HERITAGE ASSESSMENT REPORT

Item 8.6Attachment B

NAME:	Munro Karst	**PLACE:**	26606
ADDRESS:	First Nations of the South East Country 407 Hynam Caves Road, Mount Light, 5271 CT 6100/748, D88823 A100, CR 5677/773, H440700 S487, CT 6100/749 D88823 A101, Hundred of Jessie		

This heritage assessment considers that the place meets criteria [c]. Refer to Summary of State Heritage Place for final approved wording, including criteria statements.

Calcite decorations formed on ancient tree roots, Munro Karst.

Source: S. Bourne, 2023.

ASSESSMENT OF HERITAGE SIGNIFICANCE

Statement of Heritage Significance:

Munro Karst offers a high potential to yield new scientific information about the Hynam Range and early Pleistocene cave development and biodiversity of the South East region. Located on the Hynam Range, in the Naracoorte area of the South East region of South Australia, its location is significant as the Hynam Range is probably the oldest of a series of Pleistocene coastal ridges that extend from Naracoorte to the modern coast. These ridges have been heavily degraded by natural erosion and land use since European colonisation but preserve a record of landscape evolution, ancient sea levels, regional uplift, and glacial to interglacial climate cycles over the last two million years. Preserved within the Munro Karst is a large, mostly intact limestone cave system that is rare on the Hynam Range and is potentially older than any others in the region, including those within the World Heritage listed Naracoorte Caves.

The combination of associated features preserved within the Munro Karst, such as large caves with multiple levels of passage, subaqueous speleothems, bedded calcite raft deposits, calcite and gypsum minerals, sediment deposits, solution pipe infills, and vertebrate fossil breccias is rare for the South East. Scientific investigation of the cave system would improve understanding of the natural history of South Australia, specifically its speleological, palaeontological and geological history.

Statement of Designation: Speleological

Munro Karst contains multiple karst and cave features which hold high value for speleological research. Included among these are speleothems, sediments and fossils that can be dated using numerical techniques to elucidate the age of the cave system and preserved fossil faunas.

Caves at Munro Karst may represent the earliest period of development in the Naracoorte area as they are positioned on the Hynam Range, which is of uncertain age but potentially up to two million years old. Therefore, the caves and associated fossils and speleothems may yield the only early Pleistocene cave deposits in South Australia.

The intact nature of much of the Munro Karst provides a rare representative area of surface karst that is largely degraded along the Hynam Range. The caves of the site are the largest, intact caves along the range and provide high scientific value for understanding cave development and karst landscape evolution in the State.

Elements of Significance:

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

- Caves within the site, including cave walls, floors, roof and entrances.
- Speleothems (calcite, gypsum) within the caves and quarry rockpiles including but not limited to flowstone, stalactites, stalagmites, columns, sub-aqueous crystal deposits, moonmilk, calcite covered root speleothems and other cave mineral features.

- Cave features including undisturbed sediments (naturally deposited), undisturbed cave floors and rock piles, *in situ* fossils (embedded in walls and trace fossils), natural collapses and rockfall formations.
- Surface karst features such as pavements, calcrete, cave entrances, and runaway holes.
- Vertebrate fossils, fossil breccias, solution pipe sediment fills.
- Evidence exposed and preserved in the quarry walls and floor, including but not limited to cave entrances, cave passages, solution pipes and their sediment infill, sediment deposits within exposed cave passages, calcite, calcified tree roots, limestone rocks, marine fossils, intact limestone rocks.
- Rock piles and limestone rubble with evidence of fossils, breccias, and cave minerals or features.

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

- Built structures.
- Fences, agricultural and residential infrastructure.

Relevant South Australian Historical Themes

The Munro Karst demonstrates the following historical theme:

Theme 1: Natural Environment.

1.1 Tracing climatic and topographical change.

1.2 Tracing the evolution of plants and animals.

Comparability / Rarity / Representation:

Munro Karst, located along the Hynam Range in the Naracoorte area, comprises a limestone karst topography situated within the broader Gambier Karst Province (White, 2023). Such areas are largely formed by the dissolution of carbonate bedrocks and are characterised by features such as caves, dolines, sinkholes, cenotes, surface pavements, poljes, streams and springs. They are integrated systems, incorporating the land surface to the subterranean caves and aquifer. Karst areas are of cultural significance to South Australia as important natural history and scientific sites.

Two key areas will be considered in this comparative analysis:

- Limestone caves and associated karst in South Australia
- Fossil caves in South Australia

Comparability with similar places entered in the South Australian Heritage Register - Limestone caves and associated karst in South Australia

Karst occurs in several areas of the State, notably the South East, Nullarbor Plain, Kangaroo Island, Yorke Peninsula, and the Flinders Ranges. Some components of these areas are entered into the SA Heritage Register, largely focusing on cave systems rather than karst landscapes specifically (see list below). The Munro Karst

holds several features typical of a karst landscape, including caves, surface pavements, and runaway holes. Although it is a small area within the broader Gambier Karst Province, it does not exemplify the full range of features for the region or the State. However, its significance lies in its location on the Hynam Range. Munro Karst contains the largest area of intact surface karst (the characteristic topography formed by dissolution of soluble rocks) remaining on the Hynam Range which is heavily degraded from land use activities and natural denudation. Munro Karst also preserves one of very few intact caves along the Hynam Range. Given the hypothesised age of the Hynam Range (~2 Ma), and the intactness of the system, the caves may yield key information regarding the earliest development of caves in the Naracoorte area.

Limestone caves are key features of South Australia's karst areas. Due to considerable differences in geological history, geomorphology, and natural values of the cave and karst sites listed on the SA Heritage Register, direct comparison may not be appropriate. However, considering the range of currently listed sites helps assess how Munro Karst fits within the context of limestone caves and karst in the State, highlighting its rarity and representation.

South Australian limestone caves entered in the SA Heritage Register (by region) include:

Gambier Karst Province, South East region of South Australia.

- Green Waterhole – Tank Cave Complex (SHP 26530). Extensive series of submerged cave passages containing fossils and other speleological features.
- Tantanoola Caves Complex (SHP 26555). Complex area of dolomitic karst containing multiple caves and karst features that contribute to understanding of geological and speleological development in the South East. Tourist site (Figure 1).
- Blanche and Victoria Fossil Caves (SHP 11604). Both caves contain large vertebrate fossil deposits and contribute to knowledge of the history of Naracoorte Caves. Tourist site (Figure 1).
- Naracoorte Caves Complex, Naracoorte Caves National Park (SHP 26459). Expansive series of caves containing vertebrate fossil deposits of Middle to Late Pleistocene and Holocene age, spectacular calcite decorations and other features of scientific and historical significance. Tourist site.
- Engelbrecht Cave (SHP 14733). An important element in the geological history of Mount Gambier, it represents a cave feature known as a doline and contains a large, partially submerged cave system. Tourist site.
- Umpherston Sinkhole (SHP 14734). Two dolines and associated collapse sinkholes. Historically used for garden plantings. Tourist site.
- Cave Gardens Reserve (SHP 14725). Encompasses a large sinkhole cave of geological and historical importance. Tourist site.

Yorke Peninsula.

