountains, N.S.W. Large-scale landforms, with major weathering and erosion processes.
  19. Lake Eyre region, S.A. Includes the Cainozoic Fossil Reserve of Lake Palankarina and Dalhousie Mound Springs.
  20. Flinders Ranges, S.A. Significant major Precambrian/Cambrian boundary site.
  21. Hallett Cove Conservation Park, S.A.
- 

### **Other sites included in the final list of sites**

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22. Yea Limestone, Victoria.
  23. Wolf Creek Meteorite Crater, W.A.
  24. Fraser Island and the Great Sandy Region, Queensland. On World Heritage List.
  25. Nullarbor Plain, S.A. and W.A. This is probably the world's largest single area of karst and the largest and most significant arid karst area. Heritage Significance of the Nullarbor Plain Region in South Australia and Western Australia. Being prepared for nomination to World Heritage List.
  26. Bungle Bungles, W.A.
  27. Darwin meteorite crater, Tasmania.
  28. Bitter Springs.
- 

A review of the work of the GSA and the AHC in assessing the significance of geological heritage sites in Australia, from the local level to World Heritage, was published in 1994 (Joyce 1994b). In 1994, the GSA was commissioned by the AHC to prepare a methodology volume which would detail techniques for locating, describing, classifying and assessing sites and features of geological and geomorphological significance. As well as rock, mineral and fossil sites, this methodology was also to cover landforms, dynamic processes, and viewpoints, including evaluating their vulnerability to natural and human activity. A grant from the AHC enabled the GSA's standing committee members and other interested heritage workers to meet at a workshop in Canberra in 1994 and led to the preparation of a two-volume methodology report, which was to assist with future geological heritage work in Australia. The assessment volume (Joyce 1995a) was prepared in limited numbers, but its contents are available on disk and CD, and on the Web (see Joyce 1995a). The report includes a review of geological heritage methodologies used in Australia and overseas (Joyce 1995b), and a full list of heritage publications by the GSA to that time.

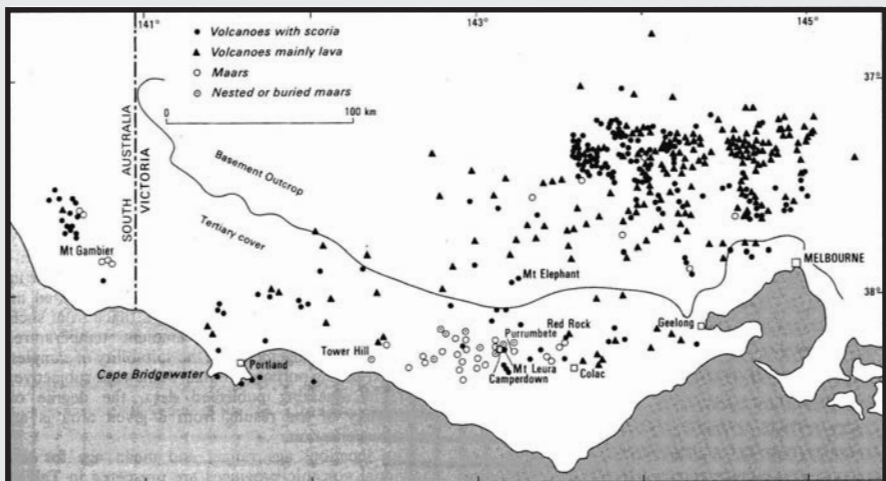
Geomorphological sites as well as geological sites can be classified using the methodology developed for the Australian Heritage Commission by Joyce (1995a), and a geomorphological and landscape approach has been discussed further by Joyce (2003). Themes are also being considered for use in Australian heritage work (see below) and

lend themselves to a landscape approach to heritage. Cochrane and Joyce (1986) listed 'geomorphic' as the second of twelve geological types to be used in the assessment of geological significance, and in their list of important Australian sites, 70 of 229 are landforms or landscapes.

