Global distribution of Cave and Karst World Heritage Properties - a Review

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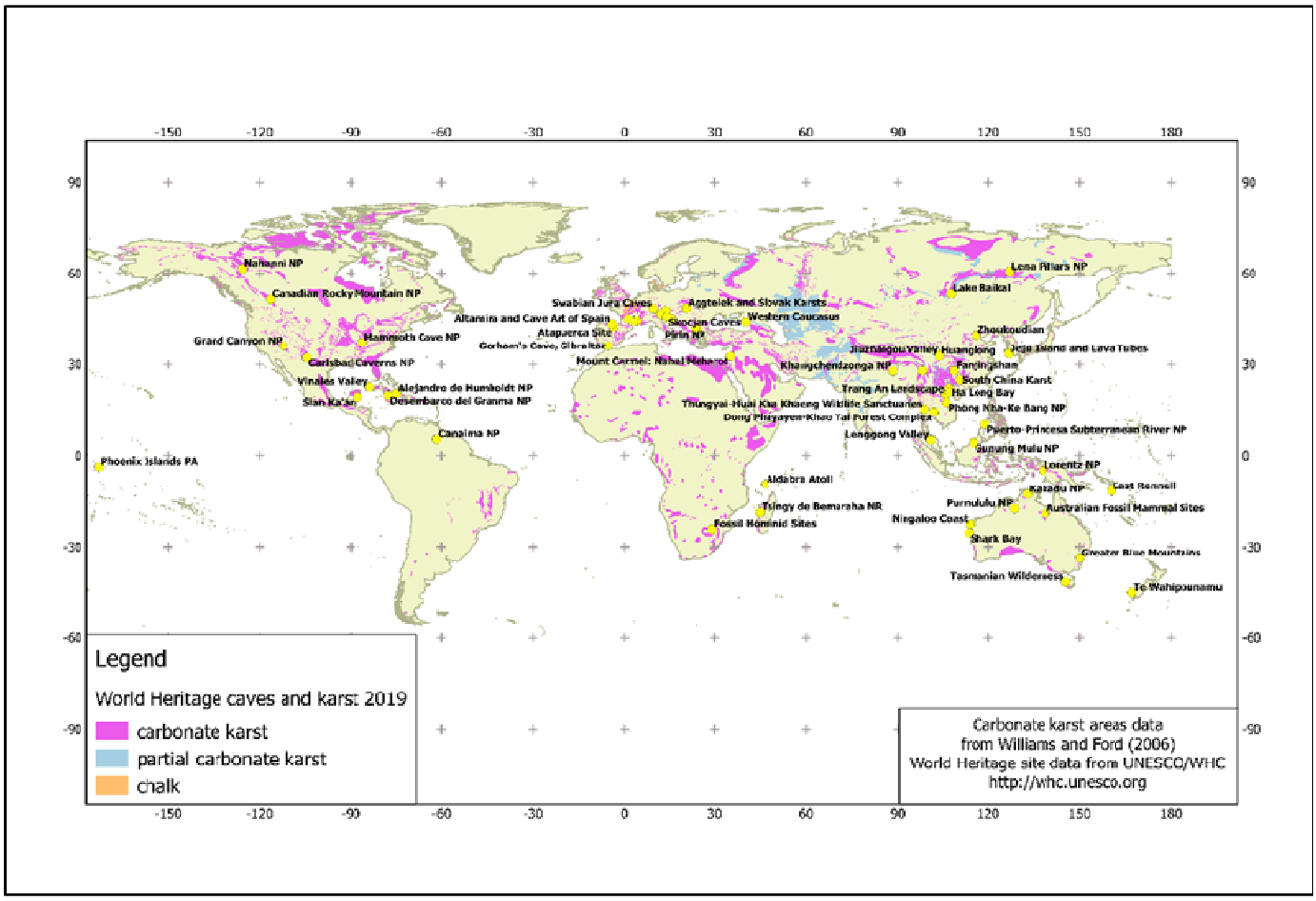
Introduction

Back in 2008, Professor Paul Williams, an ACKMA member from New Zealand, was commissioned by the International Union for the Conservation of Nature (IUCN) to review the status of World Heritage cave and karst properties (Williams, 2008). This excellent report is freely available from IUCN and should be on the reading list for anyone interested in subterranean heritage. At the time, the World Heritage Committee of the United Nations Educational, Scientific and Cultural Organisation (UNESCO), whose task is to decide which nominated properties or sites will be inscribed on the World Heritage List, indicated that there were probably enough cave and karst properties already listed. Any future nominations would have to fill real gaps in the global coverage of the "best of the best" subterranean heritage.