- Corra Lynn Cave (SHP 22798), Curramulka. The largest cave system in the State containing 14km of passages and chambers. Contains Pliocene to Miocene aged vertebrate fossils.

Nullarbor Plain.

- Koonalda Cave (SHP 14250). Large collapse entrance leads to an extensive cave containing lakes and significant First Nations Cultural Heritage (Figure 1).

Kangaroo Island.

- Kelly Hill Cave, Kelly Hill Caves CP (not listed, but identified for assessment) – contains a large cave system with superlative calcite decorations and Late Pleistocene fossil deposits. Tourist site.

Figure 1. Tantanoola Tourist Cave (top left). Blanche Cave, Naracoorte Caves (top right). Koonalda Cave (bottom).

Source: S. Bourne, 2005;E. Reed, 2021; S. Bourne, 2009.

Comparability with similar places entered in the South Australian Heritage Register - Fossil caves in South Australia

Limestone caves are composed of fossiliferous rock, which preserves fossil faunas accumulated at the time of deposition. These fossils typically include marine species, with common invertebrate groups and occasionally vertebrates. The Munro Karst limestone contains evidence of numerous forms, including bivalves, gastropods, and

bryozoans. Although these fossils are not considered 'more' or 'less' significant than others in the State, they hold scientific importance as comparative assemblages for understanding the Miocene marine faunal successions of the State.

Caves may also contain the fossil remains of vertebrate species that entered through an open entrance and became buried within the cave sediments. These vertebrate fossils are rare compared to those found in the limestone. Vertebrate fossil deposits in caves are typically rich and diverse, providing valuable information about past biodiversity and environments. South Australia has a rich record of cave vertebrate fossil deposits, with several key systems included in the SA Heritage Register (listed below). While these systems contain more abundant fossil assemblages than currently known from Munro Karst, they do not cover the early Pleistocene, which is potentially preserved at this site. The caves of Munro Karst contain bone breccias preserved as hardened solution pipe fills, along with fossil-bearing sediments. Much of the sediment within the caves remains intact and in untouched condition. The vertebrate fossils visible within these sediments are in a good state of preservation and appear to be plentiful. While the bone breccias are mainly found in the rockpiles within the quarry, there is strong potential for further, intact examples to be preserved within the karst.

South Australian caves with abundant vertebrate fossil assemblages include:

- Corra Lynn Cave (SHP 22798), Curramulka – contains the oldest cave vertebrate fossil deposits in South Australia, which may be as old as Miocene or Pliocene (see Reed, 2023 for a review).
- Naracoorte Caves Complex, Naracoorte Caves National Park (SHP 26459) – is World Heritage listed for its extensive record of fossil vertebrates spanning the past 500,000 years. The oldest dated deposit in the park is within Cathedral Cave where the lower excavated unit dates to ~528 ka (Prideaux *et al.*, 2007).
- Blanche and Victoria Fossil Caves (SHP 11604), Naracoorte Caves National Park (– Blanche Cave contains extensive vertebrate deposits spanning the past 65 ka (Macken and Reed, 2013). Victoria Fossil Cave (Figure 2) contains multiple dated fossil deposits spanning the Late to Middle Pleistocene (Wells *et al.*, 1984; Moriarty *et al.*, 2000; Reed and Bourne, 2000).
- Green Waterhole – Tank Cave Complex, Tantanoola (SHP 26530) – contains large deposits of Late to Middle Pleistocene vertebrate fossils in submerged underwater caves (see Reed, 2023 for a review).
- Kelly Hill Cave, Kelly Hill Caves CP, Kangaroo Island (not listed, but identified for assessment) – contains extensive Late Pleistocene fossil deposits preserved within sediment deposits in a large limestone cave (McDowell *et al.*, 2013; Reed, 2023).

Rarity and representation

Figure 2. Victoria Fossil Cave, Naracoorte Caves.

Source: E. Reed, 2025.

The significance of Munro Karst relates to its location, potential age, intactness, and the diversity of physical evidence of importance for scientific investigation. It is uniquely placed to address key gaps in scientific knowledge regarding the timing of cave development and vertebrate fossil accumulation in the State during the early part of the Pleistocene. It may serve as the 'missing link' for understanding the earliest history of caves in the South East region. The information provided in this assessment has been compiled from the initial investigations and exploration of the accessible part of the cave system which is yet to be fully explored.

Key aspects of the Munro Karst reflecting its rarity and representation:

- Location: It is situated on the Hynam Range, likely the oldest of a series of coastal strandlines that reflect glacial to interglacial climate cycles and regional uplift during the Pleistocene.
- Intactness: Munro Karst preserves the largest intact area of surface karst remaining on the Hynam Range. This feature has been largely destroyed by land use and erosion making the Munro Karst a representative example of the Hynam Range karst.
- Cave preservation: It contains the largest, relatively untouched caves on the Hynam Range. Most of the caves listed in the previous section have been impacted by human activities such as exploration and land use. As the recently uncovered Munro Karst caves have had few people enter, they are more intact than most in the region, especially along the Hynam Range.
- Age: Since cave development in the Naracoorte area may be partially related to the deposition of the dune ranges and given that the Hynam Range is hypothesised to be as old as 2 Ma (million years old) (early Pleistocene), the

caves at Munro Karst may be the oldest in the region and significantly older than the Naracoorte Caves.

- Fossils: Vertebrate fossils found within the Munro Karst may be older than other deposits in the region, given the hypothesised age of the caves. Solution pipes, subsurface voids that form because of waterflow and can fill with sediment and trapped organisms, in this case vertebrates, are found in other limestone caves in the South East region; however, the hardened (rock rather than loose sediment) solution pipe fossil breccias found at this site are not observed in any other caves mentioned in this section. Early Pleistocene fossil deposits are currently unknown from any caves in South Australia.
- Cave features: The Munro Karst caves are not highly decorated like some of the other caves entered in the South Australian Heritage Register, but they do contain speleothems (mineral deposits that accumulate in caves e.g. stalactites and flowstones) that are rare or unique for the region. These include bedded calcite raft sequences, sub-aqueous calcite crystal pockets and infills with limestone voids. Of note is a large deposit of calcite covered tree root stalactites. Other features include hardened sediment filled solution pipes and 'embryonic' cave passage at multiple levels within the stratigraphy of the site.

Assessment against Criteria under Section 16 of the *Heritage Places Act 1993*. All Criteria have been assessed using the 2024 Guidelines.

(a) it demonstrates important aspects of the evolution or pattern of the State's history.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place should be closely associated with events, developments or cultural phases which have played a significant part in South Australian history. Ideally it should demonstrate those associations in its fabric.*
>
> *Places will not normally be considered under this criterion if they are of a class of things that are commonplace, or frequently replicated across the State, places associated with events of interest only to a small number of people, places associated with developments of little significance, or places only reputed to have been the scene of an event which has left no trace or which lacks substantial evidence.*

Criterion (a) focuses on the State's history. Munro Karst, it relates to Historic Theme 1: Natural Environment. However, the site relates to pre-history rather than documented history and better aligns with 'natural history'. As the site is assessed here to meet criterion (c) for its exceptional record of natural history, it is considered under that criterion and not here under criterion (a).

