

## **SUMMARY OF STATE HERITAGE PLACE - DESIGNATION**

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### **REGISTER ENTRY**

**Entry in the South Australian Heritage Register in accordance with the  
*Heritage Places Act 1993***

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<b>NAME:</b>	Lake Palankarinna Fossil Reserve	<b>PLACE NO.:</b> 14392
<b>ADDRESS:</b>	Dieri Country Approximately 90 km north of Marree Marree 5733 Outside of Hundreds CR5758/134 H832300 S362	

### **STATEMENT OF DESIGNATION**

#### **Designated Place of Palaeontological Significance**

The Lake Palankarinna Fossil Reserve is well-known for its diverse faunal assemblages that extend throughout the majority of the Cenozoic Era. It is regarded as one of the highest yielding sites for mammalian fossils in Australia and contains 59 sites of scientific value.

In 1953, one of the first mammal fossils aged between the Palaeocene and Late Pliocene discovered in mainland Australia was found in the non-marine sediments at Lake Palankarinna. The abundant vertebrate remains subsequently excavated date from the Late Oligocene (approximately 26 million years ago) into the Pleistocene epoch (~1 million years ago). The palaeontological remains at Lake Palankarinna reflect an ancient lake system with minor rivers, greatly differing to the present arid environment.

Documented taxa include megafauna, marsupials, birds, crocodiles and fish in very high concentrations, diversity and quality, some fossils remaining articulated. Since its European discovery, the fossil sites at Lake Palankarinna Fossil Reserve have yielded at least 33 fossil holotype specimens and many in situ fossils with a high potential to bear more. The State Heritage Place is likely to yield further information that could contribute to the evolutionary history of South Australia's diverse wildlife.

## Elements of Significance:

Elements of heritage significance include (but are not necessarily limited to):

- Greater than 35 palaeontological sites of interest with an additional 20 boreholes that have yielded fossil specimens.
- Diverse, well-preserved in-situ fossil specimens and extensive fossil sites with potential to yield important scientific information.
- Localities that have produced at least 33 vertebrate fossil holotypes (specimens used by researchers to describe the species).
- Local Fauna (LF) zones where mammal fossil specimens can be used to chronologically correlate and date layers of rock (stratigraphy) precisely.
- Articulated fossil specimens with excellent preservation.
- Microfossils such as fossilised pollen, algae *Botryococcus*, and foraminifera used for dating of the site in relation to other fossil sites globally.

Elements not considered to contribute to significance of place include (but are not necessarily limited to):

- Built structures including buildings, signage and trails.

## STATEMENT OF DESIGNATION

### Designated Place of Geological Significance

The Lake Palankarinna Fossil Reserve contains important palaeoenvironmental records within its exceptional geology. Late Oligocene - Pleistocene (26 million years ago (Ma) – 1Ma) soils (palaeosols) are exposed within the Lake Palankarinna Fossil Reserve, demonstrating some of the best exposed areas from these time periods in Australia. The exposures provide the opportunity for scientific research to be conducted on rock formations that are usually buried and can provide information into the past environment of the State.

The area within the Lake Palankarinna Fossil Reserve has been extensively studied and has revealed the evolution of the state over 26 million years. The site has been used for collecting palaeomagnetic data which can provide precise dating of the Etadunna Formation, in turn enabling highly precise dating of the fossils found within it.

The Lake Palankarinna Fossil Reserve is also the type locality for lithostratigraphic units: the Tirari Formation, the Etadunna Formation and the Mampuwodu Sand. The type sections at Palankarinna are excellent exposures of the formations and are essential

in understanding and defining the characteristics of the formation and its surrounding geology.

The Lake Palankarinna Fossil Reserve's geology contains precisely dated formations, three geological type localities and detailed information into the area's palaeoenvironment. As such, the area is regarded as highly geologically significant.

### **Elements of Significance:**

Elements of heritage significance include (but are not necessarily limited to):

- The type locality (location containing characteristics used to describe the geological formation) for the Etadunna Formation, Tirari Formation, and Mampuwordu Sand.
- Geological formations ranging in age from Late Oligocene into the Pleistocene.
- The stratigraphic sequence of local faunas (LFs) allowing wide correlation of stratigraphically isolated LFs,
- Numerous geological formations overlying one another both conformably and unconformably, providing insight into ancient erosion events.
- Evidence for changes in South Australian climate, shown by the type of rocks and minerals preserved within.
- Evidence of ancient lakes and rivers within the geology.
- Evidence of the changes of the earth's magnetism allowing for precise dating of fossil-bearing sediments that provide opportunity for the site to be used internationally as a reference.

Elements not considered to contribute to significance of place include (but are not necessarily limited to):

- Built structures including buildings, signage and trails.

