

ESSAY: CONSERVING AUSTRALIA'S GEOHERITAGE

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AUSTRALIAN GEODIVERSITY AND GEOHERITAGE

Preamble

A discovery of geoheritage for many is like opening a box of hidden treasures. Unravelling and understanding each treasure becomes a journey of discovery and learning about our remarkable rocks, landscapes and the past. Geoheritage can bring a new level of understanding about how special our country is and how valuable the "treasure" is for its stories and historical associations with people. Australia has extraordinary geoheritage with countless "treasures" and multiple opportunities for all Australians to learn more about *their* national inheritance and history. Whilst this geoheritage is special, we have not always recognised, protected, managed nor celebrated it as well as we could. In this essay, we explore how we can improve this situation and suggest ways to the better identify, protect and manage Australia's geoheritage with a grand objective of truly celebrating and caring for all of our natural heritage, both abiotic and biotic.

Introduction

Australia is both a mega-biological diverse country *and* a continent with outstanding geodiversity and this geodiversity helps to define its eighty-five bioregions. Australia occupies just 5.7 per cent of the Earth's land surface, has 7 -10 per cent of the world's species and for Australians and people of other lands it conjures up images of kangaroos, strange and beautiful animals, as well as remarkable geodiversity that includes Uluru, red desert lands, iconic sandy beaches and the spectacular Great Barrier Reef. Outstanding *geoheritage* such as these iconic features are celebrated as part of Australia's national identity. Many are inscribed *World Heritage Sites*, many are included on Australia's *National*

Heritage List and many, many more are formally recognised geological conservation sites. Geoheritage is special and is part of our makeup as an Australian nation.

Introducing and defining geodiversity

Australia's geodiversity has an important place in Earth's history. It is host to the world's oldest known minerals, the Jack Hills Conglomerate *zircons* of Western Australia (Wilde et al, 2001). In the story of Earth's evolution, these minerals were formed immediately following Earth's creation about 4.56 billion years ago (Luhr 2003). Australia also hosts geological sequences which span the entire history of Earth and landforms of national and international importance. This includes the Precambrian Shield of Western Australia (WA) which is the oldest continuously exposed land surface in the world; Mount Augustus (WA), the largest monolith in the world; the rounded massed domes and deep canyons of Purnululu National Park (WA); the Wolfe Creek Meteorite Impact Crater (WA); the breathtaking cliffs and plunging waterfalls of New South Wales' (NSW) Blue Mountains; and grand limestone terrain of the world's oldest caves found at Jenolan (NSW) as well as its youngest in the calc-arenite dune systems of our southern coastline (White 2012).

Our geodiversity includes more delicate features such as the 560 million year old Ediacara fossil impressions in sandstones from the Flinders Ranges in South Australia (SA), the oldest known marine animals on Earth; the outstanding 100 million year old opalised dinosaur (*Pliosaur*) fossil skeleton from Coober Pedy, SA (housed in the Australian Museum); rare, exquisite and beautifully symmetrical multi coloured minerals such as *Galena*, *Sphalerite* and *Native Copper* from Broken Hill (NSW) and uranium minerals *Torbenite* and *Autonite* from Arkaroola (SA). For Aboriginal Australians, geoheritage is an integral part of their culture and beliefs. Many landscape features and past geological events such as the volcanic eruptions of Western Victoria; meteorite impacts of Northern Territory; and sea level rise of 10,000 years ago are part of their dreamtime stories and ceremonies. This experiential heritage has been passed from generation to generation over thousands of years.

Defining Geodiversity

Geodiversity is about Australia's abiotic world. It has been defined by Murray Gray as "*the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landform, processes) and soil features. It includes their assemblages, relationships, properties, interpretations and systems*" (Gray 2004). Another definition of geodiversity has been prepared by Semeniuk who states geodiversity is: "*the natural variety of geological, geomorphological, pedological, hydrological features of a given area from the purely static features at one extreme, to the assemblage of products, and at the other, their formative process*" (Brocx 2008, p. 14).

The Australian Natural Heritage Charter defines geodiversity as *“the natural range (diversity) of geological (bedrock), geomorphological (landform) and soil features, assemblages, systems and processes. Geodiversity includes evidence of past life, ecosystems and environments in the history of Earth as well a range of atmospheric, hydrological and biological processes currently acting on rocks, landforms and soils”* (Commonwealth of Australia 2002). Clearly, key geodiversity phenomena include the rocks, minerals, fossils, soils and landforms of Australia as well as processes affecting them. Examples of geodiversity that are of very special conservation significance and that need to be conserved are recognised as *geoheritage* (Sharples 2002).