It is recommended that the nominated place **does not fulfil** criterion (a).

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

Criterion arguments have considered the *Guidelines for State Heritage Places*:

The place should demonstrate a way of life, social custom, industrial process or land use which is no longer practised, is in danger of being lost, or is of exceptional interest. This encompasses both places which were always rare, and places which have become scarce through subsequent loss or destruction.

Places will not normally be considered under this criterion if their rarity is merely local, or if they appear rare only because research has not been done elsewhere, or if their distinguishing characteristics have been degraded or compromised, or if they are at present common and simply believed to be in danger of becoming rare in the future.

The scientific value of the Munro Karst means that it is defined as a site of cultural significance according to definitions outlined in the *Burra Charter*. The site contains features that are rare in the context of South Australian karst and could be considered endangered if quarrying were to continue at the site. However, assessment of their cultural significance under criterion (b) requires further scientific research to understand the full extent of the cave system, the age of the fossil deposits and speleothems. This research may provide information that would allow alignment with this criterion to be considered in future. At this stage, given the scientific value of the caves, the Munro Karst is better represented under criterion (c).

It is recommended that the nominated place **does not fulfil** criterion (b).

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

Criterion arguments have considered the *Guidelines for State Heritage Places*:

The place should provide, or demonstrate a likelihood of providing, information that will contribute significantly to our knowledge of the past. The information should be inherent in the fabric of the place. The place may be a standing structure, an archaeological deposit or a geological site.

Places will not normally be considered under this criterion simply because they are believed to contain archaeological or palaeontological deposits. There must be good reasons to suppose the site is of value for research, and that useful information will emerge. A place that will yield the same information as many other places, or information that could be obtained as readily from documentary sources, may not be eligible.

Munro Karst holds significant cultural heritage value due to its scientific importance. When assessed against the *Guidelines for Interpreting State Heritage Criteria* (South Australian Heritage Council, 2024), there is strong evidence that the site is likely to yield information that contributes to an understanding of the State's natural history.

It contains speleological, geological and palaeontological heritage preserved in caves and karst features that will contribute to an understanding of karst geology, palaeontology and the evolution of caves systems in South Australia. The site provides a window into a poorly understood area of the broader Naracoorte karst landscape (the Hynam Range) and offers a unique opportunity to reveal the age and evolution of the area via scientific research. Careful analysis of the structure of the caves and

karst, dating of associated sediments and speleothems, and identification of vertebrate fossils would enable reconstruction of the earliest history of cave formation and biodiversity in the region.

The following outlines the aspects of the State's speleological, geological and palaeontological history demonstrated by Munro Karst, the physical evidence to support this, and the meaningful contributions research might make to understanding the State's natural history:

Pleistocene landscape evolution of the Naracoorte and broader South East region, notably the timing and development of the sequence of coastal ranges related to past marine transgressions and regressions, regional uplift and tectonics.

- Evidence – karst features at the site can be studied to understand key processes involved in development of the landscape – including surface karst features, caves, and sediments.
- Research contributions – determining the precise age of the Hynam Range to confirm whether it is a) Pleistocene and b) the oldest in the series of Pleistocene dunes. This knowledge would fundamentally improve our understanding of the early Pleistocene history of the region as this is not represented by any known sites in the region. It would also provide important context for understanding the World Heritage Naracoorte Caves and the development of the Naracoorte Ranges.

Cave and karst development in the Naracoorte and broader South Australian context and its relationship to Pleistocene landscape evolution.

- Caves that contain multiple lines of evidence that can help elucidate the age of the system and how the caves formed – including structure and form, along with sediments, speleothems and cave minerals that can be dated using numerical dating techniques to yield precise ages.
- Research contributions – determining the chronological sequence of cave development in the region by precise dating of cave and karst features. This would provide the 'missing link' in knowledge about the earliest development of caves in the region and State and expand on recent related research focussed on the Naracoorte Caves (Weij *et al.*, 2022).

Pleistocene climate and the record of glacial to interglacial cycles in a regional and broader context.

- Speleothems, cave minerals, sediments and fossils that can yield information about past climate – geochemical and dating analyses of these materials can provide precise records of climate over time.
- Research contributions – dating of speleothems preserved in the quarry, using Uranium-series dating, would elucidate the age and timing of climate oscillations that can be deduced from the same materials via geochemical

analysis. If the caves are of early Pleistocene age this would greatly enhance the past climate record obtained so far from Naracoorte Caves (Weij, Sniderman *et al.*, 2024). This would be the oldest speleothem palaeoclimate record obtained from the State.

Biodiversity and evolution of Australian vertebrate faunas, potentially encompassing the early Pleistocene (2.58 to 0.77 Ma).

- Vertebrate fossils within sediments and breccia deposits that can be studied to analyse the range of species present at the time of accumulation, their ecology and relationship to other deposits preserved in the State. The hardened fossil breccia solution pipe infill deposits are not known from any other caves in South Australia.
- Research contributions – analysis of the species composition of the fossil samples from Munro Karst would greatly enhance understanding of Pleistocene biodiversity in the Naracoorte region and the State. If they are early Pleistocene, they would be the oldest vertebrate fossils found in caves of the region and represent a time period not covered by any other cave site in South Australia.

The information that is likely to be yielded by scientific investigation of Munro Karst has not been previously documented or available from other sources because:

- Caves previously found on the Hynam Range are typically quite small or are heavily degraded by visitation, exploration, and land use practices (agriculture, rubbish dumping). Because of these factors, no other caves on the Hynam Range contain suitable materials with enough integrity and intactness for scientific investigation at the level of detail required to produce rigorous results.
- Munro Karst and its associated caves contain such a high diversity of features and materials for study that it is well placed to address the research themes outlined earlier. In the specific context of the Hynam Range and South East Region this is not provided by any other site; therefore, the level of scientific investigation that can be undertaken at Munro Karst has not been possible on the Hynam Range before.
- There has been little to no peer-reviewed, published research about the Hynam Range and its associated features. The age of the range and associated caves has only been estimated previously and not been tested using modern analytical techniques. Therefore, the information that Munro Karst can potentially yield is not currently available elsewhere.

The combined elements of significance within the site provide physical evidence that retain the level of intactness and integrity required to yield information through scientific investigation. The Munro Karst cave system has had very little visitation or exploration and as a result, contains pristine areas, representing intact values.

Although portions of the cave system have already been quarried, a large section of cave is preserved and is likely larger than currently known. There are many examples of the physical evidence outlined above in pristine and intact condition for scientific study. There is also enough material to allow preservation of representative samples for their intrinsic value. This will be important to maintain as they are representative of a system that is largely gone along the Range, or in poor condition. Further, due to the lack of disturbance to the cave system and the fact that much more of the system remains protected it is likely that undescribed species of short-range endemic cave invertebrate faunas are present in the caves.

Munro Karst preserves the largest remaining intact area of surface karst along the Hynam Range, as much of the dune is naturally eroded or destroyed by land use. Despite a long history of agricultural land use, the site integrity is good and conducive to scientific research. There is an opportunity to preserve the caves in good condition with limited access and carefully regulated research.

It is recommended that the nominated place **fulfils** criterion (c).