I have been privileged to assess a number of World Heritage nominations for IUCN over the last twenty years, with properties located in Vietnam (2), Malaysia, Indonesia, Philippines, China (2), Argentina, France (3), Switzerland, the Slovak Republic and Turkey. In this article, I take a look at the geographical spread of the existing cave and karst World Heritage properties; the criteria that are used to list them; then consider the sites on the tentative cave and karst World Heritage List; and also review some current developments in World Heritage management.

Existing World Heritage cave and karst sites

As of August 2019, there are a total of 1,121 World Heritage sites. Of these sites, 869 are cultural, 213 are natural and 39 are mixed properties. The list is available at http://whc.unesco.org/en/list/. Table 1 provides a list of the current World Heritage cave and karst properties (59 sites). The List dates from 1978 to August 2019. It includes natural, cultural and mixed cave and karst properties. It should be noted that an individual site may contain karst and caves, but that heritage may not have been the reason for its inscription on the World Heritage List. For example, the Lorentz National Park in West Papua contains significant alpine and subalpine karst around Mount Jaya (Carstenz Pyramid), but was inscribed on the List for its outstanding biodiversity and intact primary rainforests.



Distribution of cave and karst World Heritage properties in 2019

Table 1: Existing Cave and Karst World Heritage Properties 2019. Source: UNESCO World Heritage

Name	Date inscribed	Category	State Party
Nahanni National Park	1978	Natural	Canada
Plitvice Lakes National Park	1979	Natural	Croatia
Prehistoric Properties and Decorated Caves of the Vézère Valley	1979	Cultural	France
Grand Canyon National Park	1979	Natural	United States of America
Kakadu National Park	1981	Mixed	Australia
Mammoth Cave National Park	1981	Natural	United States of America
Tasmanian Wilderness	1982	Mixed	Australia
Aldabra Atoll	1982	Natural	Seychelles
Pirin National Park	1983	Natural	Bulgaria
Canadian Rocky Mountain Parks	1984	Natural	Canada
Cave of Altamira and Paleolithic Cave Art of Northern Spain	1985	Cultural	Spain
Škocjan Caves	1986	Natural	Slovenia
Peking Man Properties at Zhoukoudian	1987	Cultural	China
Sian Ka'an	1987	Natural	Mexico
Tsingy de Bemaraha Strict Nature Reserve	1990	Natural	Madagascar
Te Wahipounamu - South West New Zealand	1990	Natural	New Zealand
Shark Bay, Western Australia	1991	Natural	Australia
Thungyai-Huai Kha Khaeng Wildlife Sanctuaries	1991	Natural	Thailand
Jiuzhaigou Valley Scenic and Historic Interest Area	1992	Natural	China
Huanglong Scenic and Historic Interest Area	1992	Natural	China
Australian Fossil Mammal Properties (Riversleigh/Naracoorte)	1994	Natural	Australia
Canaima National Park	1994	Natural	Venezuela
Ha Long Bay	1994	Natural	Viet Nam
Caves of Aggtelek Karst and Slovak Karst	1995	Natural	Hungary, Slovakia
Carlsbad Caverns National Park	1995	Natural	United States of America
Lake Baikal	1996	Natural	Russian Federation
Hallstatt-Dachstein/Salzkammergut Cultural Landscape	1997	Cultural	Austria
East Rennell	1998	Natural	Solomon Islands
Desembarco del Granma National Park	1999	Natural	Cuba
Viñales Valley	1999	Cultural	Cuba
Lorentz National Park	1999	Natural	Indonesia
Puerto-Princesa Subterranean River National Park	1999	Natural	Philippines
Western Caucasus	1999	Natural	Russian Federation
Fossil Hominid Propertiess of South Africa	1999	Cultural	South Africa
Greater Blue Mountains Area	2000	Natural	Australia
Gunung Mulu National Park	2000	Natural	Malaysia
Archaeological Properties of Atapuerca	2000	Cultural	Spain
Alejandro de Humboldt National Park	2001	Natural	Cuba
Purnululu National Park	2003	Natural	Australia
Three Parallel Rivers of Yunnan Protected Areas	2003	Natural	China

