South Australian
HERITAGE COUNCIL

SUMMARY OF STATE HERITAGE PLACE

REGISTER ENTRY

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

NAME: Poole Creek Fossil Flora Complex **PLACE NO.:** 26547

ADDRESS: Arabana Country

South of Kati Thanda South (Lake Eyre South) and Covrichina Dam, Callanna SA, 5733. CL6178/960, CL6234/961, Outside of Hundreds.

STATEMENT OF HERITAGE SIGNIFICANCE

Statement of Heritage Significance:

The Poole Creek Fossil Flora Complex, including a portion of the Poole Creek Palaeochannel Geological Monument located south of Kati Thanda South (Lake Eyre South) contains rare silicified botanical fossils of leaves, wood and fruit and a unique type specimen of the pine *Manchesteria australis*, deposited during the Cenozoic Era (66 Million years ago to present). The fossil assemblages extend over 29.5km of dry riverbed and contain rare seed cones resembling *Banksia, eucalypt*-like nuts and leaves of various species with a high quality of preservation. The fossil record contained in the complex extends the known temporal and geographical range of some identified species. Poole Creek Fossil Flora Complex also has a high potential to yield further information that will enable a greater understanding of the environment and evolution of the Australian continent in ancient times.

STATEMENT OF PALAEONTOLOGICAL DESIGNATION

Poole Creek Fossil Flora Complex is a palaeochannel located south of Kati Thanda South (Lake Eyre South). It is a rare and outstanding example of a Cenozoic fossil flora assemblage. The channel runs over ~29.5km kilometres (from 29.4087° S to 29.6493° S) with 14 significant sites in which fossil flora have been identified or are highly likely to be found. The fossil assemblage yielded fossilised and silicified wood, leaves and seeds.

The age of the fossil assemblage is still being refined by paleobotanists. The assemblage contains portions of the geological Eyre and Etadunna formations, respectively aged to 62-42Ma and 25.7-12.5Ma.

The fossil site has thus far yielded 89 fossil specimens, including 18 identified species and a unique type specimen for *Manchesteria australis Stull & Rozefelds* sp. nov., identified through seed remains. Other species include rare *Banksia* infructescences (seed cones) that are found within the geological formations and eucalypt-like specimens similar to those found at Stuarts Creek.[i]

The significant palaeontological features contained within the complex are:

- Complex of 14 fossil flora sites.
- Well-preserved silicified fossil flora in the form of leaves, seeds, fruits and infructescences.
- Type locality for *Manchesteria australis Stull & Rozefelds* sp. nov.[ii]
- Eyre formation with the Etadunna formation overlaying unconformably, depicting a period of erosion and deposition and break in the geological record.
- An extensive assemblage that with further research can contribute to the understanding of the natural evolution of the State.

RELEVANT CRITERIA (under section 16 of the Heritage Places Act 1993)

(b) it has rare, uncommon or endangered qualities that are of cultural significance

The cultural significance of the Poole Creek Fossil Flora Complex lies in its scientific value, and in particular its remarkable fossil record, including the types of fossils found in the complex, their age, and the species represented. The complex contains rare fossils such as eucalypt-like fruits and nuts, banksia-like infructescences and a type specimen of the pine *Manchesteria australis.* The fossil assemblages contribute to our understanding of the evolution of the state over a geological time period, including recording climate variance between the Cenozoic and present day.

Both the identified geological formations and the fossils present provide extensive information on the changing environment during the majority of the Cenozoic Era and with its well-preserved fossils, is likely to yield high quality scientific data. Despite the relatively low level of research completed at Poole Creek in comparison to more accessible sites, Poole Creek has been identified as the type location for one of 18 species thus far identified from the Complex.

Given the high level of preservation and high potential for more finds, the scientific community anticipates identifying additional type specimens at the Poole Creek Fossil Flora Complex. Furthermore, the type specimen found at

Poole Creek Fossil Flora Complex is unique (thus far) to this site and contributes greatly to providing an insight into the natural history of this part of South Australia and to the botanical fossil record.