Defining Geoheritage

The Australian Geological Society has a definition of geoheritage.

“Globally, nationally, state-wide, to local features of geology such as its igneous, metamorphic, sedimentary, stratigraphic, structural, geochemical, mineralogic, palaeontologic, geomorphic, pedologic, and hydrologic attributes at all scales, that are intrinsically important sites or culturally important sites, that offer information or insights into the formation and evolution of the Earth, or into the history of science, or that can be used for research, teaching or reference” (cited in Brocx 2008 p13)

Australia's geoheritage is discussed further following an assessment of the importance of geodiversity and how well Australia understands what geodiversity is found on this continent.

THE IMPORTANCE OF GEODIVERSITY

“The only record of the history of our planet lies in the rocks beneath our feet: rocks and the landscape are the memory of the Earth. Here, and only here, is it possible to trace the processes, changes and upheavals which have formed our planet over thousands of millions of years: the more recent part of this record, of course, includes the evolution of life, including Man. The record preserved in the rocks and landscape is unique, and much of it is surprisingly fragile. Today it is threatened more than ever” (ProGeo 2012).

Geodiversity is an integral part of our natural environment and its importance was described by Colin Prosser and his colleagues (2011) who stated:

“The nature and distribution of our landscapes, biodiversity, landuse and local character are defined by underlying geology, landforms and geomorphological processes and this rich geodiversity provides the spectacular backdrop to many popular tourism destinations and underpins the ecosystems on which we all depend” (Prosser et al, 2011).

Geodiversity is a fundamental resource for human society, its well-being and standard of living through the natural resources it provides our industries, through soils which help sustain our agriculture and food sources and through the many spectacular landform settings it provides for our tourism industry. It is also a rich record of the evolution of our

planet as well as our immediate past as a species and it is a focus for on-going research and scientific discovery into Earth's natural heritage. Many expressions of this geodiversity are of great interest and importance to science and to people; they may be unique and they are often irreplaceable. Understanding what geodiversity exists is an important starting point for establishing potential *geoheritage* that should be conserved.

GAPS IN GEODIVERSITY INFORMATION

Australia has completed considerable work in understanding its geodiversity for geological, geomorphological, soils, minerals and fossil phenomena. Systematic geological surveys by State organisations, Geoscience Australia, research institutions and others have completed broad geological and soils mapping and recorded the geology, important mineral locations and soils for the entire nation (Pillans 2012, pers. comm.). This work is ongoing but there is a capacity to appraise the geological and soils geoheritage for Australia. Important mapping of landforms has been completed but more systematic work however is still needed to achieve a national assessment of Australia's landforms (Kiernan 2012, pers. comm.). This is considered to be a gap in the knowledge of Australia's geodiversity. Systematic mapping of Australia's geomorphology would permit the comparative analysis of geomorphological sites and a determination of outstanding geoheritage phenomena. In terms of potential however, Australia is relatively "unexplored". With a comparable land area to either Europe or the USA, Australia has had but a handful of professional mineralogists, palaeontologists and geomorphologists working to reveal the geodiversity of this continent when compared with the many hundreds of geoscientists in these other lands.

There are strategic gaps in the information about Australia's minerals and fossils and further work is needed at a level of detail. There is no taxonomically correct and peer reviewed whole-of-nation inventory for either minerals or fossils though there are many individual institutional collections (Gehling 2012, Pring 2012 pers. comm.). Using the power of the e-world together with wise funding investments, co-operation and new partnerships around Australia this situation could be transformed. An investment (for example) in voluntary co-operative partnerships of museums and institutions of Australia and an investment in research could help generate scientifically correct lists of Australia's fossil evidence and for mineral species. With time, the collections could be made available publicly as a "virtual" collaborative whole-of-nation e-collection. With such information, Australia could help fill any gaps that exist in its (individual) institutional heritage collections; comparative analysis could be completed scientifically for National Heritage Listing (and other) assessment processes and new research could use this information for further discovery.

A LIST OF AUSTRALIA'S GEOHERITAGE

Work on assessing the geodiversity of Australia for its geoheritage has been undertaken, but it has not been systematic at a whole-of-nation level. Tasmania has been recognised for its

national leadership for geoheritage recognition through its excellent and systematic *Tasmanian Geoconservation Database* (TGD) and supporting *Classification Key* and *Training Manuals* (DPIPWE 2012). The TGD recognises a formal listing process, the establishment of significance, peer review and an assessment of the sensitivity of each geoheritage site. Other assessments of Australian geoheritage have mostly been site based and have been quite thorough, consistent with the level of significance being assessed.

