SUMMARY OF STATE HERITAGE PLACE – DESIGNATION

Entry in the South Australian Heritage Register in accordance with s14(7)(a)(i) and s14(7)(b) of the Heritage Places Act 1993

NAME: Wilkawillina Archaeocyatha Site **PLACE: 14377**

ADDRESS: Adnyamathanha Country
Ikara-Flinders Ranges National Park
Flinders Ranges SA 5434
CL 6213/306 D84473 A11, CR 6228/877 D90825 Q61, Outside of Hundreds

STATEMENT OF DESIGNATION

Designated Place of Palaeontological Significance

The Wilkawillina Archaeocyatha Site is a distinctive palaeontological and geological site located within the Ikara-Flinders Ranges National Park. The Site includes sedimentary rocks ranging in age from early and early-middle Cambrian approximately 530-509Ma (Million years ago).

The Wilkawillina Archaeocyatha Site is named after the Archaeocyatha marine fossils found in high concentrations in the area. The site is considered by palaeontologists as among the most complete and well-studied Archaeocyatha fossil locations in Australia. Archaeocyatha deposits have been identified in the geological formations throughout Wilkawillina and the abundant fossils allow researchers to determine the age of stratigraphical layers at high precision. This provides valuable geological information about the site. Altogether, the type localities of at least 24 species lie within the Site.

The exposure of the formations and rich abundance of fossils at Wilkawillina Archaeocyatha Site, provides considerable opportunities for further research and demonstrates a high level of palaeontological and geological scientific importance for South Australia.

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

- Fossiliferous sediments and 'bioherms'
- Bunkers Graben and Hawker Group sediment
- The Wilkawillina platform, recognised Geological Monument, for the presence of geological features and fossiliferous rocks
- Fossil type localities
- Type sections of the Wilkawillina Limestone and Bunkers Sandstone