The Poole Creek Fossil Flora Complex has a fossil assemblage that will provide insights into climate change and South Australia's environment during the Cenozoic Era. It contains rare fossilised botanical specimens including a thus far unique type specimen. It is for these reasons that the Complex is considered to possess uncommon and rare qualities that are of cultural significance to South Australia.

(c) it may yield in formation that will contribute to an understanding of the State's history, including its natural history

The fossil assemblage at Poole Creek Fossil Flora Complex is diverse and offers the potential to reveal further information about the natural history of central South Australia. The Poole Creek Fossil Flora Complex has yielded numerous fossils in the past and is considered by palaeobotanists to be highly likely to continue to yield numerous fossils in the future. The silicified leaves present at Poole Creek record plant families, genus and species. The specimens can provide vital information to help understand the climate, environment and ecological interactions that occurred during the Cenozoic Era.

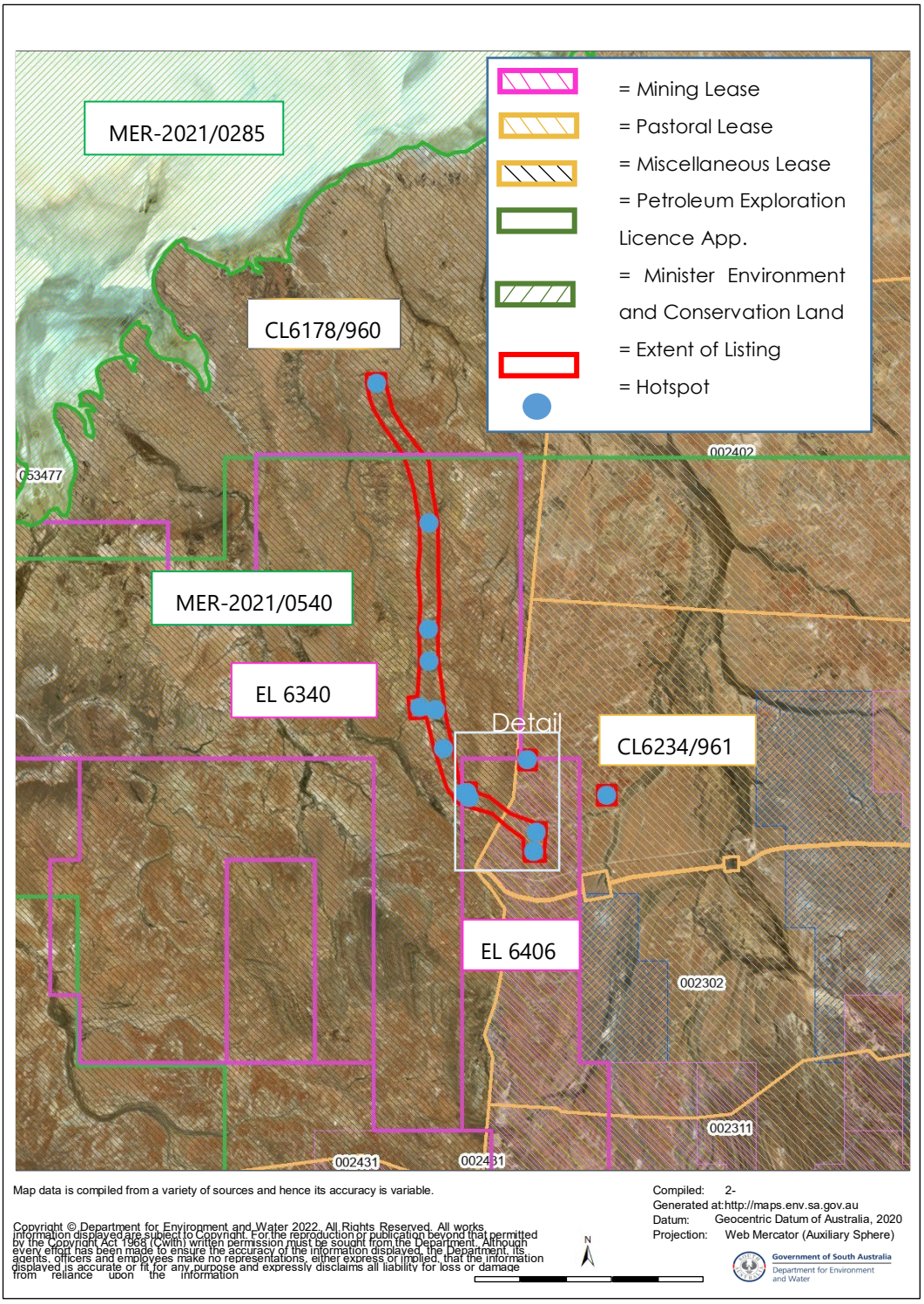
While some investigation and research has occurred at Poole Creek, the site remains understudied. Thus far, 18 specimens have been positively identified at Poole Creek Fossil Flora Complex, including at least one type specimen that is thus far unique to this site. Palaeobotanists anticipate the site is highly likely to yield many further examples, including type specimens. The type specimen found at the Complex, Icacinaceae (*Manchesteria australis* Stull & Rozefelds *sp. nov*.), is highly significant due to the unexpected appearance of the plant species in Central Australia. Fossil records for this family are predominantly from the Northern Hemisphere having been found in Europe and North America.