Based on the methodology approach discussed in Joyce (1994a and 1994b) and elaborated in Joyce (1995a, 1995b) the procedure can be referred to by the acronym IDEM, and summarized as Identification (of a site or feature of possible significance), Documentation (of its details), Evaluation (assessment of its geological significance), and Management (recommendations for protection and conservation). The case study in Box 3.2 illustrates the process of assessing geological significance.

**Box 3.2: An example of the evaluation (assessment of geological significance) of an area: the Newer Volcanic province of southeastern Australia (based on Joyce 1994a, 1995b)**

The young volcanic province of southeastern Australia provides an instructive example of how significance can be assessed (Figure 3.4). There are nearly 400 volcanoes, including about 40 maar craters (Maars are landforms caused by volcanic explosion and consist of a crater which extends below ground level and is considerably wider than deep, with a surrounding rim (tuff ring) constructed of material ejected from the crater). Extensive basaltic lava flows, some containing lava caves, cover a large part of western and central Victoria, and an adjacent part of South Australia. These have been identified and documented over many years (see for example Joyce 1975). The significance of about 25 volcanoes was assessed in an initial inventory (Joyce and King 1980). Included were volcanoes with young, morphologically well-preserved lava flows, including some with lava caves.



**Figure 3.4:** The Newer Volcanic Province of southeastern Australia

The initial assessment was of individual features such as cones, craters, flow features and lava caves. The possibility and indeed the necessity for further management planning to assess the whole of a particular eruption became evident, so that the cone and crater, flows, and any related features such as lava-dammed drainage were then looked at together.

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An example is the Mt Napier volcanic complex (Joyce and King 1980: 116-120) consisting of a main volcanic centre with several eruption points, a broad area of lava flows forming a shield, several constricted valley flows with one flow having a major set of lava caves, and an unusual group of lava tumuli. Each set of features (cone, flows, caves, tumuli) initially was given its own significance level. The complex as a whole was later given a national significance.

In assessing the significance of features of the province beyond the local or state level, it was necessary to compare them with areas of similar volcanicity found in northern Queensland. In assessing their significance at international or world level, it was necessary for the assessor to have a good understanding of young basaltic lava fields around the world, such as the Auvergne in France, the Eifel in Germany, and areas in the United States of America, Mexico, New Zealand, and also the area of current activity in Hawaii. It was also possible to distinguish groups of possible higher significance within the province, such as the 40 or so maar volcanoes, which in variety, size and exposure rival those of the type area in the Eifel.

Another group that can be distinguished is that of the lava caves, which are found in several localities in the province, and in a variety of geomorphic settings including valley flows, flank flows, within a cone, and as part of an open vent. These caves are widely known in the geological literature, and one of the main theories for lava cave formation has been based on the study of the caves of this province.

A panel trying to assess the whole province, or its parts, would require local detailed knowledge (a field geologist, geological survey staff member, a geology teacher active in the area), and a knowledge of comparable areas elsewhere (perhaps a geomorphologist, especially if also a physical volcanologist). It would also help to commission a special study, and this has now been done in Victoria under the sponsorship of the Geological Society of Australia and the Victorian Branch of the National Trust of Australia, with funding from the government, and a discussion of the methodology used is given in Rosengren (1994a). At the final stage, a panel was used to check the assessment of significance carried out by the consultant, justifying significance levels in the broader context of the whole of Victoria, Australia or the world.

In this example it is possible to see how the process of identifying, documenting, and assessing individual features or sites, such as a scoria cone or lava cave, has been followed by the grouping of features, such as the Mt Napier complex, and then by the need to perhaps assess the whole volcanic province, or at least substantial sub-sets such as all lava caves, or all maar craters, at the international level.

Recommendations for future management should then follow.

