

WORLD HERITAGE NOMINATION - IUCN SUMMARY

AUSTRALIAN FOSSIL SITES

Summary prepared by IUCN/WCMC (March 1994) based on the original documentation submitted by the Government of Australia. This original and all documents presented in support of this nomination will be available for consultation at the meetings of the bureau and the committee.

1. LOCATION

The three sites of Riversleigh, Murgon and Naracoorte are widely scattered across eastern and southern Australia, in the states of South Australia and Queensland, respectively. Over 2000 km. separate Riversleigh in the north from Naracoorte in the south.

2. JURIDICAL DATA

Murgon is at present under private ownership but will be protected as a nature refuge under the provisions of the Nature Conservation Act 1992. Riversleigh, owned by the State of Queensland, was gazetted as part of the Lawn Hill National Park 1992, and will be declared a national park under the Nature Conservation Act 1992. Naracoorte, owned by the State of South Australia, was gazetted as Naracoorte Caves in 1917, and is currently protected under the provisions of the South Australia National Parks and Wildlife Act 1972.

3. IDENTIFICATION

The Murgon site (1 ha.) is situated in a small drainage gully. The site includes the Main Quarry on the south face of the hill which continues to produce all mammal specimens. The age estimates of the sediments have ranged from Miocene to early Tertiary (54.6 ± 0.5 my). Murgon has produced the first evidence that terrestrial placental mammals were in Australia during the early Tertiary. This challenges the notion that Australia's marsupial-dominated modern biota occurs because ancestral Australian marsupials were not subjected to competition from early placental.

The Tertiary fossil fields of Riversleigh (10,000 ha.) are confined to the watershed of the Gregory River. Riversleigh's faunal assemblages have profoundly altered understanding about Australia's mid-Cainozoic vertebrate diversity. A 15 million-year-old monotreme has provided new information about this highly distinctive group of mammals and several Tertiary thylacines have been identified. Placental mammals are represented by more than 35 bat species, and the Riversleigh fossil bat record is considered one of the richest in the world.

Naracoorte (300 ha.) is located in flat country, punctuated by a series of stranded coastal dune ridges that run parallel to the present coastline. The most significant fossil accumulation is found in the Victoria Fossil Cave. Specimens representing 93 vertebrate species have been recovered, ranging in size from very small frogs to buffalo-sized marsupials. These include superbly preserved examples of the Australian Ice-Age megafauna, as well as a host of modern species such as the Tasmanian Devil, thylacine and others.

The three sites represent distinct paleohabitats. At Murgon, the current interpretation is a shallow, low-energy aquatic environment such as a swamp or lake, populated by crocodiles and turtles. Riversleigh's late Oligocene to early and middle Miocene assemblages have been interpreted

primarily as rainforest communities. Knowledge of the preferred habitats of the extant species present in the Victoria Fossil Cave fauna suggests a dry sclerophyll forest and savannah woodland.

4. STATE OF PRESERVATION

Grazing at Murgon has been excluded from the quarry area. There has been little or no use of the site other than by the present landholders and scientists involved in palaeontological research. The conservation agreement for the nominated site will include terms that permit the private landholder to carry out all activities normally associated with management of the surrounding land consistent with the protection of the fossil deposit. Naracoorte's fossil caves have been partially modified for visitor access and some guano mining was conducted in the years before it became a park in 1972. Access to the main ossuaries is carefully controlled and they remain in an undisturbed condition.

The Riversleigh site is contained within the Riversleigh Management Unit of the Lawn Hill National Park. Due to the rugged limestone terrain, activity is restricted to grazing, palaeontological research and education. Until recently, the Riversleigh was a grazing property. In 1992 the nominated site was acquired for National Park purposes with arrangements for cattle grazing to continue under permit for a period of seven years.

The only significant impact on the natural condition of the nominated sites is the collection of fossil-bearing rocks by palaeontological researchers. Explosives may be used to extract limestone, although their impact is restricted to very small areas.

5. JUSTIFICATION FOR INCLUSION ON THE WORLD HERITAGE LIST

The Australian Fossil Sites nomination, as prepared by the Government of Australia, provides the following justification for designation as a World Heritage natural property:

- (i) **Outstanding examples representing major stages of Earth's evolutionary history** Murgon provides the only window on to the origins and early differentiation of the distinctive and endemic Australian fauna.

Riversleigh provides outstanding examples of middle to late Tertiary mammal assemblages, in a continent whose mammalian evolutionary history has been the most isolated and distinctive in the world.