Similarly, the identification of eucalypt-like specimens from the locality suggests the potential for further eucalypt-like specimens to be identified potentially providing valuable data about the evolution of one of Australia's most abundant modern flora.

The Poole Creek Complex has high potential to yield further information that will contribute to building our understanding of the vegetation, climate and environment of central South Australia. In particular, the site is likely to yield meaningful information about past environmental conditions and the impact of climate change on vegetation during the Cenozoic, including possibly the evolution of Eucalypts.

SITE PLAN

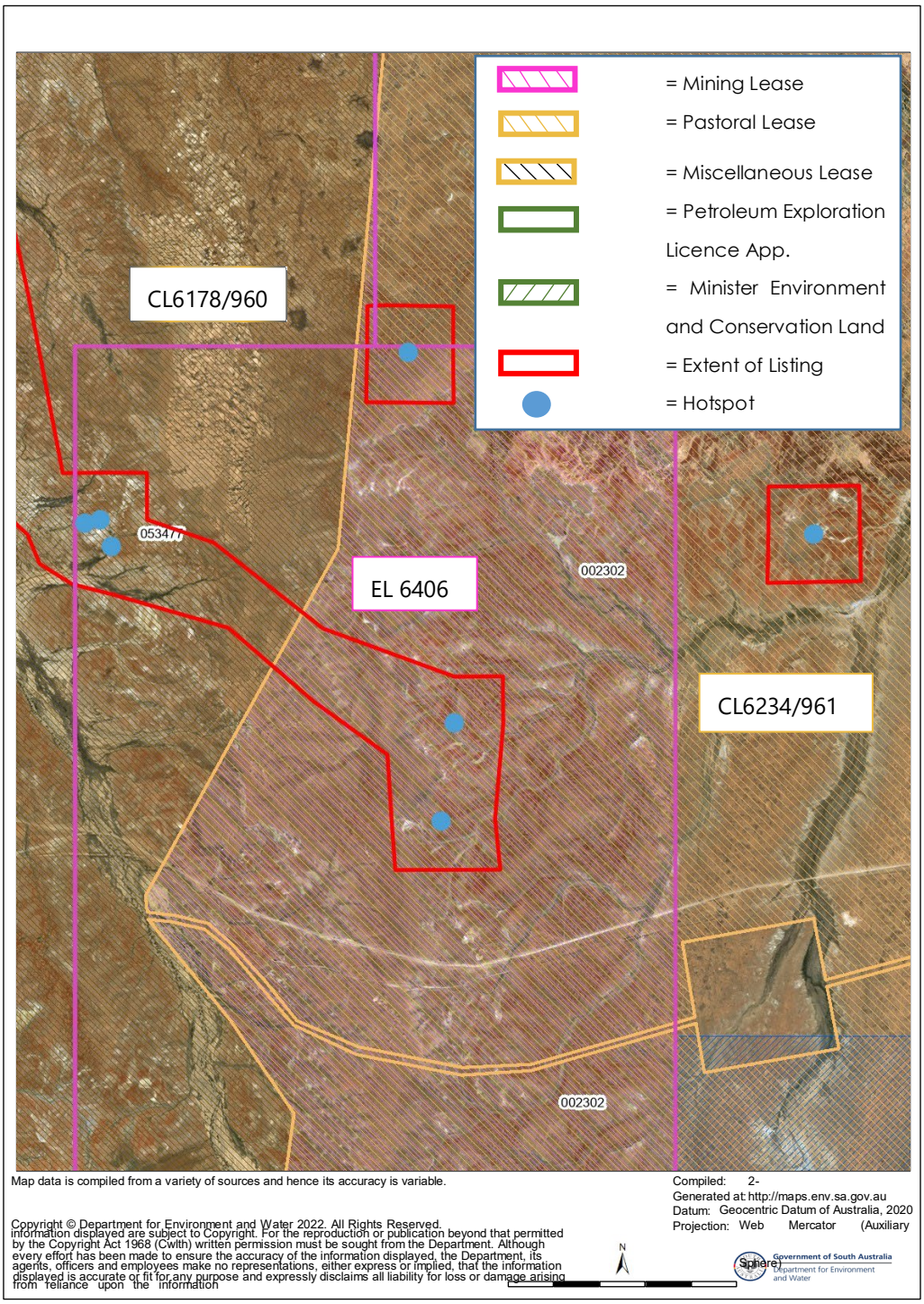
Poole Creek Fossil Flora Complex **PLACE NO.: 26547**