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

- Built structures including buildings and signage

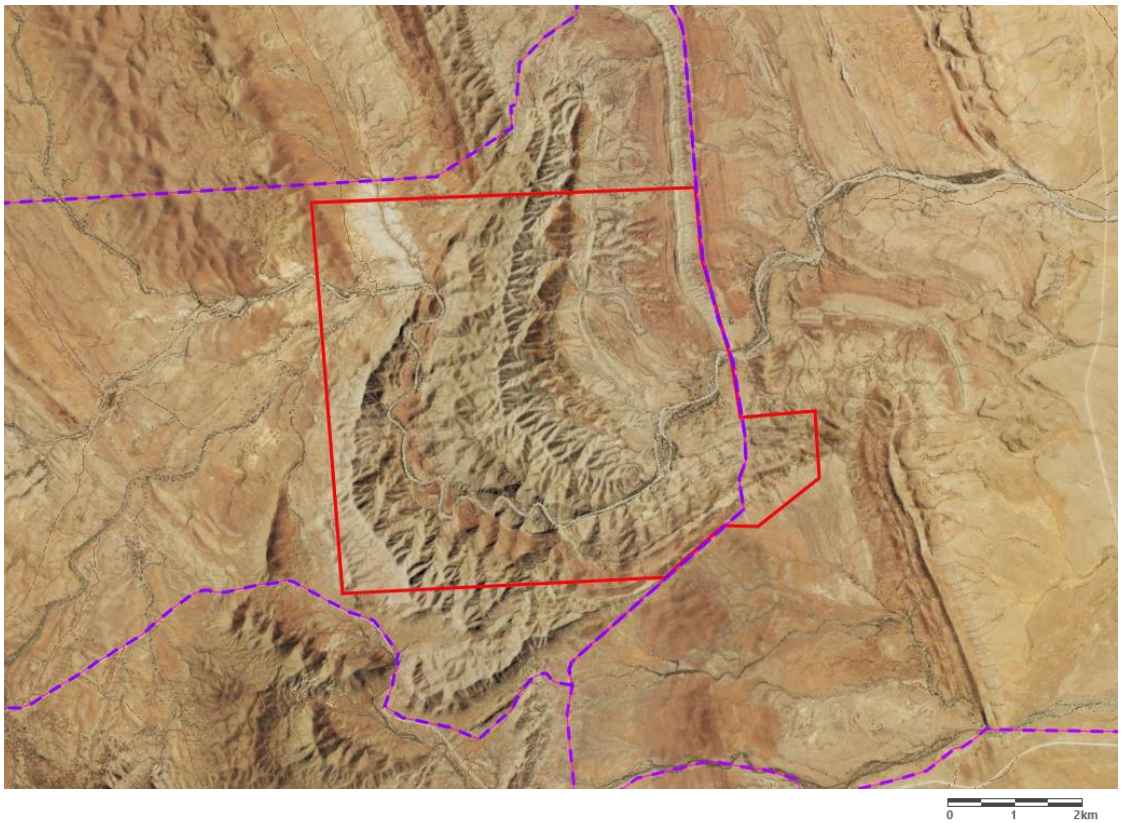
SITE PLAN, PHYSICAL DESCRIPTION & ELEMENTS OF SIGNIFICANCE

Entry in the South Australian Heritage Register in accordance with s14(2)(a) of the *Heritage Places Act 1993*

Site Plan

Wilkawillina Archaeocyatha Site **PLACE NO.: 14377**

Ikara-Flinders Ranges National Park, Flinders Ranges SA 5434



Adnyamathanha Country, Ikara-Flinders Ranges National Park, Flinders Ranges SA 5434
CL 6213/306 D84473 A11, CR 6228/877 D90825 Q61, Outside of Hundreds

LEGEND **N ↑**

Parcel boundaries (Indicates extent of Listing)

Outline of Elements of Significance for State Heritage Place – Red outline is indicative of elements of significance, noting imperfect alignment of aerial imagery with parcel cadastre.

Physical Description

The Wilkawillina Archaeocyatha Site includes sedimentary rocks predominantly from the Early Cambrian[i] with some early middle Cambrian sediments[ii], approximately 530-509Ma. The site and the associated Wilkawillina Gorge consist of hills and gullies comprising various fossiliferous limestone, sandstone and shale formations. A majority of the State Heritage Place is within the Ikara-Flinders Ranges National Park and areas outside of the National Park have been recognised as a Geological Monument[iii] due to the abundant fossil materials present. The Hawker Group consists of the geological formations that comprise most of the State Heritage Place. Importantly, these formations include the Wilkawillina Limestone and Mernmerna formation in the Bunkers Graben, a sunken piece of ground between faults.

Both the Wilkawillina Limestone and Mernmerna formation, as well as some smaller formations such as the Wirrealpa Limestone, are found in a highly fossiliferous band that curves across the State Heritage Place. Additionally, both Ten Mile Creek, sometimes referred to as Mt Billy Creek, and the Wilkawillina Gorge loosely follow this curve throughout the State Heritage Place.

The site is among the most complete and well-studied Archaeocyatha fossil locations in Australia[iv] and the varied suite of fossil groups range in age from ~530-509 million years. Exposures of Archaeocyatha, organisms that constructed mound-like ancient reefs, now generally referred to as 'bioherms',[v] are found within the Wilkawillina Limestone, and are readily exposed at Wilkawillina Gorge but are heavily concentrated in various areas. Four areas of high Archaeocyath abundance are in the Wilkawillina Limestone: two on the south-eastern limb of the graben, generally referred to as the Wilkawillina platform, and one on its north-western limb.[vi] The fourth area is within the younger Wirrealpa Limestone, which has yielded the youngest Archaeocyatha in Australia-Antarctica.[vii]

The Wilkawillina Limestone is predominantly rocky limestone but also reflects a 'platform-derived archaeocyathan-calci-microbe limestone'.[viii] Platform-derived means that the limestone was formed in a shallow-water environment surrounded by deeper water. While archaeocyathan-calci-microbe refers to an association between archaeocyathsa, the earliest calcified sponges, and calcimicrobes, which are microscopic colonial reef-forming, calcium carbonate-based organisms that formed the limestone. The Wilkawillina platform is 'arguably one of the best preserved Early Cambrian carbonate platforms in the geological record'.[ix]

While the Archaeocyatha form a large percentage of the fossil assemblage, examples of other ancient sponges, notably trilobites, and a variety of small skeletal and shelly fossils, including bradoriides, phosphatocopides, brachiopods, tommotiides, molluscs, hyoliths and echinoderms, have all also been identified.[x]

The area not only houses the above examples of distinct fossils but also a thriving ecosystem. The Wilkawillina Gorge, within the State Heritage Place, is a well-known area for yellow-footed rock wallabies. The gorge is also a popular geological monument and hiking area.