Victoria Fossil Cave at Naracoorte preserves an outstanding record of terrestrial vertebrate life spanning the last 170,000 years.

- (ii) **Outstanding examples representing significant ongoing geological processes and biological evolution** Murgon provides outstanding examples of the evolution and development of Australia's terrestrial animals, providing fossils 40 million years in age.

Riversleigh is the richest Australian, and one of the world's richest, Oligo-Miocene mammal records, linking that period (15-25 million years) to the predominantly modern assemblages of the Pliocene and Pleistocene.

Victoria Fossil Cave illustrates faunal change spanning two ice ages, highlighting the impacts of both climatic change and man on Australia's mammals (18,000-17,000 bp).

Note: A detailed justification, running to fifteen pages, is provided in the original nomination, highlighting points of intercontinental (global) and intracontinental significance.

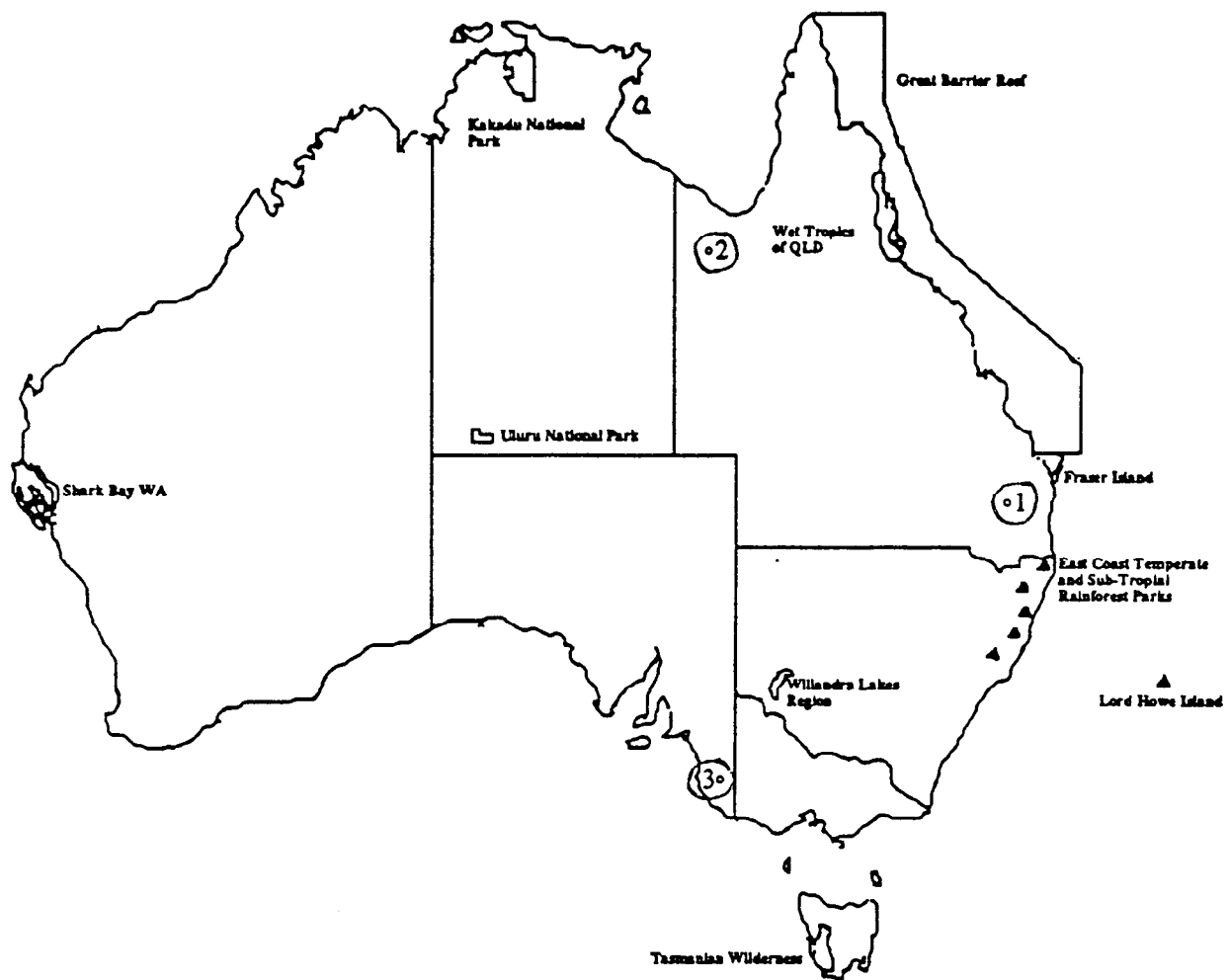


Figure 1: Australian Fossil Sites World Heritage Nomination, 1993

- 1 Murgon
- 2 Riversleigh
- 3 Naracoorte

(Des cartes détaillées sont disponibles dans la nomination)