Poole Creek Fossil Flora Complex, South of Kati Thanda South (Lake Eyre and Covrichina Dam, Callanna SA, 5733. CL6178/960, CL6234/961, Outside of Hundreds

SITE PLAN - DETAIL

NAME: Poole Creek Fossil Flora Complex **PLACE NO.:** 26547



Poole Creek Fossil Flora Complex, South of Kati Thanda South (Lake Eyre South) and Covrichina Dam, Callanna SA, 5733. CL6178/960, CL6234/961, Outside of Hundreds

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*

Physical Description

Poole Creek Fossil Flora Complex is located approximately 36km West of the town of Marree and approximately 11km from Kati Thanda (Lake Eyre South). The complex is a palaeochannel that extends for about 29.5km kilometres from 29.4087º S to 29.6493º S and contains 14 areas from which fossils have been recorded.

The area of the palaeochannel is seasonally dry with very little water throughout the year. The fossil flora are deposited and preserved in silcrete, a hard layer of duricrust that preserves cavities and impressions of fossil leaves, wood, stems and fruits. Only a few mummified fossils and carbonate casts of plant materials have been found.[iii]

The most notable fossil sites have been included within the proposed State Heritage Place. It is also noted that site 13 is likely to contain fossil flora within the surrounding cliffs and as such, has been included in the Poole Creek Fossil Flora Complex.

The fossil sites within the proposed State Heritage Place are split between two geological formations. One of these being the Etadunna Formation, a layer of rock 25-80 metres thick[iv] and spanning into Queensland and the Northern Territory. The age is 25.7-12 Million years old. The Eyre formation, the second of the geological layers in the proposed Poole Creek State Heritage Place and is between 42 and 62 Million years old. It is similarly large, being up to 120 metres thick and spanning into NSW, NT and QLD. [v] However, despite the known age of the formation, the fossils have not been aged absolutely.[vi]