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HISTORY & PHOTOGRAPHS

Entry in the South Australian Heritage Register in accordance with s14(1)(a) of the *Heritage Places Act 1993*

History of the Place

Archaeocyathids are an extinct group of filter-feeding sponges that formed reefs during the late Ediacaran and Cambrian. Many of the fossiliferous deposits present in the Wilkawillina Archaeocyatha Site are aged between the early and middle Cambrian. Archaeocyath-bearing rock, particularly those identified by Geologist Brian Daily as faunal assemblages I and II were largely deposited in an unrestricted shallow marine environment with varying energy from calm to turbulent wave action.[xi]

The sequence of sediments in the Bunkers Graben within the State Heritage Place is complex and depicts various depths of marine environments. A majority of sediments were deposited on shallow, open shelves with varying levels of activity. The 'carbonate platform' to the east, compromised partly of Wilkawillina Limestone demonstrates a shallow marine environment that jutted out above the seafloor while being deposited.[xii]

This platform, sometimes referred to as the Wilkawillina platform is an archaeocyath biohermal bank on the southeast limb of the Bunkers Graben was also formed during the early Cambrian. After formation, the Wilkawillina Limestone platform was exposed during the Delamerian Orogeny, where orogeny refers to a process resulting in the formation of mountains through a mountain building event, which began approximately 514Ma and was ongoing for ~24Ma.[xiii]

The Ikara-Flinders Ranges National Park was created in 1945 as the Flinders Ranges National Park and protects the great majority of the Wilkawillina Archaeocyatha Site. The site has been of interest to both geologists and palaeontologists. Brian Daily was one of the earliest palaeontologists to publicise the fossils. In his 1956 doctoral thesis, Daily explored the Archaeocyatha in the south and south-east section of the Bunkers Graben in detail and identified bands of two Cambrian faunal assemblages (I and II) within the geology of the now State Heritage Place. These assemblages correspond to two of twelve Cambrian assemblages recognised throughout South Australia by Daily and are differentiated by the organisms present within the stratigraphy. In 1967, Astrobiologist Malcolm Walter published on the biostratigraphy of the Wilkawillina platform which is located to the east of Daily's localities. His research included details of the fossil presence and is used in biostratigraphic dating and correlation.

In 1980, geologist and palaeontologist David Gravestock's palaeontological research identified new species from the northern section of the Hawker Group.[xiv] The following year, the Geological Society of Australia's South Australian division recognised the eastern section of the Wilkawillina State Heritage Place as a Geological Monument.

Ten years after Gravestock's discoveries, a research team led by palaeontologist Stefan Bengtson described two trilobite species within the Wilkawillina Limestone.[xv] Geologist Jonathan Clarke would also revisit the eastern Wilkawillina platform following a more palaeoecological approach in his research. The same year, Geologist Noel James and Gravestock observed that the Wilkawillina Limestone included a key marker horizon known as the Flinders Unconformity.[xvi] The Flinders Unconformity is characterised by a distinctive reddened crust that is readily mapped within the Wilkawillina Archaeocyatha Site and marks a distinct change in the fauna present, referred to as a faunal turnover.[xvii]

The following year, research conducted on the Wirrealpa Limestone yielded additional species. From the low-diversity fauna of this unit, two species, one archaeocyath and one radiocyath, both with their type locality at Ten Mile/Mount Billy Creek, were described and identified within the Wilkawillina Archaeocyatha Site. Together with calcified microbes, these species were key constructors of a distinctive reef type marking the end of early Cambrian reef-building in Australia.[xviii] Later, in 1993, the Wilkawillina Archaeocyatha Site was added to the South Australian Heritage Register due to its paleontological and geological significance.