## COMMENTARY ON THE LISTING

**Description and notes with respect to a place entered in the South Australian Heritage Register in accordance with the *Heritage Places Act 1993***

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### STATEMENT OF SIGNIFICANCE

In 1953 the first discovery in Australia of a diverse array of Paleogene and Neogene mammals was made at Lake Palankarinna, one of many salt pans east of Kati-Thanda Lake Eyre, by R A Stirton and R Tedford, Fulbright Scholars from the University of California, and G D Wedford of the University of Adelaide. Vertebrate remains dating from the late Oligocene to the early Miocene Period (approximately 26 million years ago) into the Pleistocene Period (1 million years ago) have been described from this site.

Note: Lake Palankarinna Fossil Reserve was confirmed in the South Australian Heritage Register on 4 March 1993, the Statement of Significance was approved on 28 February 2000, under delegation. A correction has been made to the previous statement of significance, where additional research provided more accurate dating of the remains at Lake Palankarinna Fossil Reserve.

### Physical Description

The Palankarinna Fossil Reserve is an isolated saltpan located 63km east of Kati-Thanda Lake Eyre<sup>1</sup> and 90km North of Marree.<sup>2</sup> The Lake Palankarinna Fossil Reserve covers approximately 35km<sup>2</sup> with greater than 35 fossil sites of interest located predominantly on the western shore of Lake Palankarinna. While the area was once a lake and river system it is now dry and unvegetated and is surrounded by low cliffs and sand dunes.<sup>3</sup> Four smaller lakes to the southwest are also present within the State Heritage Place, however there is currently no evidence of fossils at these sites.<sup>4</sup>

'Faunal Zones', where concentrations of fossils are high, are partly within the four major geological formations at Lake Palankarinna and are referred to as Local Faunas. Local Faunas are layered sequences of rock containing fossilised biological material that can be dated with high precision and accuracy.<sup>5</sup> Local Faunas allow for correlation between Lake Palankarinna and 'stratigraphically isolated' areas, where it is difficult to date specimens using rock layers, such as Lake Namba (SA) and Riversleigh (QLD).

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There are four major time periods and three geological formations<sup>6</sup> and one member within the Lake Palankarinna Fossil Reserve, namely:

- Etadunna Formation (Late Oligocene–Middle Miocene - ~26-15 Ma),<sup>7</sup> containing, but not limited to, fossil flamingos, pelicans, lungfish and ancestral koalas (Minkina, Ditjimanka, Ngapakaldi, Ngama, and Treasure Local Faunas).
- Tirari Formation (Pliocene - ~4 Ma) (Golden Fleece Local Fauna).<sup>8</sup>
- Katipiri Sands/Formation<sup>9</sup> (Pleistocene – ~1 Ma), containing, but not limited to, fish, reptile and marsupial bones (Malkuni Local Fauna).<sup>10</sup>
- Mampuwodu Sand (Pliocene - ~4 Ma), a member as a part of the Tirari Formation. Containing, but not limited to, fish, turtles, crocodiles, marsupials (Palankarinna Local Fauna).<sup>11</sup>

## Geological and Palaeontological Background

For research purposes rock layers, both exposed above ground and buried underneath it, are named, and split into stratigraphic units (stratum meaning layer and grafi meaning to describe). This is done by describing the physical characteristics of the rocks found within each layer, a study known as lithology. The characteristics considered include the type of rock, colour, texture, presence of fossils, and mineral composition. The main group of stratigraphic units are known as formations, each is distinct from the others. Formations can then be split into members. The Lake Palankarinna Fossil Reserve contains three major geological formations and a member.

The rock formations and member at the Lake Palankarinna Fossil Reserve are layered over one another. However, due to previous geological movement, do not always create layers in a consecutive order. There are also numerous periods of time missing from between the layers of rock where erosion may have occurred. These create an 'unconformity' in the geological record and can provide information about previous geological events and how the rock layers have been altered over time.

To aid in describing the unique layers and rocks within formations, type localities or stratotypes are identified. These are areas specifically chosen where a deposit has all of the characteristics expected of the formation and allow it to be compared to other stratigraphic units worldwide. Within the Lake Palankarinna Fossil Reserve are type localities for the Etadunna Formation, Mampuwodu Sand and the Tirari Formation. Local Fauna (LF) are additional recognised areas within formations and members documented by researchers. These faunas are identified using mammal fossil

specimens to date the rock sequence. Numerous LF can be found within Lake Palankarinna Fossil Reserve and can be correlated to other fossil sites throughout Australia for dating purposes.

Lake Palankarinna also has a large number of type localities for fossil species. These are locations where fossil specimens have been found, named and recorded. Holotype specimens are used to describe the species and as references to identify the characteristics of specimens subsequently found and classify them. 33 holotype specimens have been collected, thus far, at Lake Palankarinna Fossil Reserve. This is an exceptionally number of type specimens to be found in such a small area.