These have included:

- *International geoheritage significance* assessment through rigorous World Heritage inscription evaluations. Fifteen of Australia's nineteen World Heritage sites include assessed geoheritage phenomena. The Riversleigh and Naracoorte World Heritage fossil sites (for example) are inscribed on the World Heritage List for the criteria: "*outstanding examples representing major stages of Earth's evolutionary history*".
- *National geoheritage significance* assessment through a rigorous National Heritage List nomination process. Some twenty-five sites of ninety-seven on the list have been identified for their outstanding geoheritage values in relation to *process; rarity; a class of place for natural values; or the potential to yield information or their special association with a person, persons or importance in Australia's natural history*. These include the *Dinosaur Stampede National Monument* at Lark Quarry, Queensland, and the *Ediacara Fossil Site* in the Flinders Ranges, SA.
- The two-volume *Assessment of Australian Geological Sites of Possible National or International Significance* compiled since the 1970s by state and territory divisions of the Geological Society of Australia and published by the Australian Heritage Commission (Yeates 2001a; 2001b).
- Records of geoheritage sites included on the Register of the National Estate, an archive of information about more than 13,000 heritage places throughout Australia identified between 1975 and 2007.
- State and territory based *Geological Survey* and *Geological Society of Australia* listings of important geological sites including specialist reports by Ian Percival (1985) and the excellent work of the Geological Society of Australia's South Australia Division since the 1970s.
- State and territory protected area organisations records of geoheritage sites such as in Tasmania and NSW.
- Records and reports of the Australian Speleological Federation.
- Science based reports published in the wider literature and other special, internal professional organisation and government reports.

Despite these (and other) contributions, a rigorous, systematic assessment of Australia's *national* geoheritage is still missing. The Geological Society of Australia has lobbied for such an approach and has recommended a system to undertake such work (Brocx 2008; Brocx

and Semeniuk 2009). The Tasmanian TGD method is another system which should be closely assessed for its use with a systematic approach to geoheritage recording (DPIPWE 2012).

The preparation of a *select* and *definitive* list of Australia's *national* geoheritage along with an assessment of its potential significance from an international and national level of significance is needed. Other geoheritage that may be of state, territory and local level of significance is also important, but should be recognised and managed separately. Many of these sites could contribute to the development of a *national list*. National Heritage Listed geoheritage would presumably be drawn from such a national list and preferential funding for protection and management should also be influenced by it. The development of a national list should be a collaborative task involving appropriate State, Territory and Commonwealth Government organisations; research institutions; Non-Government Organisations; Indigenous Groups; and voluntary bodies such as the Geological Society of Australia and the Australian Speleological Federation. A vision should be to establish a single, national list of peer-reviewed geoheritage sites that are based on agreed criteria and that are recognised as having at least national or international levels of significance. Individual geoheritage sites which are part of larger *geoheritage stories* could also be recognised on a national list. The list should be reviewed and upgraded on a regular basis.

Such a future national list of Australia's geoheritage also needs to account for the integrity of the phenomenon, its condition and its vulnerability. Some geological phenomena, such as landforms or certain rock exposures may well be robust, but others such as fossil or mineral sites may be vulnerable to stealing, vandalism or development impacts. Many national geoheritage sites will be irreplaceable and the very process of listing may also endanger a site. The national geoheritage list should include an assessment of the condition of the geoheritage at the time of listing; it should have the capacity to assess any trend in condition from time to time and should account for its vulnerability to disturbance. A co-operative partnership that develops a systematic listing of our national geoheritage should also bring forward approaches for condition and trend in condition assessments. Because of their sensitivity to disturbance or theft, some sites may not be publicly disclosed. Others may require special protection investments.

THE PROTECTION OF GEOHERITAGE

Legal protection for geoheritage sites in Australia is achieved in 2012 in a number of ways including:

- State and territory protected area and heritage legislation that directly protects natural heritage.
- The Australian Government's EPBC Act which provides protection for the values of geoheritage sites on the World Heritage List.

- The Australian Government's EPBC Act which provides protection for geoheritage sites on the National Heritage List from actions by corporations or Commonwealth agencies.

This means that an identified geoheritage site is otherwise legally unprotected unless it has specific protection under state or territory heritage law or is within a protected area, or part of a National Heritage listed place (where the value of the place has been defined) or part of an inscribed World Heritage site.

