

BETTER HERITAGE INFORMATION SUMMARY OF STATE HERITAGE PLACE

COMMENTARY ON THE LISTING

Description and notes with respect to a place entered in the South Australian Heritage Register in accordance with either the *South Australian Heritage Act 1978* or the *Heritage Places Act 1993*.

The information contained in this document is provided in accordance with s14(6) and s21 of the *Heritage Places Act 1993*.

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

KNOWN AS: Wilkawillina Archaeocyatha Geological Site, partly located within Ikara-Flinders Ranges National Park

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

CONFIRMED IN THE SOUTH AUSTRALIAN HERITAGE REGISTER:

19 August 1993

STATEMENT OF HERITAGE SIGNIFICANCE

The massive outcrops of Wilkawillina Limestone in this area contain fossil Archaeocyatha in a state of remarkable preservation on a scale rarely found in other parts of the world. Archaeocyatha, which partly resembled both sponges and coral, are known to be the first great reef builders in the sea, with a wide geographical distribution, and are the earliest fossils to be preserved in the Cambrian sediments of South Australia. Their appearance is used as a marker fossil to differentiate between Precambrian rocks and the earliest Cambrian rocks. Their preservation in South Australia is exceptional and various species from this locality have been used for correlation with other regions worldwide. Several type sections for Early Cambrian fossiliferous rocks, including that of the Wilkawillina Limestone, have been designated in the locality.

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

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

Various features of the Wilkawillina Archaeocyatha Site are well-known among geologists and researchers interested in biostratigraphy. Species of Archaeocyatha have been identified at the site and have been used to correlate Cambrian time zones around the world, including assemblages present in Siberia.

Faunal assemblages in the centre of the Wilkawillina Archaeocyatha Site, identified by Geologist Brian Daily include some of the earliest Cambrian fossil assemblages described in South Australia and are only present at a few other select locations in the State. Additionally, the Wilkawillina Archaeocyatha Site is noted as one of two of the best-preserved examples of Daily's faunal assemblage I that is recognised in several fossil deposits throughout the State. The deposits present within the Wilkawillina Archaeocyatha Site provide excellent exposure of well-preserved fossil assemblages and yields great opportunities for research. The highly fossiliferous sediment of the Wilkawillina Archaeocyatha Site and several faunal assemblages also contain new species with a high likelihood of yielding further new species.

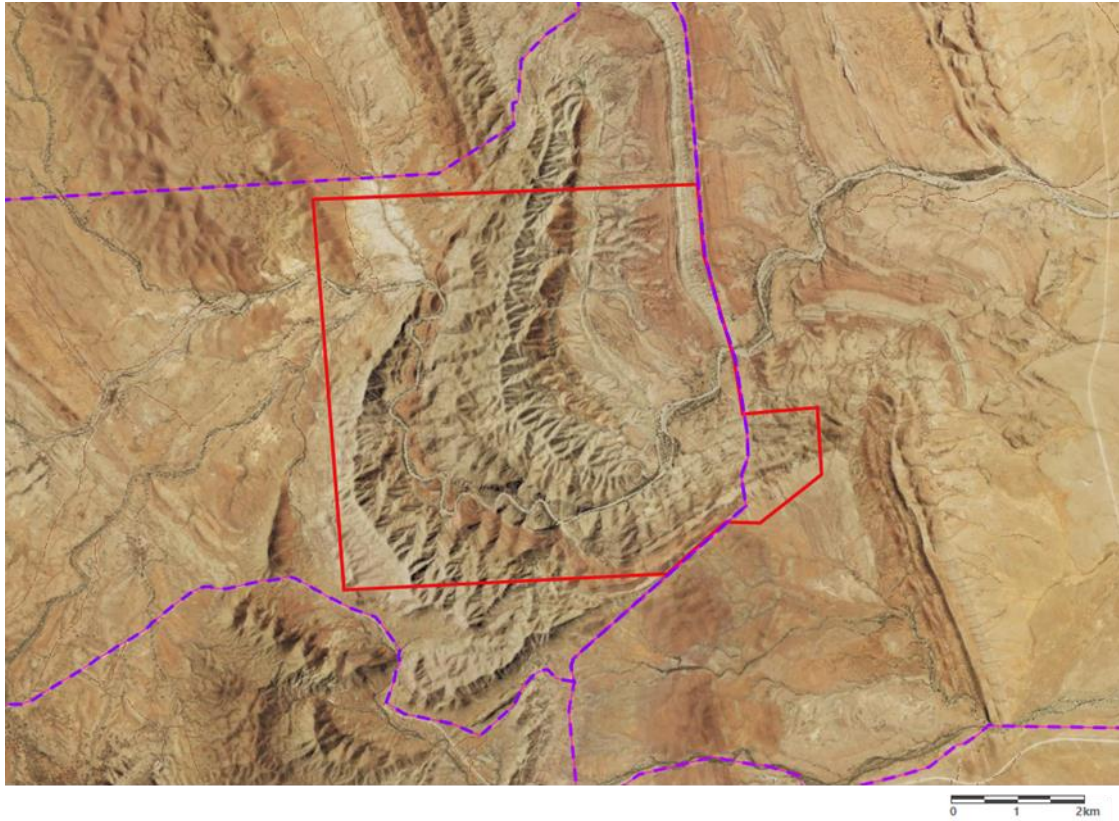
The Wilkawillina platform in the east of the State Heritage Place is also readily exposed and comprised of numerous and extensive, well-preserved deposits of further Archaeocyathan fossils along with the Bunkers Graben. It is an exceptionally well-preserved early Cambrian platform deposit and is arguably the best preserved in the geological record.