While the areas of high significance have been researched in great detail (noted in the Site Plan), areas outside this boundary have received little attention. It cannot be stated with confidence that these areas do not contain elements of significance. When considering the abundance of fossil specimens around the lake itself, it is likely that these areas could also yield further specimens.

## References

### Journal Articles

- Metzger CA (2010), 'Paleosol record of Neogene climate change in the Australian outback', [Doctoral Dissertation, Department of Geological Sciences and the Graduate School of the University of Oregon], Appendix A Supplementary data, pp. 106-110.
- Nanson GC et al. (2008), 'Alluvial evidence for major climate and flow regime changes during the middle and late Quaternary for eastern central Australia', *Geomorphology*, Vol. 101, no. 1-2, pp. 109-129.
- Tedford RH Wells RT and Barghoorn SF (1992), 'Tirari Formation and contained faunas, Pliocene of the Lake Eyre Basin, South Australia', *The Beagle: Records of the Museums and Art Galleries of the Northern Territory*, Vol. 9, No. 1, pp. 173-193.
- Woodburne MO et al. (1994) 'Land Mammal Biostratigraphy and Magnetostratigraphy of the Etadunna Formation (Late Oligocene) of South Australia', *Journal of Vertebrate Paleontology*, Vol. 13, no. 4, pp. 483-515.

## Online Sources

Department of Energy and Mining (2023) 'SARIG Map', <<https://map.sarig.sa.gov.au/>>, accessed 17/05/2023, Government of South Australia.

Geoscience Australia (2023) 'Australian Stratigraphic Type Sections', Australian Government <<https://www.ga.gov.au/data-pubs/datastandards/stratigraphic-units/stratigraphic-type-sections>>, accessed 17/05/2023.

Register of the National Estate (1980), 'Lake Ngapakaldi to Lake Palankarinna Fossil Area, Etadunna via Marree, SA, Australia', Australian Government.

## Publications

Heritage SA 'Register Assessment Report 14392 – Tertiary Mammal Fauna Lake Palankarinna Fossil Reserve, Central South Australia', Assessment Report, 8 pages.

McBriar EM and Giles CW (1984), 'FN. 20 Lake Palankarinna Fossil Reserve', Geological Monuments in South Australia Part 5, Geological Monuments Subcommittee of the S.A. Division of the Geological Society of Australia Incorporated.