A majority of the proposed State Heritage Place lies within the much larger Geological Monument recognised as "Poole Creek Palaeochannel", a 35km long area. This monument was recognised by the Geological Society of Australia's South Australian Branch as an area of Geological Significance in 1994. The Monument report focuses heavily on the fossil plants found within the site but also mentions the Eyre and Etadunna geological formations in the area while also focusing on the 'River and swamp deposits of Middle Eocene to Late Pleistocene age'.[vii]

Within the report, the "best" Eocene outcrops are noted to have plant fossils within them, each of which is included in the proposed State Heritage Place. The Miocene Etadunna formation sequence is less represented in the State Heritage Place, reflecting the lower fossil presence. However, the importance of the formation in the Geological Monument report is punctuated by the presence of fossils, all of which the known localities of have been included in the proposed State Heritage Place. This demonstrates that, while smaller, the proposed State Heritage Place includes the

identified areas of geological interest which are also tightly incorporated into the areas of palaeontological significance, rather than being a separate entity. As a result of both the overlap and predominantly palaeontological focus of the geological monument report, it was determined that the area did not need to be designated as a place of Geological significance unless additional evidence of geological significance emerges in the future.

Elements of Significance:

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

- 14 richly fossiliferous 'hotspots' (identified on site plan) including high abundance and diversity of fossil flora and samples of rare Banksia infructescences and Eucalyptus-like fruits,
- 26km long palaeochannel containing fossiliferous geological formations from the Etadunna and Eyre formations,
- Silicified and compressed wood and leaves that are taphonomically unique,
- Type locality for Manchesteria australis Stull & Rozefelds sp. nov,
- Eyre formation with the Etadunna formation overlaying 'unconformably', depicting a period of erosion and deposition and break in the geological record.

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

- Built tracks, walkways and signage.

History of the Place

Geological Time (Dates approximate)

During the Jurassic, approximately ~199-145Ma, Australia began separating from Gondwana and started its northward movement towards the equator. Before this northward movement, the majority of the Australian continent experienced light summers and dark winters.

Between ~150 and ~100 Ma the environment was originally believed to be largely fluvial (rivers) and/or lacustrine (lakes). However, the presence of river systems is currently in debate with some evidence concluding that there may not been river and drainage systems until the middle Eocene,[viii] though the climate was very wet and humid[ix] and there were drastic changes in sea level, leading some of the region to be underwater.[x]

By ~70 Ma, the climate was uniformly humid. During the Palaeocene and Early-Eocene (~66- 50 Million years ago), the environment within central Australia was 'warm temperate with seasonally high precipitation'.[xi] Mean annual temperatures were 18-19 degrees Celsius and rainfall approximately 1400 mm/year. The

temperature and rainfall levels created ideal conditions for rainforest plants to grow, and such vegetation is reflected in the fossil record.

During the Middle Eocene, the oldest possible time of deposition for Poole Creek, the surrounding places (such as Nelly Creek) show evidence of dry-adapted (Sclerophyllous) and semi-deciduous monsoon-like forests (Mesophyll).[xii] At this time, it is thought that the mean annual temperature was >20 degrees Celsius and the warm and strongly seasonal environment created distinct macroflora which are smaller than other Middle Eocene-aged floras. [xiii]

In central Australia, approximately ~60 Ma, there were believed to be large amounts of transient swamp-like land in the west and sandy alluvial fans common in the east.

By ~38 Ma, Tasmania and Antarctica finally separated, allowing the Antarctic Circumpolar current to form. The Antarctic Circumpolar current caused cooling throughout the Antarctic and Australia.

Over time central Australia's lakes periodically dried and returned, allowing sporadic survival of rainforests until they dwindled in the Late Miocene. Open grasslands came to dominate, with rainforests standing only close to water sources as an annual dry period developed.[xiv]

By ~20 Ma, northern Australia gained its monsoonal climate and rainforest-like environment, while the rest of the continent became drier with duricrusted (a hard soil layer produced through evaporation of water and precipitation of minerals, common in arid areas) ground surfaces common. At this point, lakes were still common in the Australian outback.