A national register of geoheritage with a vulnerability assessment should also identify tenure status and land ownership. It is assumed that the majority of Australia's nationally-listed geoheritage sites will be outside of protected areas and while some will be remote or undisclosed sites, many other sites may require greater protection than just the good-will caretaker role of landowners and local stewards.

In some states and territories, there is statewide/territory wide protection for heritage phenomena. Native wildlife and Aboriginal sites for example have statewide or territory wide protection and consents are needed from conservation organisations before wildlife may be taken or before Aboriginal sites may be destroyed. These consent processes are embedded in NSW's planning approval processes for example and a similar approach for geoheritage protection could be considered.

Geoheritage is commonly irreplaceable and formal recognition should include adequate protection measures. It is suggested that geoheritage site access and protection, as part of a national geoheritage listing process should be reviewed and improved by an expert working group to achieve enhanced and practical protection approaches for off-protected area sites. This group could include Commonwealth, state and territory government representatives, representatives from the mining industry, local government representatives, landowner representatives and other key stakeholders.

THE IMPROVED MANAGEMENT OF GEOHERITAGE

A national geoheritage list should inspire the collaborative development of a *National Geoheritage Conservation Strategy*. This could be developed as a parallel to the *National Biodiversity Strategy 2010-2030* (NRMMC 2010) and provide guidance for priority geoheritage management and for funding investments. Some guidance for this work should be secured by researching the work of the *Scottish Heritage Charter* (Scottish Geoheritage Forum 2012) and research completed by Scotland's University of St Andrews (Gordon and Barron 2012). A *National Geoheritage Conservation Strategy* could also provide priority guidance for the selection and establishment of outstanding new geoheritage protected areas as appropriate, and should inform *Australia's Strategy for the National Reserve System 2009-2030* (NRMMC 2009). It would form a basis for Australia's next *State of the*

Environment Report accounting for geoheritage conservation progress. The management of national geoheritage should be guided by Australia's *Natural Heritage Strategy* (Commonwealth of Australia 2002) which specifically recognises geodiversity values and the need for their management.

Only two of Australia's eight protected area organisations, Tasmania's Department of Primary Industry, Parks and the Environment and the NSW Office of Environment and Heritage are known to have specialist geoheritage management staff. Both organisations are undertaking sound geoheritage conservation work, with Tasmania being quite advanced with its systematic identification system. Protected area managers are employed at geoheritage cave-sites such as Jenolan and Yarrangobilly (NSW), Hastings Caves (Tasmania), Naracoorte and Kelly Hill Caves (SA) and Margaret River (WA) and provide responsible management. Commonly these professional conservation managers possess more generalist natural heritage management degrees. An important conservation geomorphology and geoheritage management course is provided at the University of Tasmania (Kiernan 2012, pers. comm.) but there is no other known specialist tertiary geoheritage conservation management training course in Australia (Pillans 2012, pers. comm.).

The management of geoheritage needs geologists, geomorphologists, palaeontologists, mineralogists and other geoscientists with specialist training in geoheritage conservation management and there is a need for one or more of Australia's universities to provide such training opportunities. Skill sets and management competencies need to be defined, and this needs to be linked to the national geoheritage list and its conservation management needs. A working group of academics, researchers, geoheritage managers and mining industry experts could be established to help define the course content. Protected area organisations could also be encouraged to employ at least one such specialist each, but preferably geoheritage trained conservation staff should be employed to protect geoheritage on-site. Some mining companies could be interested in retaining geologists with such training as a means for investing professionally in the conservation of geoheritage in parts of their mine sites. Many mining sites include remarkable geoheritage phenomena and many mining companies may wish to help conserve these as part of their special story, as part of the heritage of the site and as part of the history of development of Australia. A process could also be established where geoheritage conservation is facilitated and where new partnerships between the mining industry, governments and the community help make this happen.

THE STATE OF GEOHERITAGE

The *Australia State of the Environment Report 2011* provides scant attention to geodiversity let alone the conservation and management of geoheritage. Soils are partly dealt with,

some specific sites such as Jenolan Caves, the Australian Alps and the geomorphology of the seabed are included, but the condition and trend in condition of geoheritage phenomena such as landforms, mineral species, fossils and geological sites is not described. The next *State of the Environment Report* should include these aspects of Australia's heritage. The status of geoheritage should also be considered. An assessment of geoheritage as a category of heritage in its own right (like biodiversity) should be considered.