(d) it is an outstanding representative of a particular class of places of cultural significance.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place should be capable of providing understanding of the category of places which it represents. It should be typical of a wider range of such places, and in a good state of integrity, that is, still faithfully presenting its historical message.*
>
> *Places will not be considered simply because they are members of a class, they must be both notable examples and well-preserved. Places will be excluded if their characteristics do not clearly typify the class, or if they were very like many other places, or if their representative qualities had been degraded or lost. However, places will not be excluded from the Register merely because other similar places are included.*

Munro Karst holds several of the features that are typical of a karst landscape including caves, surface pavements and runaway holes. However, it is a small area within the broader Gambier Karst Province and does not exemplify the full range of features for the region in a manner that would allow it to be considered as an outstanding representative. Its significance as a karst landscape is related to its location on the Hynam Range and the potential to yield information of importance to understanding the State's natural history. Therefore, it better addresses criterion (c).

It is recommended that the nominated place **does not fulfil** criterion (d).

(e) it demonstrates a high degree of creative, aesthetic or technical accomplishment or is an outstanding representative of particular construction techniques or design characteristics.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

The place should show qualities of innovation or departure, beauty or formal design, or represent a new achievement of its times. Breakthroughs in technology or new developments in design would qualify, if the place clearly shows them. A high standard of design skill and originality is expected.

Places would not normally be considered under this criterion if their degree of achievement could not be demonstrated, or where their integrity was diminished so that the achievement, while documented, was no longer apparent in the place, or simply because they were the work of a designer who demonstrated innovation elsewhere.

Munro Karst is a natural history site and as such, does not demonstrate a high degree of creative, aesthetic or technical accomplishment. It is not an outstanding representative of particular construction techniques or design characteristics. Thus, it does not address the criterion.

It is recommended that the nominated place **does not fulfil** criterion (e).

(f) it has strong cultural or spiritual association for the community or a group within it.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

The place should be one which the community or a significant cultural group have held in high regard for an extended period. This must be much stronger than people's normal attachment to their surroundings. The association may in some instances be in folklore rather than in reality.

Places will not be considered if their associations are commonplace by nature, or of recent origin, or recognised by a small number of people, or not held very strongly, or held by a group not widely recognised, or cannot be demonstrated satisfactorily to others.

There is no evidence that the Munro Karst has a strong association with the Naracoorte community, or broader community of South Australia. It has an association with the family of the landowner, but that is confined to that small group. As the caves within the site are a recent discovery and have not received many visitors there is limited knowledge of the site and no strong cultural association for any particular group of people.

It is recommended that the nominated place **does not fulfil** criterion (f).

(g) it has a special association with the life or work of a person or organisation or an event of historical importance.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

The place must have a close association with a person or group which played a significant part in past events, and that association should be demonstrated in the fabric of the place. The product of a creative person, or the workplace of a person whose contribution was in industry, would be more closely associated with the person's work than would his or her home. Most people are associated with many places in their lifetime, and it must be demonstrated why one place is more significant than others.

Places will not generally be considered under this criterion if they have only brief, incidental or distant association, or if they are associated with persons or groups of little significance, or if they are associated with an event which has left no trace, or if a similar association could be claimed for many places, or if the association cannot be demonstrated. Generally the home or the grave of a notable person will not be entered in the Register unless it has some distinctive attribute, or there is no other physical evidence of the person's life or career in existence.

The Hynam Range could be associated with the eminent South Australian geologist Reg Sprigg, as he mapped and defined it in the 1950s (Sprigg, 1952). However, it is not a strong association, and he is best known for his discovery of the Ediacaran fossils in the Flinders Ranges (Sprigg, 1947, 1988). Future scientific research at the Munro Karst site will allow scientists to test Sprigg's hypotheses regarding the age of the Hynam Range and its origin. However, as the caves at the Munro Karst site have only recently been uncovered it cannot be argued that there is a special association with the life or work of Professor Sprigg or any other person or organisation or an event of historical importance.

It is recommended that the nominated place **does not fulfil** criterion (g).

PHYSICAL DESCRIPTION

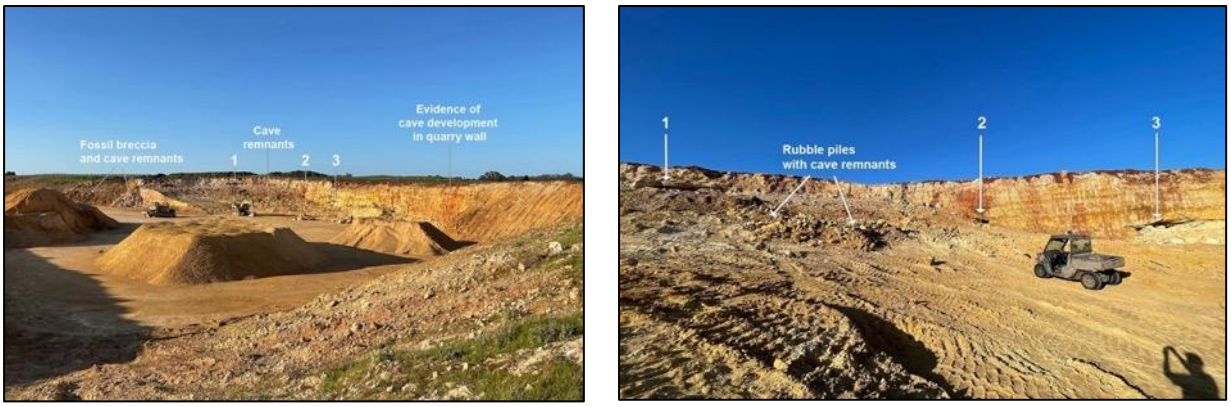
The Munro Karst site is located on the Hynam Range in the Naracoorte area of the South East region of South Australia. The site is situated on an agricultural property, part of which has been used for limestone quarrying over the past decade. The property occurs in an area that is characterised by limestone caves and surface karst features such as limestone pavements and runaway holes. The proposed Heritage Place encompasses a limestone quarry and adjacent intact karst landscape.

The site's boundary is approximately 1.99 km, and the area covered is ~0.16 km^2 or 14.6 hectares. The quarry's boundary is approximately 0.97km, with an area of 0.05km^2 or 4.64 hectares. The quarry covers approximately 31.7% of the nominated place, while 68.3% remains largely intact. Both the quarry and intact karst area contain significant values.

Caves

Large cave passages have been exposed by quarrying in three positions on the northeastern face of the quarry. Additional, cave passages were uncovered along the southern face and floor of the quarry. These represent a large, interconnected cave system. Prior to this there was no record of large caves at the property; however, surface karst features, and runaway holes were well known there prior to quarrying. These are often indicators of cave development below the surface and are important to karst hydrology.

The caves contain vertebrate fossils, sediments and speleothems, along with evidence of ancient cave development processes. The Munro cave system is likely to be extensive, with currently accessible caves representing approximately 60 metres of passage, 1 to 4 metres in height. There may be at least 100 metres of passage in the currently accessible portions and the system probably extends into the area of the karst that has not been quarried. Surface karst evidence indicates this is the case.



Munro Quarry showing holes leading to caves on the north-eastern wall – numbered 1, 2 and 3, position of rubble piles, and other features mentioned in the text (above and below).