Phong Nha-Ke Bang National Park	2003	Natural	Viet Nam
Dong Phayayen-Khao Yai Forest Complex	2005	Natural	Thailand
South China Karst	2007	Natural	China
Jeju Volcanic Island and Lava Tubes	2007	Natural	Republic of Korea
The Dolomites	2009	Natural	Italy
Phoenix Islands Protected Area	2010	Natural	Kiribati
Ningaloo Coast	2011	Natural	Australia
The Causses and the Cévennes	2011	Cultural	France
Propertiess of Human Evolution at Mount Carmel: The Nahal Me'arot/Wadi el-Mughara Caves	2012	Cultural	Israel
Archaeological Heritage of the Lenggong Valley	2012	Cultural	Malaysia
Lena Pillars Nature Park	2012	Natural	Russian Federation
Decorated Cave of Pont d'Arc, known as Grotte Chauvet-Pont d'Arc, Ardèche	2014	Cultural	France
Trang An Landscape Complex	2014	Mixed	Viet Nam
Zuojiang Huashan Rock Art Cultural Landscape	2016	Cultural	China
Gorham's Cave Complex	2016	Cultural	Gibraltar, United Kingdom
Khangchendzonga National Park	2016	Mixed	India
Caves and Ice Age Art in the Swabian Jura	2017	Cultural	Germany
Fanjingshan range, Guizhou Province	2018	Natural	China

An individual site must have Outstanding Universal Values (OUV) for inscription on the World Heritage List. The State Party (the national government) must provide a detailed justification for listing in terms of the OUV criteria.

The cultural values in the OUV criteria are:

i) to represent a masterpiece of human creative genius;
ii) …
iii) to bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;
iv) …
v) to be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;
vi) to be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance.

Expert advice on nominations citing cultural values is provided by the International Council on Monuments and Sites (ICOMOS), based in Paris.

The Prehistoric Sites and Decorated Caves of the Vézère Valley in France were inscribed in 1979 under cultural criteria (i) and (iii). The extensive art in the limestone caves dates back at least 24,000 years and testifies to the high level of skill shown by the artists who depicted the bison, mammoths and ibex that they hunted. The use of natural pigments, perspective and the clever use of the cave wall topography combine to provide masterpieces of art in which the animals appear almost to move - especially by a flickering light.

Left: Limestone cliffs near Font de Gaume cave in the Vézère valley

Right: Mammoth painting in Grotte de Bernifal, approximately 24,000 years old

For natural values, the OUV criteria are:

(vii) to contain *superlative natural phenomena* or areas of exceptional natural beauty and aesthetic importance;

(viii) to be outstanding examples representing *major stages of earth's history*, including the record of life, significant on-going geological processes in the development of landforms, *or significant geomorphic or physiographic features*;

(ix) to be outstanding examples representing *significant on-going ecological and biological processes* in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;

(x) to contain the *most important and significant natural habitats* for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

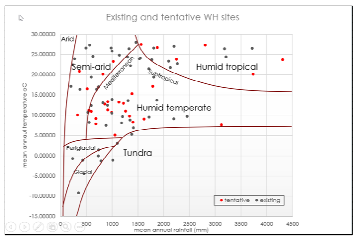
Expert advice on nominations citing natural values is provided by the IUCN, based in Gland, Switzerland.

The caves and karst of Gunung Mulu National Park, Sarawak were inscribed, in 2000, under natural criteria (vii), (viii), (ix) and (x). This is exceptional and testifies to the landscape integrity, outstanding caves and karst and rich biodiversity thriving in pristine rainforest environments.