At ~10 Ma, central Australia became increasingly dry, nearing modern levels of aridity,[xv] as South Australia had drifted northward into latitudes that most often develop dry environments. This time period is the absolute latest that the fossil floras at Poole Creek could have been deposited. This implies that the fossil Flora of Poole Creek may show evidence of the changing environment over this extended period of geological time.

Heritage South Australia thanks Neville Alley and Robert Hill for their contributions to paleontological sections of this report, including providing advance access to forthcoming publications.

First Nations Interactions (overview)

The Arabana People have an ongoing association with Kati Thanda (Lake Eyre) and surrounding areas. In the mid-1800s, the Arabana People were recorded as living to the South and West of Kati Thanda (Lake Eyre) and may have camped at times near or at the Poole Creek Fossil Flora Complex.

Please contact the Aboriginal Heritage Unit for further details about cultural sites for the Arabana People.

Research Conducted at Poole Creek Fossil Flora Complex

Explorations were conducted and recorded in the South Australian Resources Information Gateway (SARIG) in the form of rock sample analysis by Roger Callen and David Greenwood in 1986 and 1988 respectively. Another exploration was conducted by D. J. Barrett and B. Gare from the Department of Mines and Energy of South Australia in 1988.[xvi] However, it was some time before findings from Poole Creek were published. This occurred in a 1990 paper by Greenwood *et al*.[xvii]

Greenwood *et al*.'s 1990 paper identified 11 of 14 fossil sites.[xviii] Remaining localities were identified in 1986 and two 1988 explorations. While further research has been conducted, with some ongoing as of this report, little further exploration of the area has been completed.

Despite limited exploration, the area was noted as a place of high palaeontological significance with a high likelihood to further contribute to the South Australian palaeontological record in the 2006 'Australia's Fossil Heritage: A Catalogue of important Australian fossil sites' document, produced by the Australian Heritage Council.[xix]

Chronology

Year	Event
~56Ma	Beginning of the Eocene Epoch & Palaeocene-Eocene Thermal Maximum
~50Ma	Earliest age of deposition
~30Ma	Tectonics altering environmental factors within Australia as the continent moves northward
~15-5Ma	**Beginning of Central Australia's Aridification in earnest. Environment dried and plant assemblages changed greatly**
Pre-1836	Aboriginal People operate trade routes throughout the area.
Post 1836	European arrival in the area.
~1860	Nearby Marree Township founded as Hergott Springs.
1937	Inland Australia becomes area of palaeontological interest.[xx]
1990	**First confirmed paper published on the fossil flora[xxi] at Poole Creek and the area is recognised as a site of great palaeontological interest.**
1990-Present	Subsequent explorations and publications, primarily by Neville Alley, Roger Callen, Robert Hill and David Greenwood.

1994 **April. Recognised as a Geological Monument by the South Australian Division of the Geological Society of Australia.**[xxii]

2006 **Included as part of 12 sites in Australian Heritage Council's *Australia's Fossil Heritage: A Catalogue of Important Australian Fossil Sites.***[xxiii]

2021 Included as priority for assessment in *Fossil Heritage Survey for South Australia*.

2022 Neville Alley forthcoming publication.

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SITE DETAILS

Poole Creek Fossil Flora Complex **PLACE NO.: 26547**

Arabana Country, South of Kati Thanda South (Lake Eyre South) and Covrichina Dam, Callanna

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DESCRIPTION OF PLACE:	Cenozoic age fossil flora complex consisting of fourteen sites containing silicified fossil leaves, wood, stems and fruits. The fossils can be found within a mostly dried palaeochannel that can be seasonally wet. The rock found in the area is predominantly silcrete.	
REGISTER STATUS:	Provisional Entry: TBA	
CURRENT USE:	Creek Bed	
LOCAL GOVERNMENT AREA:	Pastoral Unincorporated Area	
LOCATION:	**Town/Suburb:** South of Kati Thanda (Lake Eyre South) and Covrichina Dam	
	Title Reference:	CL6178/960, CL6234/961
	Plan No.:	D34847AL2, 255659
LAND DESCRIPTION:	**Hundred:**	Out of Hundreds
	Encumbrance:	Native Title Holder: Arabana Aboriginal Corporation RNTBC (Determination Date: 22 May 2012) Miscellaneous Crown Lease: CL6178/960 - ARABANA ABORIGINAL CORP RNTBC Pastoral Crown Land: CL6234/961 – GC Morphett