Source: E. Reed, 2023.

The Munro Karst caves evident in the northeastern face of the quarry are described here as cave entrances 1,2,3 but note that these are breaches of the system due to quarrying and not natural entrances. There are also smaller breaches into the cave system evident on the southern face of the quarry, and natural entrance pathways in the intact surface karst areas. The following describes the accessible portions of the cave on the northeastern face of the quarry.

Cave entrance 1 – the largest of the accessible entrances, it leads to a cave chamber that is around 160m^2 with a ceiling height of around 1.5m. The central part of the chamber consists of rock piles, with fossil-bearing sediment deposits evident on the floor and along the cave walls. There are also areas of clay-rich sediments. Calcite speleothems (flowstone, stalagmites and stalactites) are present in the chamber, along with gypsum crystals on some of the limestone rubble. A singular feature of the chamber is a large area of fossil tree roots (also known as rootsicles or arborites – Smith, 2022) on the ceiling, that have developed into branching calcified root casts and calcite stalactites. The walls of the cave are covered with moonmilk in places, which is a white, micro-crystalline calcite deposit.

Features of the cave associated with entrance 1 include:

- An extensive area of calcite covered tree root speleothems known as rootsicles or arborites.
- Calcite stalactites, flowstone, stalagmites and moonmilk.

- Gypsum mineral formations on the sediment floor and rock surface.
- Sub-aqueous calcite mineral formations.
- Vertebrate fossils preserved within sediments on the floor of the cave, and within rubble and sediments at the entrance.
- Sediments on the cave floor including quartz, carbonate and clay-rich materials.

Cave entrance 2 – leads to an extensive portion of cave development totalling >60m of passages and chambers, much of which has a ceiling height of >1.8m. The entrance hole, broken into during quarrying, is approximately 2m wide and around 0.7m high. In the quarry wall above the hole is a large sediment infill deposit, along with calcite raft and sub-aqueous crystal deposits indicating past water levels.

Within the cave associated with entrance 2 are two distinct leads connected by a large chamber with upper and lower levels. The deeper section that leads on from the right of the entrance connects back to entrance 3 at the southern end. The left lead reveals an extensive section of cave passage that has multiple passages branching off from a central long passage that runs in a northerly direction. This passage has at least three distinct levels, which represent interconnected but different periods of cave development. Solution features (formed by ground water during cave development), are clearly observable on the cave walls and ceiling, along with sub-aqueous calcite crystal pockets. The lower level contains pristine sediment deposits and unusual calcite crystal clusters on the cave wall and rockpiles. Clay-rich sediments are present on the cave floor and adhering to the walls in places.

Cave entrance 3 – connects with the cave passages described above; however, it is unsafe for entry into the cave due to damage from quarrying. Part of the passages leading from this entrance are accessible from entrance 2. A large slab of white calcite flowstone is visible to the left of the hole but has mostly been quarried away. This flowstone overlies cave sediment deposited near the entrance. Entrance 3 is approximately 4m wide and around 0.5m high.

Features of the caves associated with entrances 2 and 3 include:

- Large, cave passages and chambers.
- Sediment infill deposit, calcite raft and sub-aqueous crystal deposits at the entrance in the northeastern face of the quarry.
- Flowstone and other calcite speleothems.
- Multi-level cave passage.
- Solution features on the cave walls and ceiling, along with sub-aqueous calcite pockets.
- Pristine sediment with associated calcite crystal clusters on the cave wall, rockpiles and sediment surface.
- Sediments on the cave floor including quartz, carbonate and clay-rich materials.

Fossils

Rockpiles throughout the quarry contain remnants of cave floors, speleothems, and fossil deposits. In the northern rockpile there are remains of hardened, fossil bone rich breccias derived from sediment infills of solution pipes and fissures. Vertebrate fossils are easily discernible in the breccias. A fossil tooth from a kangaroo was found in the breccia along with cranial material from small mammals and postcranial material from large mammals. Given the number of solution pipes evident in the quarry wall, it is likely that further breccias are preserved in the un-quarried portion of the site.

Within the caves, vertebrate fossil bones are present within cave sediments and on the floor surface in places, particularly in the cave associated with cave entrance 1. Marine invertebrate fossils are visible in the limestone in the quarry and cave walls.

As approximately 60% of the cave system remains undisturbed and from current evidence it is likely that undescribed species of short-range endemic cave invertebrate faunas are present.

Palaeontological features include:

- Hardened fossil breccia containing vertebrate fossils and representing ancient solution pipe fills.
- Fossil bones within sediments and on the surface of the cave floors and within rockpiles.
- Invertebrate fossils within the limestone of the quarry walls, rockpiles, and cave walls.

Other features of the quarry, and Surface karst

Calcite speleothems and rare bedded calcite raft sections have been found in rockpiles within the quarry. These features are also seen in the quarry walls and caves. Extensive development of solution pipes and fissures with associated sediment fills are visible in the exposed walls of the quarry. Entrances to a large cave system are present in the northeastern face of the quarry (as described in the previous section), and smaller openings have been uncovered in the southern face. Additional, small cave passages are visible in the northeastern face at a higher level than the previously described caves.

Extensive evidence of karst and cave development is present in Munro quarry and the adjacent block of land. On the land surface in the block adjacent to the quarry there is evidence of cave entrances, vadose (underground, above the water table) water flow pathways, limestone boulders, and runaway holes. On the southern side of the homestead there is a large, intact runaway hole, and another on the northern end of the quarry. The latter was filled in during quarrying and requires restoration, but the former is still active and intact. In karst landscapes, these features are characteristic of extensive subterranean development and key components of the

groundwater hydrological system. Intact karst pavements of weathered limestone are present on the surface in the area adjacent to the quarry.

Features of the surface karst and quarry include:

- Rockpiles – contain evidence of calcite speleothems including bedded calcite raft deposits.
- Solution pipe and fissure development with associated sediment infills. Some of these contain vertebrate fossils as evidenced by remnant fossil breccia found in the rockpiles.
- Entrances to a large cave system, and smaller openings to cave passage evident in the quarry walls and floor.
- Extensive and largely intact surface karst features including pavements, evidence of past water flow (karren), cave openings, solution pans, and runaway holes

Elements of Significance:

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

- Caves within the site including cave walls, floors, roof and entrances.
- Speleothems (calcite, gypsum) within the caves and quarry rockpiles including but not limited to flowstone, stalactites, stalagmites, columns, sub-aqueous crystal deposits, moonmilk, calcite covered root speleothems and other cave mineral features.
- Cave features including undisturbed sediments (naturally deposited), undisturbed cave floors and rock piles, *in situ* fossils (embedded in walls and trace fossils), natural collapses and rockfall formations.
- Surface karst features such as pavements, calcrete, cave entrances, and runaway holes.
- Vertebrate fossils, fossil breccias, solution pipe sediment fills.
- Evidence exposed and preserved in the quarry walls and floor, including but not limited to cave entrances, cave passages, solution pipes and their sediment infill, sediment deposits within exposed cave passages, calcite, calcified tree roots, limestone rocks, marine fossils, intact limestone rocks.
- Rock piles and limestone rubble with evidence fossils, breccias, and cave minerals or features.