Hidden Valley in Gunung Mulu National Park. This overlies Clearwater Cave

Looking towards the entrance of Deer Cave, Gunung Mulu National Park

There are some notable gaps in the representation of karst regions and cave sites in the existing list of World Heritage properties. There are a number of reasons this might be so. First, we would expect that the distribution of potential sites will be constrained by the area of outcrop of karstic rocks (in the broadest sense). Second, the prevailing climate in an area of karstic rocks may inhibit the formation of karst and caves. For example, we would not expect extensive karst in Arctic Canada, despite the large area of limestone there. However, a recent expedition to Greenland has discovered significant ancient caves relating to a Tertiary wetter climate (http://northeastgreenlandcavesproject.com/2019-expedition-to-northeast-greenland/). Third, some countries lack capacity to develop World Heritage nominations and management plans, despite the fact that World Heritage status is an important, widely respected and marketable brand for international tourism.

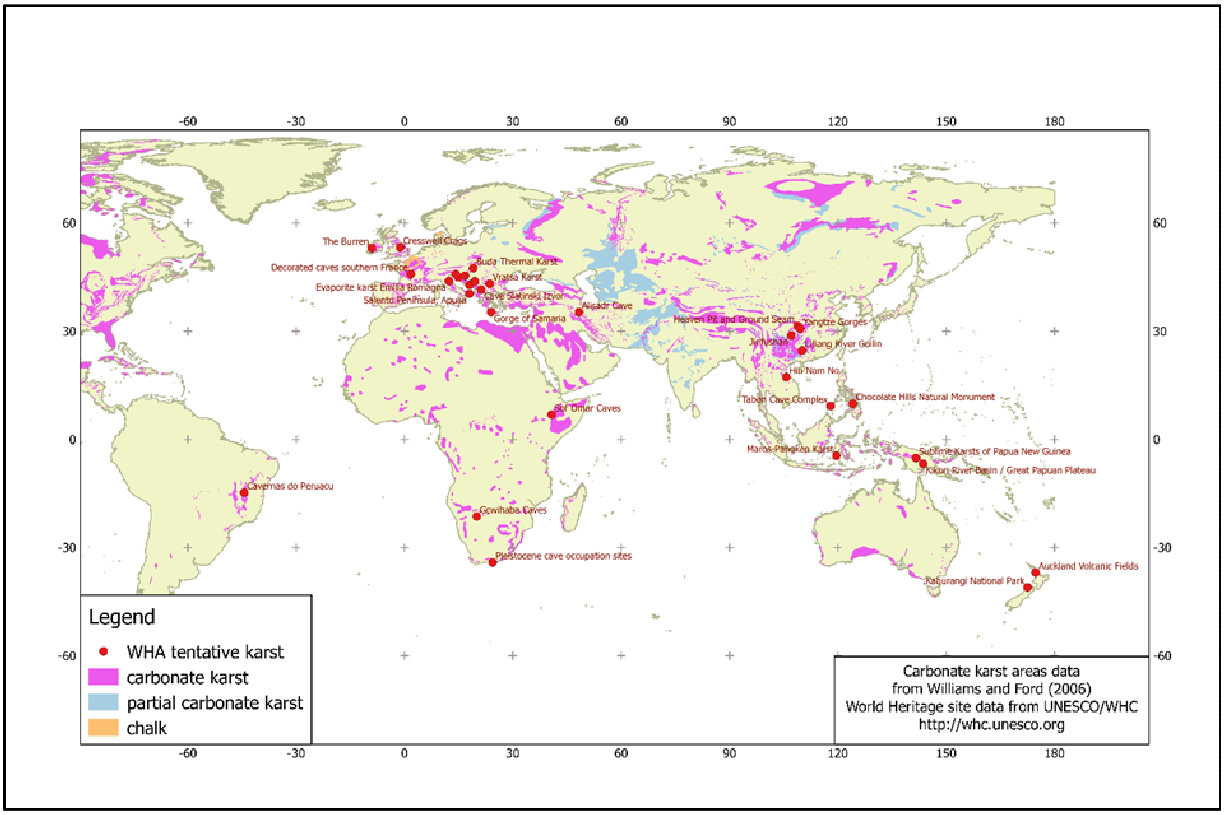


Distribution of existing and tentative World Heritage properties in relation to broad climatic zones

There are relatively few World Heritage karst sites in the southern hemisphere, particularly in South America, Africa, Australasia, and the South Pacific. There are also few sites in Eurasia and the Middle East, despite extensive areas of carbonate rocks. There are very few sites in the Russian Federation, despite large areas of karst. In terms of broad climatic zones, karst World Heritage properties are poorly represented in arid and semi-arid, tundra, glacial and periglacial environments. There are many World Heritage properties in humid-temperate and humid-tropical regions. These include iconic sites such as the huge caves of Vietnam and Sarawak, important art and fossil sites in Europe and Asia, and important wild karst lands in Tasmania, China and Canada. It would be hard to justify new nominations from these areas, as the caves and karst are well-represented. However, the nomination process is essentially a political one and, in recent years, the World Heritage Committee has chosen to disregard the expert advice provided to it by IUCN and ICOMOS.