Sites or features are classified as a geological or geomorphological type, for example stratigraphy, rocks and minerals, fossils and palaeontology, karst, glacial and so on. (Joyce 1995a), They can be representative of a group of similar sites, or they may be classed as outstanding. Assessment is carried out by a committee whose members have a wide range of geological experience and expertise. Sites or features are assessed at a level of significance, ranging from local, through regional, state, national, to international (see discussion in Joyce 1995a). The most recent discussion of the current procedure and protocol for the documentation and assessment of geological heritage sites in Australia is by White and Mitchell (2006). The most recent discussion of geological heritage work

in Australia can be found in Brocx (2008). Chapter 5 in this book (pp.81-116) gives a historical review of initiatives and principles that underpin the conservation of geoheritage significance in Australia.

A review by Gray (2004: 249-254) described the GSA's work on geological heritage in Australia, especially in South Australia and Victoria. Gray discussed the criteria used by the AHC to assess geological features and sites for the Register of the National Estate, and the methodology developed for the AHC by Joyce (1995a), and he compared the work of the GSA with the work done by Tasmanian Government departments, discussing a code of practice developed in Tasmania. Finally, he discussed organisations such as the National Trust which are also interested in geological sites and features across Australia. The report by Rosengren (1994a) on the volcanoes of Victoria is an example of the landscape-related work carried out by the GSA with the Victorian section of the National Trust. Further examples are given in Bird and Joyce (2006). The result of the Geological Society of Australia's work is that Australia has for many years been recognized both within Australia and internationally as a leader in the field of geological conservation (see Geological Society of Australia Inc. web site).

## Heritage registers

When the Australian Heritage Commission was set up by the Australian Government in 1975, one of its tasks was to compile a Register of the National Estate. This was to include places of natural, historic and Aboriginal heritage which should be kept for present and future generations. The GSA's heritage subcommittees soon became regarded by the AHC as expert nominators to the Register of the National Estate, and a total of 691 geological sites are currently on the Register (Creaser 2008).

Several Australian states also have heritage registers. In South Australia, natural sites including geological sites can be listed on the State Heritage Register, but in Victoria the register grew out of an historic buildings register, and so far only archaeological sites and shipwrecks have been added, and geological sites normally cannot be registered.

The National Trust of Australia consists of largely independent organizations in each state, and while mainly concerned with historic buildings and related heritage such as gardens, state national trusts may also study and classify landscapes, including their geological aspects, and include these landscapes on their registers (Bird and Joyce 2006).

## Some other government-sponsored geological heritage studies

A major government sponsored study by Davey and White (1986) discussed the evaluation of the significance of caves and karst in the state of Victoria. Work at state government level includes consultant projects such as those of Rosengren in Victoria, including his study of the Late Cainozoic basaltic eruption points of Victoria (Rosengren 1994a) and its use in the management of scoria and tuff quarrying (Rosengren 1994b); the study was carried out jointly for the GSA's Victorian Subcommittee and the National Trust of Australia (Victoria), under an AHC grant.

In Tasmania, the Forestry, and Parks and Wildlife agencies of the Tasmanian Government have developed a methodology which includes geomorphological and soil features (Dixon *et al.*, 1997), and a Tasmanian Geoconservation Database is available on the web at: <http://www.dpiw.tas.gov.au/inter2.nsf/WebPages/LBUN-6TY32G?open> (See also: <http://www.dpiw.tas.gov.au/inter.nsf/WebPages/SJON-57W4FD?open>.) White

(2008), current Convener of the GSA's Geological Heritage Standing Committee, has recently described the Tasmanian work and compared it with the work of the GSA.

## **Australian Natural Heritage Charter**

An Australian Natural Heritage Charter was funded by the AHC and published in 1996 (Australian Committee for IUCN 1996). It was based in part on the Australia International Council on Monuments and Sites (ICOMOS) Charter for the Conservation of Cultural Significance ('Burra Charter' of 1992), which provided guidelines for places with both natural and cultural values. The Natural Heritage Charter provides standards and principles for the conservation of places of natural heritage significance. A Natural Heritage Places handbook published in 1998 provided further assistance in applying the Charter to determine significance and prepare conservation and management plans.