Subsequent research culminated in the extensive biostratigraphic dating of the fossil assemblages, released in 2006. The biostratigraphic dating divides the Wilkawillina limestone at the Wilkawillina Archaeocyatha Site into three time zones, each identified by the presence of specific fossils and correlated to other Cambrian sites worldwide.[xix] However, a large portion of archaeocyatha within the site are yet to be examined.

From 2011, the Ikara-Flinders Ranges National Park has been co-managed by Parks SA and the Adnyamathanha Traditional Lands Association RNTBC and in 2016 the National Park was renamed Ikara-Flinders Ranges National Park.[xx]

Research has continued into the first decades of the 21st century. In 2016 and 2017, a suite of small skeletal fossils was described within three sections in the Bunkers Graben. These fossils included twelve species of tommotiides, eight species of brachiopods, four species of molluscs and seven species of bradoriides, together with indeterminate hyoliths, anabaritids and protoconodonts.[xxi] An occurrence of the key trilobite genus *Redlichia* from the Mernmerna Formation was also recorded within the Site.[xxii]

Aboriginal Cultural Considerations

The Heritage Places Act 1993 *makes provision for the identification, recording and conservation of places and objects of non-Aboriginal heritage significance. The protection and preservation of Aboriginal heritage is provided for under the* Aboriginal Heritage Act 1988. Contact the Aboriginal Heritage Unit for listings.

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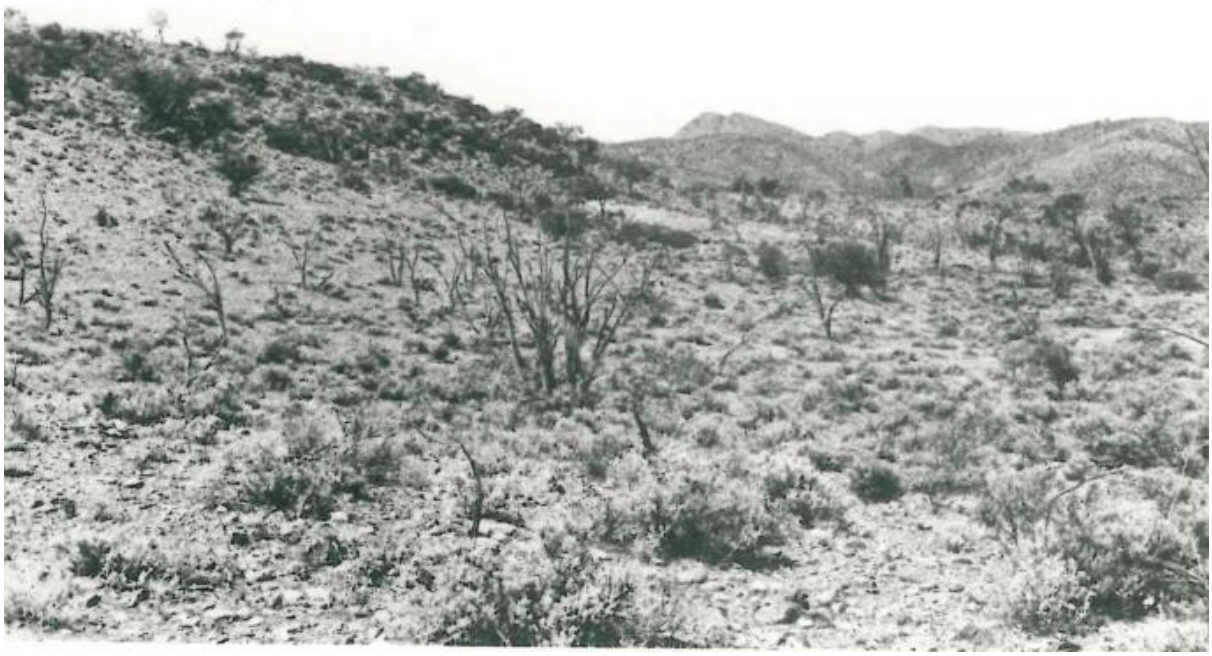
PHOTOGRAPHS

Wilkawillina Archaeocyatha Site **PLACE NO.**: 14377



Area of the State Heritage Place with a low rise to the left containing a concentration of fossil specimens.

Source: DEW Files

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