Tentative World Heritage cave and karst properties

In addition to properties already inscribed on the World Heritage List, there are also 33 properties on the Tentative List which have significant karst values. Some of these have been on the Tentative List since the early 1990s, reflecting the lack of capacity or willingness of the relevant country to produce a nomination. For example, huge areas of karst occur in the Middle East, but are not included in nominations because the State Parties there have focused entirely on cultural sites; in Jamaica, the well-known Cockpit Country karst deserves a nomination but this is not a priority for that government. Tentative List properties can be seen on the World Heritage Centre website http://whc.unesco.org/en/tentativelists/



Tentative World Heritage cave and karst properties 2019

Table 2: Tentative Cave and Karst World Heritage properties 2019. Source: UNESCO World Heritage Unit

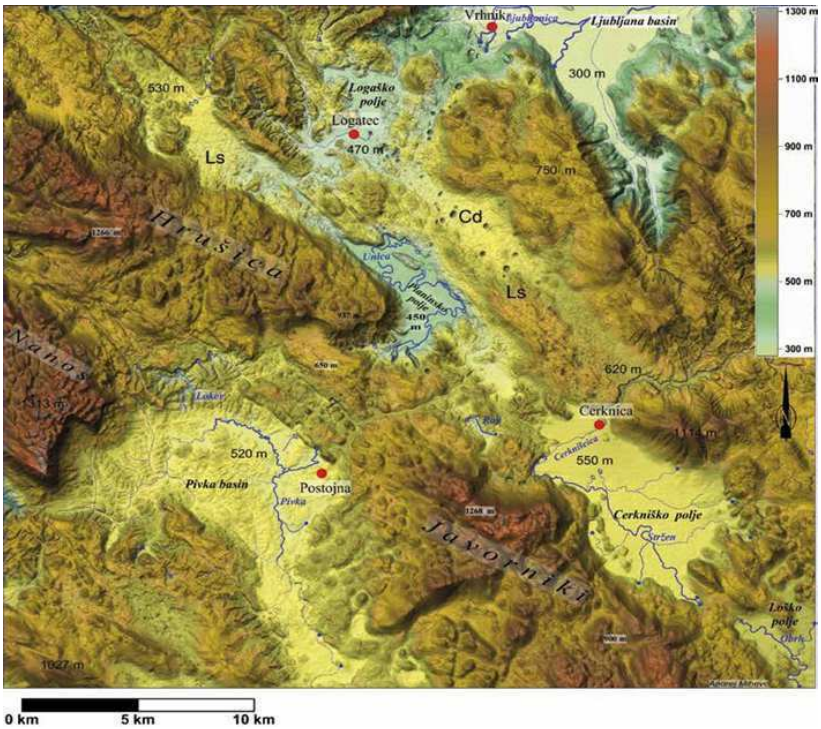
Name	Date first proposed	Category	State Party
Buda Thermal Karst	1993	Mixed	Hungary
Caves of the Buda Thermal Karst	1993	Natural	Hungary
Lijiang River Guilin	1996	Natural	China
Cavernas do Peruacu	1998	Mixed	Brazil
Decorated caves of southern France	2000	Natural	France
Heaven Pit and Ground Seam	2001	Natural	China
Jinfushan	2001	Mixed	China
Yangtze Gorges	2001	Mixed	China
Tara National Park	2002	Natural	Serbia
Cave Slatinski Izvor	2004	Natural	North Macedonia
Vjetrenica cave	2004	Natural	Bosnia and Herzegovina
Lonjsko Polje	2005	Mixed	Croatia
Velebit Mountain	2005	Natural	Croatia
Chocolate Hills Natural Monument	2006	Natural	Philippines
Kikori River Basin/Great Papuan Plateau	2006	Mixed	Papua New Guinea