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

- Built structures.
- Fences, agricultural and residential infrastructure.

HISTORY

Geological history

The Naracoorte and Hynam areas are situated in the western portion of the Otway Basin which is a rift basin formed during the late Mesozoic as Gondwana broke up and Australia separated from Antarctica (White and Webb, 2015). From the Late Eocene (~37 Ma) through the Middle Miocene (~15-12 Ma) the Gambier Limestone, a fossiliferous carbonate, was deposited through the region when it was covered by a shallow cool marine environment (Li *et al.* 2000; White and Webb, 2015). The Middle Miocene Naracoorte Limestone is the uppermost member of the Gambier Limestone (White and Webb, 2015). Significant uplift across south-eastern Australia, combined with a marine regression in the Late Miocene to Pliocene (~12 to ~5.3 Ma) marked the end of deposition for the Gambier Limestone. This was followed by a period of erosion and karstification (development of karst) of the exposed limestone (White and Webb, 2015). Tectonism during the same period may have resulted in movement of the underlying Kanawinka Fault which displaced the limestone in the Naracoorte area (White and Webb, 2015). A high sea-stand at around 10 Ma flooded the area again (White and Webb, 2015) and quartz-rich shoreline sediments were laid down during the Early Pliocene ~5.3 to 3.6 Ma (Belperio, 1995).

The fault scarp is overlain by Pleistocene beach dune deposits of the Bridgewater Formation (Figures 3 and 4), which incorporate a series of stranded coastal ranges that record sea level changes and regional uplift during the Pleistocene from around 1.3 Ma (Belperio, 1995; Idnurm and Cook, 1980; White and Webb, 2015; Murray-Wallace, 2018). These ranges extend from Naracoorte to the present coast. The dune range series was first mapped and reported by Tenison-Woods (1866) and later refined and described in detail by geologist Reg Sprigg (1952, 1979). The oldest of the Pleistocene ranges is typically considered to be the Naracoorte East Range which is dated between 1.1 Ma and 0.9 Ma (White and Webb, 2015); however, uncertainty remains regarding the ages obtained and a precise age has not been determined (Weij *et al.*, 2022). The Naracoorte West Range is thought to be between 0.88 Ma and 0.78 Ma old, but again these ages are uncertain (Weij *et al.*, 2022).

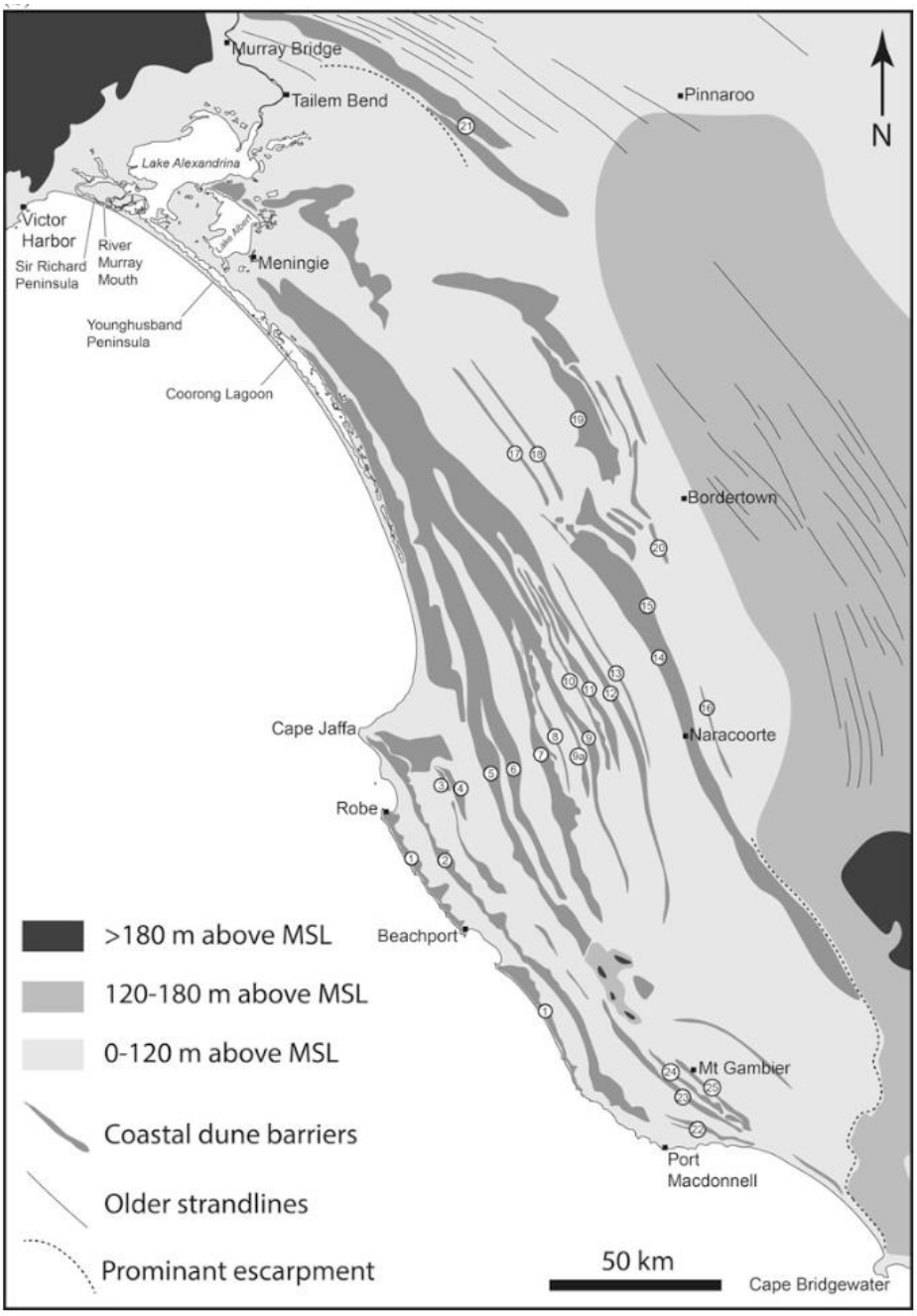


Figure 3. Pleistocene coastal barriers of the Coorong Coastal Plain. Relict coastal barrier landforms in the transect from Robe to Naracoorte are indicated; 14. West Naracoorte Range; 15. East Naracoorte Range; 16. Hynam Range.

Source: Murray-Wallace, 2018.

Further east of the Naracoorte East Range is the Hynam Range (location of Munro Karst), which is of unknown age. Sprigg (1952) referred to it as the Hynam dune, noting that the dune was older than the Naracoorte East Range and preserved as non-continuous remnants at a higher level. Sprigg proposed that the structure of the Hynam Range may support a Pliocene age after comparison with similarly aged ancient strandlines in the region (e.g. in the Tintinara district). Others have grouped the Hynam Range with Pliocene aged deposits (see Belperio, 1995), but at that time the lower boundary of the Pleistocene was defined as 1.8 Ma. Later, Sprigg noted that

estimations using 'radiation correlation dating' suggested an age of around 0.95 Ma, tying the dune development to sea level changes related to Milankovitch cycles (Sprigg, 1979). This relationship was tested by Idnurm and Cook (1980), who used palaeomagnetism to identify magnetic reversals in the regional dune sequence as a way of aging them; however, they did not consider the Hynam Range.