WORLD HERITAGE NOMINATION - IUCN TECHNICAL EVALUATION

AUSTRALIAN FOSSIL SITES

1. DOCUMENTATION

- i) IUCN/WCMC Data Sheet (19 references)
- ii) Additional Literature Consulted: Cochrane R.M. and E.B. Joyce. 1986. Geological Features of National and International Significance in Australia; Westoby M. 1988. Comparing Australian Ecosystems to Those Elsewhere. Bioscience 38 (8); Gould S.J. 1993. The Book of Life; Flannery T. 1993. The Case of the Missing Meat Eaters. Natural History.6; State of Queensland. 1994. Riversleigh Management Unit. Draft Management Plan.
- iii) Consultations: 12 external reviewers, DESET, South Australian and Queensland park service officials, Flinders and NSW University specialists.
- iv) Field Visit: May 1994. J. Thorsell

2. COMPARISON WITH OTHER AREAS

All three of the individual sites which make up the nomination are included on the Global Indicative List of Geological sites as compiled by the World Heritage Geological Working Group. This list now totals 300 but does not provide any basis for their comparative value. Both Riversleigh and Naracoorte are included in Australia's own inventory of some 70 internationally significant geological sites compiled in 1986. The Murgon site is not on this list due to the fact that its significance has only recently been studied.

Sites with important fossil values on the World Heritage List include the Canadian Rocky Mountain Parks (which contain as one of their many features the famous Burgess Shales), the Dinosaur Provincial Park (with 60 species of Cretaceous dinosaurs) and the Grand Canyon National Park (where exposed horizontal strata display fossil remains over 2 billion years of geological time). It should be recalled that Dinosaur Park was nominated on the basis of two other natural criteria as well and that the Burgess Shales, certainly the most internationally significant of all North American sites, was subsumed as part of the Canadian Rockies site in 1990. Many other World Heritage sites contain notable fossils as one element of their total value but there is no site on the list for its fossil values alone.

This nomination is for fossil values alone but is unique in presenting a serial nomination of three sites which together span the age of mammals and thus provide a four-dimensional view of time. There is no other World Heritage List that has taken such a temporal view although there are other natural sites which are disjunct in space but considered as one. The nomination is thus a new approach to the recognition of earth's evolutionary history when the full story from one window of time is insufficient to tell the full story.

It is difficult to compare the mammal fossil record in Australia to anywhere else as Australia has been a separate continental island for 50 million years and much of its biota has a unique evolutionary history. Faunistically, Australia is the most distinctive continent in terms of Cainozoic

biota. There is simply no other location where such fossils are found (in contrast to widely distributed marine fossils, for example). In selecting sites in Australia that would make up the nomination there is no question that the three selected are the best available and stand above many other competitors (eg. the Etadunna Formation near Lake Eyre, Wellington caves, and many others). This is no guarantee, however, that others will not be found in future but for this point in time all three provide the most diverse and best preserved fossils of their type. The nomination document (page 50-53) provides a useful and convincing comparative discussion.

3. INTEGRITY

Both Riversleigh and Naracoorte Caves are protected under the relevant parks legislation of each State. Murgon is privately owned but pending nature refuge status is sufficient for protection of such a small site. While neither Murgon nor Riversleigh contain all the fossil-bearing deposits they do include the best representation. Riversleigh is in an area of very active mining exploration and although reduced from the optimal, its boundary delimitation is judged adequate. It is noted that the surficial boundaries of the Naracoorte park do not match those of its underground cave deposits. As the entrances to the caves, however, are protected, this is the critical factor.

Paleontology is an extractive science and the value of a site depends on removal of specimens to laboratories for study. Fossils as such are movable properties and the Committee may wish to note this in relation to paragraph 25 of the Operational Guidelines. The extent to which the resource is affected by excavation in Riversleigh is less than 1% and all specimens remain the property of the Queensland museum. Excavations in Naracoorte affect a higher proportion but most of the valuable deposits have not been disturbed. Murgon is an exposed quarry of less than 0.5 ha and the sampled area is less than .001%. Murgon, however, is not protected as yet by a fence and cattle wander through the site.