Salento peninsula, Apulia	2006	Cultural	Italy
Sublime Karsts of Papua New Guinea	2006	Natural	Papua New Guinea
Tabon Cave Complex	2006	Cultural	Philippines
Alisadr Cave	2007	Natural	Iran
Auckland Volcanic Fields	2007	Mixed	New Zealand
Kahurangi National Park and Canaan karst	2007	Natural	New Zealand
Maros-Pangkep Karst	2009	Mixed	Indonesia
Gcwihaba Caves	2010	Natural	Botswana
The Burren	2010	Mixed	Ireland
Sof Omar Caves	2011	Mixed	Ethiopia
Vratsa Karst	2011	Natural	Bulgaria
Cresswell Crags	2012	Cultural	United Kingdom
Gorge of Samaria, Crete	2014	Natural	Greece
Classical Karst	2015	Mixed	Slovenia
Pleistocene cave occupation sites	2015	Cultural	South Africa
Hin Nam No National Park	2016	Natural	Laos
Evaporite karst and caves, Emilia Romagna	2018	Natural	Italy

While limestone areas are well represented on the existing World Heritage List, evaporite karst is not represented at all. The inclusion of the important evaporite karst of Emilia Romagna in Italy is a good addition to the Tentative List. It would be good if the long gypsum cave, Optimistychna (214 kilometres) in Ukraine, with a well-developed landscape of doline karst, could be added to the Tentative List. Similarly, there are no nominations for halite karst, though splendid examples exist in Israel and Iran; the latter having salt glaciers and domes as well as well-developed caves. There are some outstanding karstic landscapes developed in quartzites or quartz sandstones already on the World Heritage List. These include Purnululu (Australia), Wulingyuan (China), Meteora (Greece), and Canaima (Venezuela). Sandstone landscapes with ruiniform relief, canyons and deep joint corridors are represented in Kakadu and other parts of Arnhem Land, as well as Danxia in China (Wray, 1997).

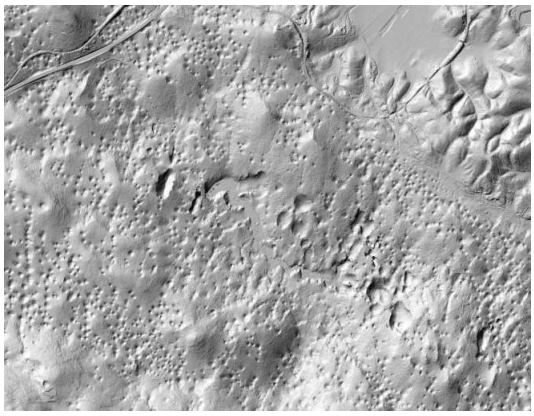
In 2019, the following cave and karst nominations are under review:

- Classical Karst, Slovenia: Surprisingly the large region from which karst takes its name has very limited representation on the World Heritage List. There are only three small sites: Plitvice Lakes (Croatia), Durmitor National Park (Montenegro), and Škocjanske jama (Slovenia). The Plitvice Lakes were on the World Heritage in Danger list due to bombing damage. The Slovenian karst is developed on limestone and dolomite and covers 8800 square kilometres or about 45% of the country.