## **Australian parks and reserves, including geoparks**

National parks in each state and in the territories provide valuable protection and management for many geological heritage sites; indeed the initial impetus for setting up such parks has often been their geological features and landscape values. However, few parks services employ or work with geologists, and management and interpretation is strongly biased towards biological and ecological aspects. Geological research including sampling is also restricted in national parks. There have been significant problems of management in World Heritage areas such as the Willandra Lakes (see Figure 3.3), and many national parks are poorly funded and interpreted (Joyce 1999).

There is a need for new groupings which emphasise geological and geomorphological sites, and the concept of *Geoparks* can be usefully applied in Australia to such areas as the youthful Western Volcanic Plains of Southeastern Australia, a closely settled agricultural region, which in June 2008 was accepted as the Kanawinka Global Geopark and thus Australia's first Geopark (McKnight 2008, Joyce and Bröhl 2008, Lewis 2008). Such regions, generally not suitable for national parks, can provide useful groupings of geological sites for future geotourism (Joyce 2007).

## **The new Australian Government approach to heritage**

The Australian Heritage Commission has now been replaced by the Australian Heritage Council, and from 1 January 2004 a new National Heritage List of places with outstanding heritage values to Australia is being developed by the Australian Government. The values of places on the new National Heritage List will be protected under the Environment Protection and Biodiversity Conservation Act 1999 and later amendments.

The new National Heritage List will be made up of outstanding places with values to be protected by the Australian Government. These places will highlight the major stories of Australia – the evolution of the land, the qualities of its people and the diversity of its culture. All Australians will be able to nominate places, but nominations will be sought from professional groups such as the Geological Society of Australia. **The earlier Register** of the National Estate included many geological heritage sites but this Register was frozen on 19 February 2007, meaning that no new places can be added or removed. It continues to be available online (<http://www.environment.gov.au/cgi-bin/ahdb/search.pl>).

After five years there are now 100 properties on the National Heritage List, but so far there are only 20 or so geological or geomorphological places on the List. The Dinosaur Stampede National Monument in Queensland was one of the first three places to be

listed on the National Heritage List in July 2004. Located at Lark Quarry Conservation Park, 110 km south of Winton in Central Queensland, the site features unique evidence of a dinosaur stampede with almost 4000 dinosaur footprints clearly visible in an area of just 210 square metres. Two archaeological sites, in the Budj Bim National Heritage Landscape, are part of the young Mt Eccles volcano and associated lava flows in southwestern Victoria, which are of geological heritage significance. Further fossil sites (Naracoorte, Riversleigh, Yea, Ediacara) have been now added, and World Heritage places such as the Great Barrier Reef, Greater Blue Mountains, Kakadu, Purnululu, Uluru–Kata Tjuta, and the Willandra Lakes have also been included on the National Heritage List.

## The use of themes

The concept of themes ‘telling a story’ is a recent AHC approach, and is similar to concepts used by World Heritage. This approach can help link individual sites to the landscape, to processes past and present, and cultural aspects, across large areas. Two examples of themes are *The onset of aridity in Australia* (dry lakes and lunettes of the World Heritage area of the Willandra Lakes in New South Wales, and desert dunes of the inland e.g. the Simpson Desert); and *Young volcanicity and tectonics in an active Australian landscape* – volcanoes, lava flows and ash deposits of the last million years in Victoria, and also in northern Queensland (Joyce 2003).



**Figure 3.5:** The famous Twelve Apostles rock stacks developed in Tertiary marine limestone, Port Campbell National Park, western Victoria, with active coastal erosion illustrated with before and after photos taken seconds apart at 9.16 am on 3 July 2005 (Photos Parks Victoria, but taken by a tourist visiting the area). The ‘Twelve Apostles’ rock stacks of the Port Campbell coastline (Bird 1993: 61-84) have a long history of studied and recorded coastal change over more than 70 years, with a deduced abrupt ‘erosion rates of 1 or 2 metres once a century’.