PHOTOS

Poole Creek Fossil Flora Complex **PLACE NO.: 26547**

Arabana Country, South of Kati Thanda South (Lake Eyre South) and Covrichina Dam, Callanna

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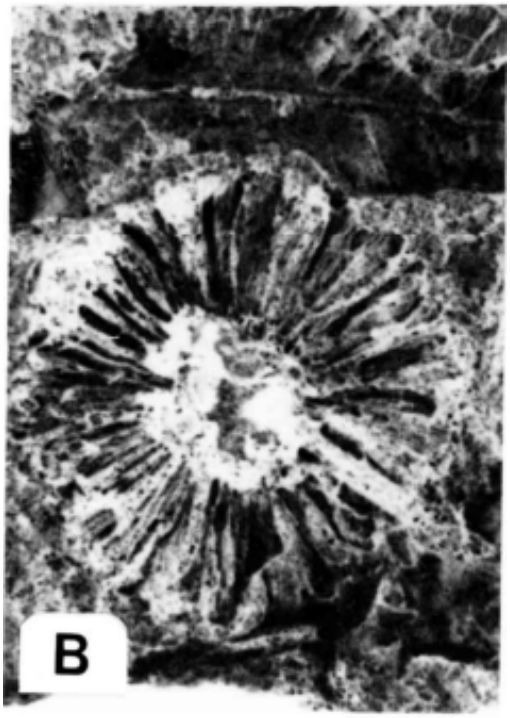
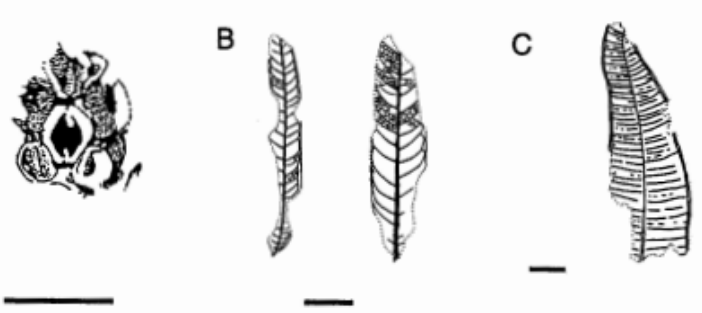


(Greenwood 1992)



Line Drawings of fossils recorded from Poole Creek. From left to right: *Gymnostoma* cone, legume leaflet, Apocynaceae sp. leaf (Greenwood 1996)

A Banksia-like cone from Poole Creek
(Greenwood 2001)

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[xv] Wilford, GE & Brown PJ (1994) 'Maps of late Mesozoic-Cenozoic Gondwana break-up: some palaeogeographical implications' in Hill, RS (ed.) *History of the Australian vegetation: Cretaceous to recent*, Cambridge University Press, Cambridge.
[xvi] Greenwood, DR, Haines PW and Steart DC (2001) 'New species of Banksieaeformis and a Banksia 'cone' (Proteaceae) from the tertiary of central Australia'.
[xvii] Greenwood, DR, Callen RA and Alley, NF (1990) 'The Correlation and Depositional Environment of Tertiary Strata Based on Macrofloras in the Southern Lake Eyre Basin, South Australia'.
[xviii] Greenwood, DR, Callen RA and Alley, NF (1990) 'The Correlation and Depositional Environment of Tertiary Strata Based on Macrofloras in the Southern Lake Eyre Basin, South Australia'.
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