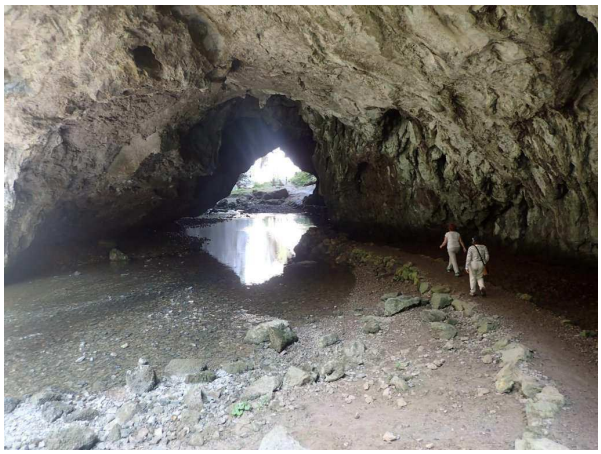


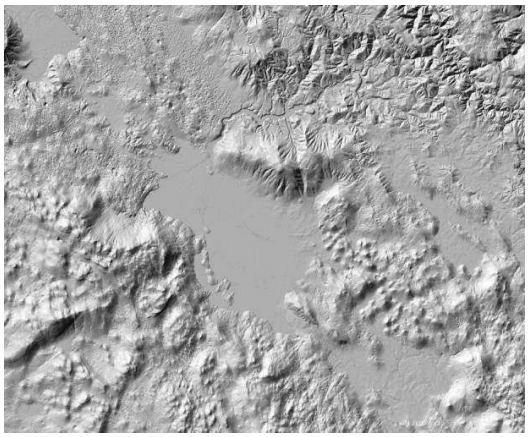
The classical karst area being nominated for World Heritage listing. Drainage from the Pivka basin flows though the Postojnska jama to the Planinsko polje, emerging at Planina jama. The Cerkniško polje is part of a large drainage system that floods seasonally. From Mihevc et al., 2016.

The karst consists of structural plateaux and large flat floored valleys (poljes) with extensive underground drainage, thousands of dolines and many caves. A World Heritage nomination currently under review covers some iconic features of the Classical Karst, namely the Postojnska jama, the Rakov Skocjan caves and karst, Cerkniško polje and the Pivka lakes basin. This core area of 83,800 hectares includes forested mountains as well as the type examples of poljes and their underground drainage. The Pivka river flows across the basin on flysch rocks, which is a drained polje. It sinks into the 20 kilometres long Postojnska jama. The Postojnska jama has been a show cave since the early nineteenth century and currently receives about 800,000 visitors each year. The underground river from Postojnska jama reappears after 2.5 kilometres in the 8.5 kilometres long Planinska jama on the edge of the Planinsko polje. The largest polje, Cerkniško, covers an area of 3,800 hectares and its floor is cultivated seasonally. The polje is flooded to a depth of several metres in winter. The Rakov Skocjan area contains several natural bridges and stream caves which drain into Planinsko polje. The proposed area also includes a buffer zone to help maintain the integrity of the karst drainage, which feeds northwest to the Ljubljanica springs and river.

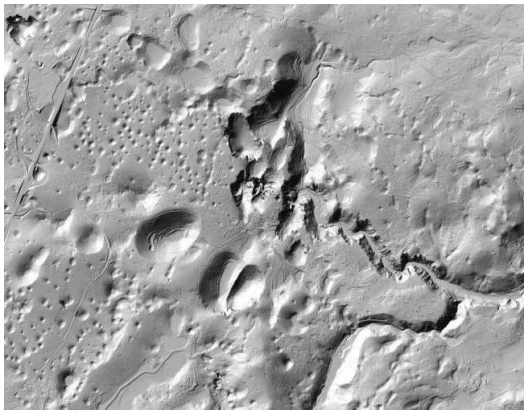


Rakov Skojcan caves





Cerknisko polje



Škocjanske jame

The images on the previous page were LIDAR images and views of selected sites in the Classical Karst. LIDAR Source: Survey and Mapping Authority of the Republic of Slovenia (http://gis.arso.gov.si/evode/profile.aspx?id=atlas_voda_Lidar@Arso&culture=en-US)

- Sof Omar Caves, Ethiopia: Sof Omar is the longest cave in Ethiopia at 15 kilometres. It is located in the Bale National Park and the cave takes the entire drainage of the Web River. The cave floods to the roof seasonally and is notable for its phreatic features including pendants, spongework and flutings. A Sheikh Sof Omar Ahmed took refuge here in the 11th Century and local Muslims make a pilgrimage to the cave each November.

In 2021 the following tentative nominations are due to be assessed by the World Heritage Committee:

- Auckland Volcanic Fields, New Zealand
- Cat Ba Archipelago (extension) to Ha Long Bay, Vietnam
- Dinosaurs and Caves of Koytendag, Turkmenistan
- Pleistocene Occupation Sites: Emergence of Modern Humans, South Africa

In Australia, there has been recent activity in new World Heritage nominations after a long period of inactivity. The successful 2019 nomination of the serial site, Budj Bim Cultural Landscape in western Victoria, sets a useful precedent for the incorporation of Indigenous heritage in Australian World Heritage properties. The Commonwealth government insists that any future World Heritage nominations must first be nominated and inscribed on the National Heritage List. This is a complex process and subject to a great deal of delay, especially where there is perceived conflict with mining interests.