## 14 Geotourism: The Tourism of Geology and Landscape

In Australia it is important for future geoheritage understanding to be able to explain to the public the story of the continent's changing landscape – the marks left by the climate of the last ice age, the effects of aboriginal occupation, sea level change, and European arrival. The present landscape should be linked to aboriginal dreaming and indigenous archaeology, to past and present climate, and finally to current and active landform changes (see Figure 3.5). Links can also be made to European 18th and 19th century exploration, and finally to the understanding of the Australian landscape developed over the past 200 years through the experiences of early settlers, miners and farmers, builders and architects, gardeners and landscape planners, poets and painters, and musicians and writers. This thematic approach is ideal for the selection and setting up of geoparks, and their use in geotourism.

### Recent reviews and evaluations

The Australian Heritage Commission has commissioned an independent review of geological heritage sites in Australia, providing from its resources a list of sites to be investigated. A two-volume report has been prepared, listing, describing and evaluating sites of possible international and national significance. The first volume covered 198 Australian rock and landform sites (Yeates 2001a), and a companion volume (Yeates 2001b) provided a similar assessment for 150 fossil sites (see summary of numbers in Table 3.2, suggesting that not all states have been adequately covered).

**Table 3.2:** Number of fossil sites in each state/territory of Australia, from Yeates (2001b).

New South Wales	52
Queensland	28
Western Australia	18
Northern Territory	14
Victoria	13
Tasmania	9
South Australia	9
Australian Capital Territory	0
TOTAL	143
No of sites considered	150

Between 2005 and 2007, the AHC commissioned palaeontologists from seven state and territory museums to conduct a comprehensive comparison of outstanding fossil sites, in addition to a report that provided a comparison of the most important plant fossil sites nationally. These eight documents were then peer reviewed and edited to produce a single document, titled *Australian Fossil Sites for Potential National Heritage Listing* (Cook 2007). This draft report will enable strategic assessment of fossil sites for the National Heritage List by providing a shortlist of places that best demonstrate the evolution of Australia's biota.

The AHC also held expert workshops in 2006 and 2007 to establish a national framework for the assessment of important karst and pseudokarst sites. Results from both workshops will allow the effective comparative assessment of karst and pseudokarst sites around Australia, and produced a shortlist of important sites that illustrate the range of karst and pseudokarst features in Australia, along with a strategy for further research (Ambrose and Douglas 2008).

## Geotourism in Australia

In 1996 the conference of the Geological Society of Australia was held in the national capital Canberra, and two presentations were concerned with geotourism – perhaps the earliest mention of the term amongst the Australian geological community. Casey and Stephenson (1996) spoke from their practical experience and provided ‘tips and practical experience’ on putting geology in tourism. They argued for the use of simple explanations of geology, avoiding the use of jargon, and they suggested including links to indigenous (aboriginal) legends, and also making use of the public’s interest in orchards and wineries. W. Mayer’s 1996 paper discussed geology and tourism, and suggested Australia was well-suited to nature tours, for example in areas such as Kakadu and the Great Barrier Reef. Mayer (1996) also referred to geotours in the Hamersley and Pilbara regions of far northern Western Australia, and argued that geotourism needed ‘small, compact, but well-illustrated guidebooks’; he suggested that the Geological Society of Australia might help produce these.

Geotourism, or tourism related to geological sites and features, including geomorphological sites and landscapes, can be seen as a new phenomenon, and also a subset of geology and tourism. In the Australian context, the definition of geotourism has been explored, and a working definition of *geotourism* suggested:

*people going to a place to look at and learn about one or more aspects of geology and geomorphology*

(Joyce 2006b, c)

A recent book (Dowling and Newsome 2006) discusses geotourism across the globe, but unfortunately the section on Australia fails to acknowledge the work of the GSA, thus demonstrating the need to make databases of Australian geosites better known and more freely available (see discussion in Joyce 2008).

In August 2008, the Inaugural Global Geotourism Conference, ‘Discover The Earth Beneath Our Feet,’ was held in Fremantle, Western Australia, and several presentations reviewed the work of the GSA and the AHC over the past 40 or more years and its importance for future geotourism in Australia (Ambrose and Douglas 2008, Creaser 2008, Joyce and Bröhl 2008, Lewis 2008). These papers show how geological heritage studies in Australia are being applied to local geotourism.