The most recent age estimate for the Hynam Range is older than around 0.99 Ma and potentially up to 2 Ma (see Murray-Wallace and Woodroffe, 2014 and Murray-Wallace, 2018 for an overview). The accepted start of the Pleistocene is now 2.588 Ma, which places the hypothesised maximum age of the Hynam Range within the Gelasian Stage (2.58Ma to 1.8 Ma) of the early Pleistocene. However, the age of the Hynam Range remains speculative in the absence of numerical dating using modern techniques.

Caves and vertebrate fossil deposits

Cave development in the Naracoorte area commenced at least 1.34 Ma before present (Weij *et al.*, 2022). The most extensive caves are located along the Kanawinka Fault escarpment, overlain by the Pleistocene Naracoorte East Range (White and Webb, 2015). The orientation of cave passages in the area is strongly controlled by NW/SE joints associated with the fault. The caves developed just inland of the ancient shoreline via dissolution at margin of the sea and freshwater (groundwater) lenses (White and Webb, 2015). After sea levels dropped, the caves drained and remained dry due to regional uplift. Extensive speleothem development commenced at least 1.34 Ma. Uranium-Lead and Uranium-Thorium dating of speleothems has provided insight into the timing of cave development (Weij *et al.*, 2022) and the nature of past climate in the region (Ayliffe *et al.*, 1998; Weij, Sniderman *et al.*, 2024). Over time, entrances formed in the caves via collapse and dissolution of the limestone to form solution pipes (Arnold *et al.,* 2022). Recent research suggests that most of these opened after around 600 ka before present (Weij *et al.*, 2022). The oldest reported fossil deposits from Naracoorte Caves are ~528 ka (Prideaux *et al*., 2007).

Once connected to the surface, the caves accumulated a range of materials from the land surface including sediments, pollen, charcoal, plants and vertebrates. Vast fossil-rich sediment deposits are present in many caves within the area, notably the Naracoorte Caves World Heritage Area (Reed, 2023). There are more than 200 registered cave and karst features in the Naracoorte region and many of these contain vertebrate fossils (Reed and Bourne, 2000). The fossil deposits at Naracoorte

preserve a diverse suite of vertebrates numbering over 130 species (Wells *et al.*, 1984; Reed, 2023). These include the iconic extinct Pleistocene megafauna.

Several caves are known from the Hynam Range, but none of them contain fossil deposits comparable to the Naracoorte Caves. Bone deposits found in the Hynam caves represent recent deposits and no Pleistocene material has been reported to date. Munro Karst contains fossil material preserved in hardened fossil breccias representing ancient solution pipe fills and contains material that is likely to be of Pleistocene age.

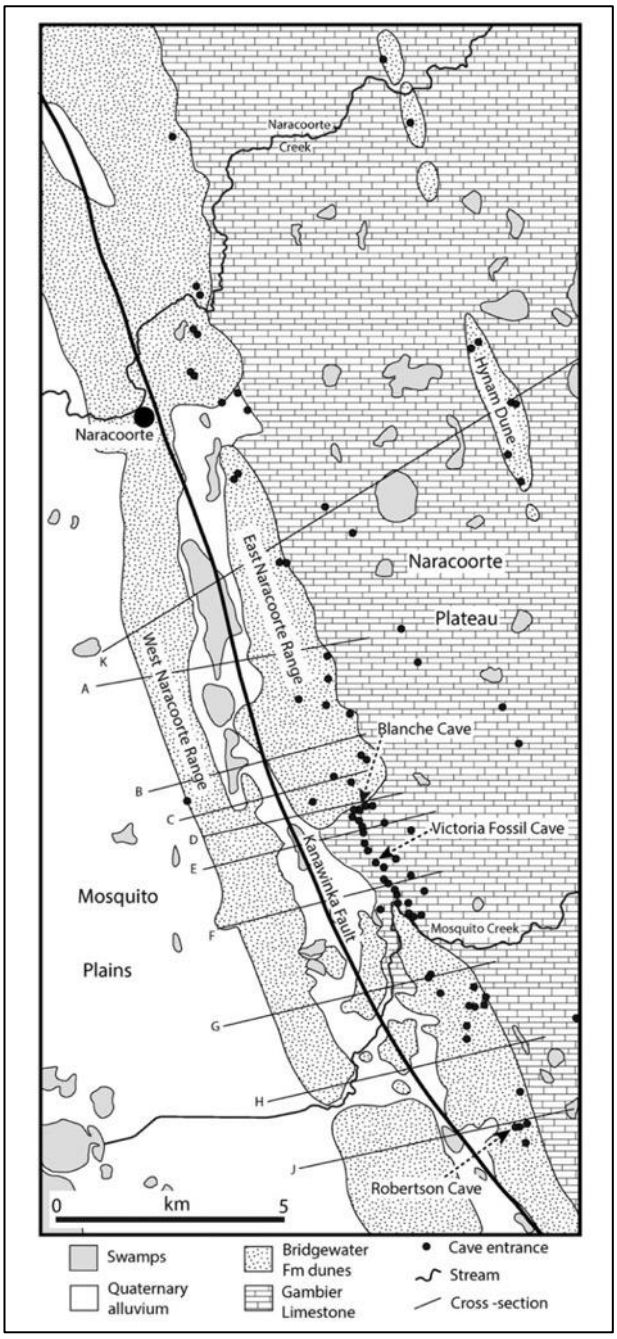


Figure 4. Quaternary dune ranges at Naracoorte and Hynam. The Hynam Range, Naracoorte East and Naracoorte West Ranges are indicated on the figure.

Source: adapted from White and Webb, 2015.

Human and recent history

Munro Karst is found on First Nations of the South East Country. Thus far, evidence of First Nations occupation has not been found within the cave.

European colonisation of the Naracoorte region began in the 1840s and the area rapidly became a centre for agricultural production – primarily wool, cereal crops and meat (Murdoch & Parker, 1963). Significant changes were made to the natural landscape as a result, including extensive land-clearing, and drainage of wetlands. Caves were known from the mid-1840s and became popular attractions for visitors and locals (Reed & Bourne, 2013; Reed, 2023). Some caves were heavily damaged by unregulated tourism and exploration (Reed & Bourne, 2013). In other instances, caves were destroyed, impacted by quarrying (Figure 5), or used as rubbish dumps (Figure 6). During the 20th Century, the availability of heavy machinery allowed for more extensive quarrying and ripping of the limestone for construction, agriculture and viticulture. Ripping of limestone in areas of shallow soils resulted in the destruction of surface karst, leaving few of these areas intact today (Figure 7).

Figure 5. Evidence of 19th Century limestone quarrying within Robertson Cave, Naracoorte Caves National Park.

Source: S. Bourne, 2010.

The Munro Karst site was probably used for agricultural purposes since early in the European history of the area. Fortunately, land use practices at the property have facilitated the preservation of parts of the surface karst which remain intact within the Munro Karst property. The property has been owned by the Munro family since 1977, and they are the current landowners. They use the property for agriculture, primarily livestock grazing.