CELEBRATING GEOHERITAGE CONSERVATION

Geoheritage conservation has many benefits and special values and *should* be celebrated. A *National Geoheritage List* and a *National Geoheritage Conservation Strategy* should help facilitate such a celebration. There are many aspects to this, for geoheritage has many different values and its conservation will generate many different reasons for celebration. Geoheritage has both intrinsic and existence values and such values (for example) could be of spiritual and cultural significance. The bold granitic tor and granite waterfall terrain of Mumbulla Mountain (Biamanga National Park) and Gulaga National Park on the NSW South Coast are scenically beautiful as well as being celebrated for their special spiritual importance to the Yuin Aboriginal people and others.

Geoheritage may have aesthetic values; economic values; functional values (such as soils and ecosystem functions) and research and education values (Gray 2004). Geoheritage, such as the Blue Mountains and Morton National Parks landscapes of NSW helps underpin a vibrant tourism industry. The special role geoheritage plays for the tourism industry has been recognised through the Australian Government's *National Landscapes Program*.

Geoheritage also plays a critical role for the education and training of our future geologists and there are just a few very special Australian training sites where advanced students are taken (Table 1). These outstanding educational sites could potentially be recognised as geoheritage sites with the concurrence of landowners and other stakeholders such as the mining industry. The recognition of parts (or all) of geological educational destinations as geoheritage could ensure the long term protection of the educational values of these sites. An expert working group involving teaching institutions, key stakeholders and the mining industry should further develop this approach to achieve formalised Australian geological teaching destinations. It is a way of celebrating geoheritage through an investment in the training of our future geologists.

Australia's geoheritage should be celebrated in many other ways, and storytelling is one of these. Geoheritage sites can all tell a story, either in their own right, or as part of an immediate larger story. They are a record of the past and clever and inspirational story tellers can bring to life the drama of past events that have helped to shape our continent and our planet as we know it today. Celebrating our geoheritage is about telling these stories and presenting them to audiences from the young to the mature and from lay

people to students of geology and beyond. It is what geoheritage is about. It is what a National Geoheritage List for Australia should inspire...an excitement about the past and a thirst for greater knowledge about our country.

Table 1: Australian Geological Education Sites

Tertiary institution	Geological education location	Geological education values
Australian Capital Territory		
Australian National University	Mount Isa	<ul style="list-style-type: none"> High grade metamorphic and tectonics Mineralisation
New South Wales		
University of Sydney	Broken Hill	<ul style="list-style-type: none"> High grade metamorphics Mineralisation and the mine
University of NSW	Broken Hill	<ul style="list-style-type: none"> See Broken Hill above
Queensland		
University of Queensland	Mount Isa	<ul style="list-style-type: none"> See Mt Isa above
James Cook University	Mount Isa	<ul style="list-style-type: none"> See Mt Isa above
South Australia		
The University of Adelaide	Arkaroola	<ul style="list-style-type: none"> Epithermal deposits Uranium mineralisation and brecciation Radiogenic heat affected rocks; Iron rich formations Cap carbonates, Arkaroola Reef and ancient life Sturtian Tillites; base Adelaidean sequences Mesoproterozoic granitic rocks Mesoproterozoic metamorphic rocks
	Flinders Ranges Regional	<ul style="list-style-type: none"> Ediacaran and Cambrian Fossils Neoproterozoic Earth History (climate, ocean chemistry, meteorite impact site)
	Alice Springs	<ul style="list-style-type: none"> Tectonics and high-grade metamorphics
	Kangaroo Island	<ul style="list-style-type: none"> Emu Bay Cambrian fossils, megafauna and geomorphology of Flinders Chase National Park
Tasmania		
The University of Tasmania	Western Tasmania	<ul style="list-style-type: none"> High grade metamorphic rocks
Victoria		
Ballarat University	Arkaroola	<ul style="list-style-type: none"> See Arkaroola above
The University of Melbourne	Arkaroola	<ul style="list-style-type: none"> See Arkaroola above
	Broken Hill	<ul style="list-style-type: none"> See Broken Hill above
	Walkerville	<ul style="list-style-type: none"> Cambrian greenstones, submarine volcanics, limestone and tightly folded Ordovician sediments
	Mansfield	<ul style="list-style-type: none"> Student mapping site, Devonian sediments
	Otway Coast	<ul style="list-style-type: none"> Tertiary and Cretaceous sedimentary sequences
Monash University	Arkaroola	<ul style="list-style-type: none"> See Arkaroola above
Western Australia		
The University of Western Australia	Kalgoorlie	<ul style="list-style-type: none"> Precambrian granitic and greenstone rocks and high grade metamorphism; nickel mining site
Curtin University of Technology	Kalgoorlie	<ul style="list-style-type: none"> As above