There is now growing support for the nomination of the South Australian part of the Nullarbor Plain as World Heritage. This would most likely be as a mixed serial site, incorporating both natural and cultural values of a number of key locations across the arid karst. Steps have already been taken to have sites placed on the National Heritage List, although Koonalda Cave is already on the List. Natural values would include the largest arid karst area in the world (filling a gap in global coverage), spectacular caves with saline lakes, very well-preserved marsupial bone deposits and speleothems yielding long environmental histories back to at least the Pliocene. Cultural values include ice-age flint quarries and parietal art, ancient songlines and sacred sites as well as a long-established association with country for the Mirning people. It will be absolutely critical to gain active Indigenous involvement in any nomination process, while State and Commonwealth support is also critical. It is to be hoped that the Heritage Section of the Department of Environment and Energy will have learnt from earlier efforts to develop a World Heritage nomination for Cape York, which foundered due to a lack of meaningful dialogue with, and involvement of, the traditional owners.

Management of World Heritage sites

The management of World Heritage properties is subject to the World Heritage Operational Guidelines, last revised in 2017. Protection and management of World Heritage properties should ensure that the OUV, integrity and/or authenticity are maintained or preferably enhanced in the future. Increasingly, the effective management of the nominated site is a very important consideration for the World Heritage Committee. There have been several cases where a nomination was sent back to the State Party for substantial improvement to the management regime before the site would be considered again (France, Turkey, Vietnam).

Other factors relevant to ongoing management

The Criterion of Integrity is described in the Operational Guidelines as "a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes". For this, we need to assess if the site:

- includes all the elements necessary to express its OUV. In some cases, this may mean that the proposed World Heritage boundary extends beyond individual protected areas and thus nomination and ongoing management may involve several jurisdictions and land tenure types.
- is of adequate size to ensure the complete representation of the features and processes which convey the site's significance. In most cases this will also involve the creation of a buffer zone around the World Heritage area to minimise off-properties impacts.
- suffers from adverse effects of development and/or neglect.

Since 1979 all World Heritage properties have a State of Conservation Report which is repeated every six years (ideally) and identifies both good management condition and threats to the integrity of the properties. A total of 3,793 reports have now been completed on 574 World Heritage properties. In recent years, some 53 properties have been declared "World Heritage in Danger" due to ongoing threats. In most cases, these properties are located in areas of conflict, resource extraction or rapid urbanisation. In extreme cases, a site may be taken off the World Heritage List. This would be a source of great shame for any government responsible for that World Heritage site. For example, the Manas Wildlife Sanctuary in the foothills of the Assam Himalaya, India was declared World Heritage in Danger in 1992 due to the effects of encroachment, forest-clearing and poaching. Substantial changes in the management regime and development of a cross-boundary agreement with Bhutan have led to the site being reinstated on the World Heritage list in 2011.

The Ha Long Bay WHA in Vietnam may be a candidate for World Heritage in Danger, due to marine pollution and overcrowding

Increasingly, the Involvement of Indigenous Peoples in World Heritage management is a priority. Since 2005, the Operational Guidelines have promoted a "partnership approach to nomination, management and monitoring", as stated in paragraph 40. This was last revised and expanded in 2017, and the active involvement of Indigenous peoples in World Heritage management is seen as essential and leading to best practice management. In 2015, the Word Heritage Committee established an International Indigenous Peoples Forum on World Heritage. This forum's aim is to elevate the role of Indigenous communities in the "identification, conservation and management of World Heritage properties" and is held every year coinciding with the World Heritage Committee meeting. In 2018, UNESCO endorsed its Policy on Engaging with Indigenous Peoples 201EX/6. This important document includes the role of indigenous peoples in the conservation of natural and cultural heritage, and applies to all activities supported by UNESCO - not just World Heritage. Management planning should also take account of traditional or local governance systems used by Indigenous peoples. There may be existing land title under customary law which has persisted for centuries. This may not be formally recognised, or even desired, by the national government, but there is still an obligation to manage with this clearly in mind.

Further Reading:

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