As a policy on the integrity of fossil sites IUCN would suggest that collections from any one site should be kept at one locality and not be too widely dispersed. This might be with a state or national museum or a research laboratory on site. Without such control one would only have a quarry and the scientific values lessened. This policy is essentially in effect for the sites in this nomination.

All three sites have management plans or are in the process of preparing them.

4. ADDITIONAL COMMENTS

- The number of geological sites around the world as registered in the International Union of Geological Sciences (IUGS), global database will soon number 2000 and will continue to grow. The World Heritage Geological Site Working Group has also compiled a list of some 300 sites that they felt were of international significance. Twenty five of these, including the three that make up this nomination, are found in the Australasian region.

All this suggests that there is a great number of potential geological sites that may eventually come forward for World Heritage Listing. The World Heritage Geological Working Group is considering another meeting in 1995 to further refine criteria and to more closely screen their provisional list. With the great number of such sites, a separate effort by the IUGS to give recognition to internationally important geological sites is being considered.

- When reviewed against the fossil evaluation checklist (see section 5 of the introduction) the three sites when taken together score high on all ten questions. When taken separately Riversleigh and Naracoorte would each rate a nine while Murgon would score high on six

but would be marginal for the others. This later finding confirms comments from a number of reviewers who felt that all three sites are not of equal importance with Murgon not yet having proved its world status as have the other two.

- The name given to this nomination is not reflective of the property and, if inscribed, will have to be more definitive.

5. EVALUATION

The Australian Fossil nomination presents a new challenge in evaluation as it is a serial nomination, the three constituent sites are greatly separated in time and space, and the precedents made by the Committee on previous fossil nominations. Moreover, one of the three sites (Murgon) has been questioned by several reviewers and this tends to call the whole nomination into question.

The major discoveries at Murgon site have only been made over the past four years and hinge mainly around mammal tooth fragments found among ancient fish bones. Murgon, as compared to the other two sites, has been a relatively poor producer of specimens (as have most Tertiary sites) and it is the only one of the three sites that does not have associated natural values. More important, the stratigraphic control of the sediment layers is not clearly determined nor is the age of the site. Dating of clays by K-Ar methods is not a routine procedure and there is some uncertainty regarding whether the clays formed *in situ* or were eroded from the catchment and deposited as secondary sediments at the same time as the bones. Add to this the very small size of the site and some concern over its management and it is clear that Murgon can not yet hold its own along with the two other components of the nomination.

The question then becomes whether the nomination still has sufficient rationale to present the four-dimensional story of the evolution of Australian mammals if Murgon's contribution of "chapter one" is not included. The answer to this is suggested by an evaluation of the two remaining sites taken together.

At Riversleigh, a combination of factors have given rise to a site where an exceptional diversity of superb fossils provides an unparalleled window into Oligo-Miocene rainforest faunas which evolved in isolation during Australia's separation from Antarctica. These faunas present the pinnacle of marsupial evolution, pre-dating the late Tertiary placental influx from Asia to Australia and the consequent wholesale re-ordering of faunas in Plio-Pleistocene time due to climatic desiccation.

Naracoorte too, opens a window into a significant period of earth's history on a continent dominated by marsupials. The last 170,000 years have been characterised by great climatic changes and the Naracoorte fauna provide a key clue to understanding marsupial responses to these. The Naracoorte assemblages also span the probable time of arrival of humans to Australia and thus is of additional value in helping unravel the complex relationships between humans and their environment. Naracoorte caves are also a source of specimens of potential value in DNA analysis of extinct species not always available from studies of swamp/lake/dune recovered fossils.

Both sites separately then provide snapshots of key stages in the evolution of the fauna on the world's most isolated continent and, when taken together, their value is further enhanced. There are no other two locations where this story is better displayed although without the Tertiary and some other gaps it is recognized that the full story cannot be told. It is concluded that criteria *i* and *ii* are met. Further, as the fossil site evaluation checklist has shown, both sites rate high on all ten scores and stand apart and above previous fossil site nominations. Certainly, if one were to list the most significant ten fossil sites in the world, Riversleigh/Naracoorte would be among them.

6. RECOMMENDATIONS

The Australian Fossil site nomination is a new departure for the consideration of such sites and the Bureau will wish to examine the options closely. IUCN would, however, recommend that a modified version of the site (without Murgon) be inscribed and it be referred to as Australian Fossil Mammal Sites (Riversleigh/Naracoorte) (name to be confirmed by Australia). If Murgon or another Tertiary site eventually proves as significant to the theme of this serial nomination, it could be added at later date.