The Wilkawillina Archaeocyatha Site has a high likelihood of yielding additional information, not currently known about South Australia's natural history. In particular, a greater understanding about the earliest life during the Cambrian period, due to the fossilisation of Archaeocyatha and other fauna in fossil assemblages, that may be revealed through palaeontological research.

SITE PLAN



Wilkawillina Archaeocyatha Site

PLACE NO.: 14377



Adnyamathanha Country, Flinders Ranges, Outside of Hundreds
CL 6213/306 D84473 A11, CR 6228/877 D90825 Q61

LEGEND

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

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PHYSICAL DESCRIPTION

The Wilkawillina Archaeocyatha Site includes sedimentary rocks predominantly from the Early Cambrian¹ with some early middle Cambrian sediments², 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 Monument³ 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 Australia⁴ 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',⁵ 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.⁶ The fourth area is within the younger Wirrealpa Limestone, which has yielded the youngest Archaeocyatha in Australia-Antarctica.⁷

The Wilkawillina Limestone is predominantly rocky limestone but also reflects a 'platform-derived archaeocyathan-calci-microbe limestone'.⁸ 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'.⁹

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 bradoriids, phosphatocopids, brachiopods, tomotiids, molluscs, hyoliths and echinoderms, have all also been identified.¹⁰

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.

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

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.¹¹

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, comprised partly of Wilkawillina Limestone demonstrates a shallow marine environment that jutted out above the seafloor while being deposited.¹²

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.¹³

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.¹⁴ 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.¹⁵ 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.¹⁶ 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.¹⁷

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.¹⁸ 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.¹⁹ 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.²⁰

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 tommotiids, eight species of brachiopods, four species of molluscs and seven species of bradoriids, together with indeterminate hyoliths, anabaritids and protoconodonts.²¹ An occurrence of the key trilobite genus *Redlichia* from the Mernmerna Formation was also recorded within the Site.²²

CHRONOLOGY

Year	Event
530-509 Ma	Early Cambrian formation of a majority of the bioherm and Archaeocyatha present at the site
514Ma	Delamerian Orogeny ²³ and mountain building in the area
Previous 66Ma	Cenozoic uplift and exposure of the Bunkers Graben and the Wilkawillina platform ²⁴
1945	Flinders Ranges National Park gazetted
1956	Faunal Assemblages I and II noted in the graben by Daily 1956
1981	Recognised as a Geological Monument by the South Australian Division of the Geological Society of Australia
1990	Recognition of the Flinders Unconformity, nominated as a State Heritage Place (August) and recommended by the SA Heritage Committee (September)
1993	Wilkawillina Archaeocyath Geological Site provisionally entered in the State Heritage Register (March) and added to the State Heritage Register (August)
2011	Flinders Ranges National Park becomes co-managed by Parks and the Adnyamathanha Traditional Lands Association RNTBC
2016	Flinders Ranges National Park renamed to Ikara-Flinders Ranges National Park

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Other

Kruse, P. (2022), Personal Communication

SITE DETAILS

Wilkawillina Archaeocyatha Site
Flinders Ranges SA 5434

PLACE NO.: 14377

DESCRIPTION OF PLACE: Highly fossiliferous geological sequence formed predominantly from limestone in the Ikara-Flinders Ranges National Park

DATE OF CONSTRUCTION: Approx. 530-509Ma (Fossils)

REGISTER STATUS: Provisionally Entered 4 March 1993
Confirmed 19 August 1993

CURRENT USE: National Park and Pastoral land

LOCAL GOVERNMENT AREA: Pastoral Unincorporated Area

LOCATION:

Street No.: NA

Street Name: NA

Town/Suburb: Flinders Ranges 5434

Post Code: 5434

LAND DESCRIPTION:

Title Reference: CL 6213/306 D84473 A11, CR 6228/877 D90825 Q61

Hundred: Outside of Hundreds

PHOTOS

Wilkawillina Archaeocyatha Site
Flinders Ranges SA 5434

PLACE NO.: 14377



Preserved ripple marks exposed in the Wilkawillina Archaeocyatha Site SHP

Source: DEW Files

Wilkawillina Archaeocyatha Site
Flinders Ranges SA 5434

PLACE NO.: 14377



**Archaeocyath exposed in Wilkawillina Limestone in the Wilkawillina
Archaeocyatha Site SHP**

Source: DEW Files

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