## Personal Communication

Worthy T (2022), Personal Communication

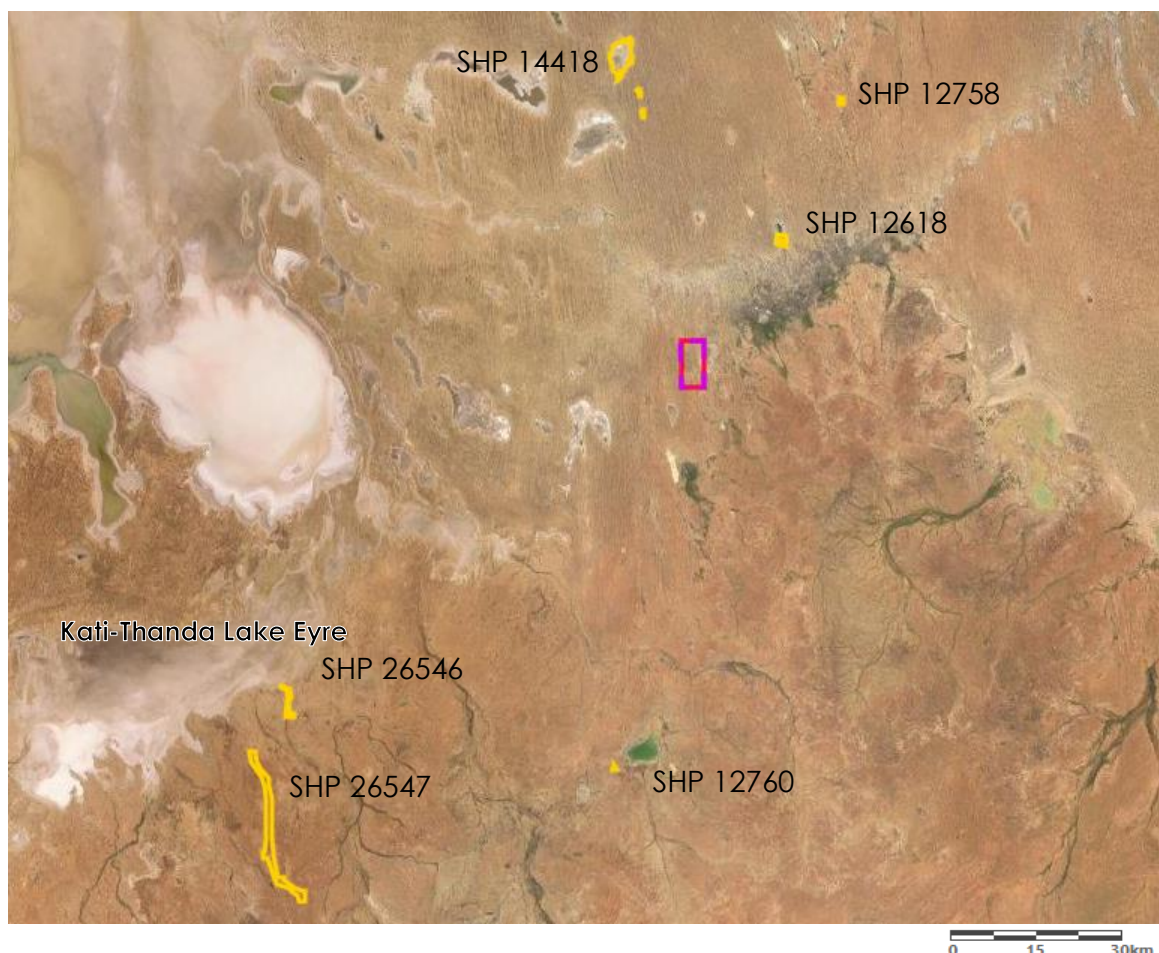
Worthy T (2023), Personal Communication



SITE PLAN

Lake Palankarinna Fossil Reserve




PLACE NO.: 14392



**Land Feature map of Lake Palankarinna Fossil Reserve, Dieri Country, Approximately 90 km north of Marree, Marree 5733, (CR5758/134 H832300 S362, Outside of Hundreds).**

LEGEND

N ↑

-  Existing State Heritage Place(s)
-  Parcel boundaries (Indicates extent of Listing)
-  Outline of Elements of Significance for State Heritage Place



SITE PLAN - DETAIL

Lake Palankarinna Fossil Reserve

PLACE NO.: 14392




GPS Coordinates available to owners recognised under the *Heritage Places Act 1993*.

0 1 2km

Detail Site Plan

LEGEND

 Parcel boundaries (Indicates extent of Listing)

N ↑

Statement of Designation Lake Palankarinna Fossil Reserve (SHP 14392)

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Intention to Designation made by the South Australian Heritage Council 19 October 2023

Designated as a place of Palaeontological & Geological Significance by the South Australian Heritage Council 14 March 2024

 Outline of Elements of Significance for State Heritage Place

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<sup>1</sup> Heritage SA (1993), 'Register Assessment Report 14392 – Tertiary Mammal Fauna Lake Palankarinna Fossil Reserve, Central South Australia'.

<sup>2</sup> McBriar EM and Giles CW (1984), 'FN. 20 Lake Palankarinna Fossil Reserve', *Geological Monuments in South Australia Part 5*, Geological Monuments Subcommittee of the S.A. Division of the Geological Society of Australia Incorporated.

<sup>3</sup> Register of the National Estate (1980), 'Lake Ngapakaldi to Lake Palankarinna Fossil Area, Etadunna via Marree, SA, Australia', Australian Government.

<sup>4</sup> Worthy T (2022), Personal Communication.

<sup>5</sup> Worthy T (2023), Personal Communication.

<sup>6</sup> Geoscience Australia (2023) 'Australian Stratigraphic Type Sections', Australian Government <<https://www.ga.gov.au/data-pubs/datastandards/stratigraphic-units/stratigraphic-type-sections>>, accessed 17/05/2023.

<sup>7</sup> Metzger CA and Retallack GJ (2010), 'Paleosol record of Neogene climate change in the Australian outback; Department of Energy and Mining (2023) 'SARIG Map', <<https://map.sarig.sa.gov.au/>>, accessed 17/05/2023, Government of South Australia.

<sup>8</sup> Tedford RH Wells RT and Barghoorn SF (1992), 'Tirari Formation and contained faunas, Pliocene of the Lake Eyre Basin, South Australia', *The Beagle: Records of the Museums and Art Galleries of the Northern Territory*, Vol. 9, No. 1, pp. 173-193.

<sup>9</sup> Nanson GC et al. (2008), 'Alluvial evidence for major climate and flow regime changes during the middle and late Quaternary for eastern central Australia'.

<sup>10</sup> Heritage SA (1993), 'Register Assessment Report 14392 – Tertiary Mammal Fauna Lake Palankarinna Fossil Reserve, Central South Australia'.

<sup>11</sup> Heritage SA (1993), 'Register Assessment Report 14392 – Tertiary Mammal Fauna Lake Palankarinna Fossil Reserve, Central South Australia'.