Professor Brad Pillans and the Geological Society of Australia's proposed "*Rock Garden*" for Canberra will help communicate this heritage through many remarkable "grand rocks" and their associated stories. Sir David Attenborough's 2010 BBC documentary *First Life* drew attention to the global importance of Australia's Ediacaran fossil record in the Flinders Ranges and the geomorphology of the Great Barrier Reef. Geologist Richard Smith's 2012 television series *Australia: the Time Traveller's Guide* and Dr Iain Stewart's 2012 BBC *How to Grow a Planet* series are excellent examples of celebrating Earth's geoheritage. Geoscience Australia's Dr Richard Blewett's outstanding new book (to be launched in August 2012) on how Australia's geological diversity has helped to shape our nation and our people is yet another means of celebration and presenting many rich geoheritage stories.

The best communicators in Australia should be involved in providing these inspirational messages for all Australians using many different mediums. Australia's National Geoheritage List should be a "living" document that is constantly shared with the community in multiple innovative and compelling ways. Some examples of the many important Australian geoheritage story themes include:

- From the Pilbara (WA), a story at the very beginning of Earth with the finding of the oldest minerals (zircons) for the world, and the oldest continuously exposed continental crust for our planet.
- Evidence at the Pilbara of the earliest microbial micro-fossils and stromatolites reefs, with the 3.5 billion year old rocks juxtaposed against the World Heritage listed Hamblin Pool with its living stromatolites.
- The concept of a "snowball" Earth and some of best evidence of massive glaciation near Earth's equator with the Sturtian and Marinoan Tillites of the Flinders Ranges (SA);
- The pre-Ediacaran emergence of animal life on Earth, the oldest limestone reefs known and the depositional "book" of continuous strata that the Adelaide Geosyncline provides to help unravel this story of the emergence of life.
- The combined Ediacaran and Cambrian fossil deposits (SA) as the finest record of the rise of animals on Earth;
- The existence of a geyser field with boiling pools, sinter deposits in an environment surrounded by high mountains and glaciers at Arkaroola (SA);
- The story of dinosaurs in Australia.
- The Yea flora fossil site in Victoria, the earliest record of vascular land plants in Australia.
- The fossil "time capsules" of early marsupial and late megafauna fossil deposits from sites Australia wide including Riversleigh (Queensland), and the Naracoorte and Nullabor Caves. (SA) A sharing of geological events with the everyday lives of Indigenous peoples such as mountain glaciation, mobile sand dunes in central Australia, sea level rise, meteorite impacts and volcanic eruptions and the telling of these events through dreamtime stories.

There are multiple stories and a future National Geoheritage List should provide the basis for these.

CONSERVING AUSTRALIA'S GEOHERITAGE: A SUMMARY

The conservation of Australia's geoheritage, an often non-renewable resource and part of our national heritage, *should* be improved through new collaborative whole-of-Australia partnerships, new research investments, the generation of new information, the generation of a National Geoheritage List and the implementation of improved training, site protection and active conservation management guided by a National Geoheritage Conservation Strategy. These improvements include:

For gaps in geodiversity information

1. The mapping of Australia's geomorphology/landforms.
2. The development of a taxonomically correct and peer reviewed Australian minerals species list and potentially a "virtual" e-National minerals collection.
3. The development of a taxonomically correct and peer reviewed Australian fossils species list and potentially a "virtual" e-National fossil collection.

A national list of Australia's geoheritage

4. The development of Australia's first peer reviewed National Geoheritage List.
5. A national geoheritage list that identifies the level of significance, vulnerability, condition and trend in condition of the phenomenon.

The protection of geoheritage sites

6. The enhanced protection for geoheritage sites by legal and other means (where there is no current protection).

The improved management of geoheritage sites

7. The development of a National Geoheritage Conservation Strategy.
8. New geoheritage conservation management training is introduced to one or more Australian universities for geologists and other specialists.

Community appreciation and the celebration of geoheritage

9. The celebration of Australia's geoheritage through remarkable stories told by exceptional communicators through the best mediums for all Australians.

CONCLUSION

Australia's geoheritage is part of our national heritage and part of what makes our country special. It needs to be officially recognised, listed, adequately protected and effectively managed and it needs to be celebrated as an integral part of the richness of being Australian.

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