## Current listings of major geological heritage sites in Australia

A number of listings of the main Australian geological heritage sites have been prepared over the last 20 years:

1. **Cochrane and Joyce (1986)**. This was the first report to list sites of International and National Significance for all of Australia, with 76 International sites.
2. **Joyce (1991)**. In 1991 a list of 28 geological sites of possible World Heritage significance was prepared for the GILGES meeting in Paris in February 1991 (see Table 3.1). Following discussion at that meeting, a revised list of 26 sites for Australia appeared in the report by Cowie (1991). A related but more detailed list of 16 sites also appeared in McBriar and Hasenohr (1994).
3. **Yeates (2001a, b)**. An independent review of geological heritage sites in Australia for the AHC listed, described and evaluated sites of possible International and Na-

tional significance (see Table 3.2). A further development is the listing of major fossil sites by Cook (2007).

4. **The current World Heritage Area list for Australia** (UNESCO World Heritage List website) shows 17 properties of which 12 are major geological sites.

In summary, the various documents listing geological heritage sites in Australia suggest there may be a total of 100 or more sites of international significance, including rock, mineral, stratigraphic, landform and process sites, and fossil sites. The actual numbers in Yeates (2001a and b) are not clearly presented. Comments by Yeates (2001a, b) also suggest additional sites may need to be added to the current listings to approach a level of completeness. In particular, he suggests further fossil sites may be needed, especially in some parts of Australia, and for certain types and ages of fossils. Yeates (2001b) noted that documentation was not complete for many fossil sites, making assessment difficult. It is likely that further landform and process sites, including coastal, tropical savannah, and weathering (regolith) sites in northern Australia, will also need to be added. Finally, in a recent study for the Australian Government expert workers selected and discussed ten fossil sites from each of Australia's seven states, giving a total of 70 sites. Some additional fossil sites were included in the related report compiled and edited by Cook (2007).

## **Geosites for Australian geotourism – how can geotourism workers find and use this information?**

The Geological Society of Australia and the Australian Heritage Commission have been the main bodies concerned with geological heritage in the past, and some 30 reports have been prepared, covering most parts of Australia. Several overall listings have also been prepared, and many sites have been listed on the Register of the National Estate maintained by the AHC.

A full set of the GSA's grant-supported reports is in the library of the (former) AHC in Canberra. Copies of GSA reports have also often gone to state government departments, and sometimes local government bodies. Recently these volumes have been reviewed and summarised for the AHC by Yeates (2001a, b). In Victoria, copies of some studies were printed by and offered for sale by the Geological Survey of Victoria. Details of sites were also included in a Geological Survey of Victoria database. In South Australia, details of sites were included in a Geological Survey of South Australia and South Australian Museum database. Recently a set of CDs of all the South Australian GSA heritage reports was made available. However, geological heritage publications on Australia, particularly of some GSA divisions (i.e. state branches) can be difficult to locate.

Databases of geological heritage information already online include the AHC's Register of the National Estate and the National Heritage List, Victorian Resources Online, and the Tasmanian Geoconservation Database. Other information is becoming available on CD and DVD e.g. Hiern and Cowley (2008).

An up-to-date listing of database of Australian geosites should be made available. Such a database inventory will be of significant value to future geological heritage work in Australia, and justify the work involved. To assist in this work a website has been set up through the Geological Society of Australia (Victoria Division), which will be used to provide the background to the proposed program, and begin developing and maintaining an index to current databases, and also provide a list of all publications on geological heritage sites in Australia. The URL is: <http://vic.gsa.org.au/geosites.htm>

These data sets will also be linked from a related *Geotourism in Australia* website (<http://vic.gsa.org.au/geotourism.htm>). Locating and listing all available databases, developing them further, and making them freely available is a necessary condition for the future of geotourism and geoparks in Australia.

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