Quarrying commenced at the property in 2012 (based on Google Earth imagery) and has remained active until recently. The quarry and associated lease is the main area included in the Munro Karst nomination. The quarrying activities were conducted to produce limestone rubble, largely for construction and road building. Evidence of caves within the area was uncovered during quarrying from at least 2022 (Munro family pers. comm.). This evidence included cave passages, speleothems, sediments and fossils.

Figure 6. Limestone cave historically used for rubbish dumping at Joanna, South East, SA. A. Rubbish and metal scrap completely filling the entrance. B. the same cave entrance following cleaning and restoration.

Source: S. Bourne, 2024.

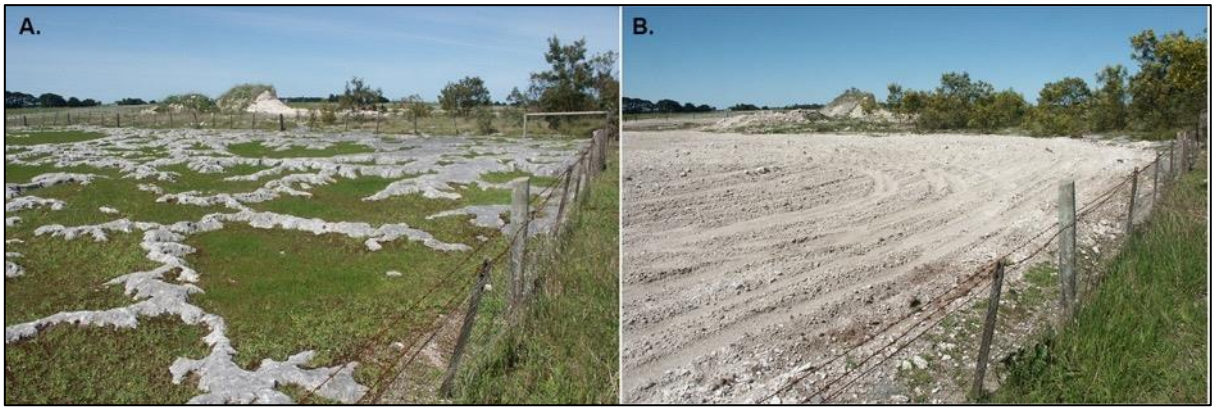


Figure 7. Destruction of limestone pavement by ripping in the Mount Gambier Region. A. Intact surface karst (October 2004). B. Same area after ripping by heavy machinery (September 2006).

Source: K. Grimes, 2006 with permission via S. Bourne.

Scientific investigation

In September 2023 local cave experts were invited to visit the site to inspect the caves. During the visit, fossils and other significant values were discovered and documented. Small samples of speleothems and fossil breccia were collected with permission. To date there has been no intensive scientific investigation of the site. The work that has been conducted so far includes documentation of cave features, minor sample

collection and qualitative interpretation of site history and cave development based on visual and material evidence preserved at the site. A sample of fossil breccia (Figure 8), sampled in September 2023, is currently being prepared for dating at the University of Adelaide OSL (optically stimulated luminescence) dating laboratory. The sample has undergone extensive preparation for dating analysis and has yielded enough quartz and feldspar to permit luminescence dating measurements to be taken. It is expected that results will be forthcoming later in 2025. The date obtained for the sediment component of the breccia will provide an age for the vertebrate fossils contained within it.

Figure 8. Fossil breccia from Munro Karst. A large fossil bone is visible in the centre of image, with smaller fossils visible preserved within the surrounding rock.

Source: S. Bourne, 2023.

Chronology

Year	Event
37-12 Ma	Late Eocene to Middle Miocene – the Gambier Limestone formed in the South East region when the area was covered by shallow cool water seas following final separation of Australia from Antarctica. The limestone formed from the calcareous shells and skeletons of marine invertebrates.
~12-2.58 Ma	Late Miocene to Pliocene (~12 to 5.3 Ma) end of Gambier Limestone deposition. Followed by erosion and karstification of the limestone and tectonism which displaced limestone in the Naracoorte area. High sea-stand at ~10 Ma, with deposition of shoreline sediments during Early Pliocene (~5.3 to 3.6 Ma).
2.58 Ma	Beginning of the Pleistocene Epoch
2 Ma	Deposition of the Hynam Range (unconfirmed, hypothesised age)
1.34 Ma	First evidence of cave development in the Naracoorte region. U-Pb dating revealed that the oldest known speleothems in caves along the

	Naracoorte East Range and the Naracoorte Plateau are at least 1.34 million years old.
~1.3 Ma	Sea-level changes and regional uplift reflected in series of coastal ridges deposited throughout the Pleistocene and extending from the Naracoorte East Range (oldest) towards the present coastline youngest Robe Range (~105 to 82 ka).
1.1 to ~900 ka	Deposition of the Naracoorte East Range
~780 to 880 ka	Deposition of the Naracoorte West Range
600 ka	Estimated timing of cave opening and earliest fossil accumulation for the Naracoorte Caves complex based on pollen and charcoal preserved in dated speleothems.
528 ka	Oldest dated vertebrate fossils from the Naracoorte region. These fossils were reported from Cathedral Cave within the Naracoorte Caves World Heritage Area.
~50 ka	First Nations arrival into the South East region.
1840s	European colonisation of the area and onset of agriculture. Caves become popular attractions in the South East.
1858	First written record of vertebrate fossils from caves at Naracoorte by Julian Tenison-Woods.
1952	Hynam 'Dune' mapped and defined by Reg Sprigg. Said it was oldest and may be Pliocene in age, though at the time, the Pliocene was defined as ending 1.8 Ma rather than the understood 2.58 Ma today.
1977	Munro family acquired the property
2012	Quarrying commenced
2022	Caves uncovered in the quarry.
2023	Caves reported by landowners and visited by scientists. Preliminary samples removed for dating
2024	22 August - Munro Karst nominated for State Heritage listing. 23 August - Munro Karst provisionally entered as a State Heritage place in the South Australian Heritage Register and Designated as a place of Speleological Significance.

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SITE RECORD

NAME:	Munro Karst	**PLACE NO.:**	**26606**

DESCRIPTION OF PLACE:	An area of limestone karst landscape that contains a cave system and palaeontological deposits.	
REGISTER STATUS:	Provisionally entered in the SA Heritage Register and Designated as a place of speleological significance. 23/08/2024	
CURRENT USE:	Agriculture (grazing) 1977 to current Limestone quarry 2012 to current	
PREVIOUS USE(S):	Agriculture Prior to 1977	
LOCAL GOVERNMENT AREA:	Naracoorte Lucindale Council	
LOCATION:	**Street No.:**	407
	Street Name:	Hynam Caves Road
	Town/Suburb:	Mount Light
	Post Code:	5271
LAND DESCRIPTION:	**Title Reference:**	CT 6100/748, D88823 A100, CR 5677/773, H440700 S487, CT 6100/749 D88823 A101
	Hundred:	Jessie
	Encumbrance:	Pastoral and Mining.

PHOTOS

NAME: Munro Karst **PLACE NO.:** 26606

Cave entrance 1 showing the rubble at the entrance and the access point to the left.

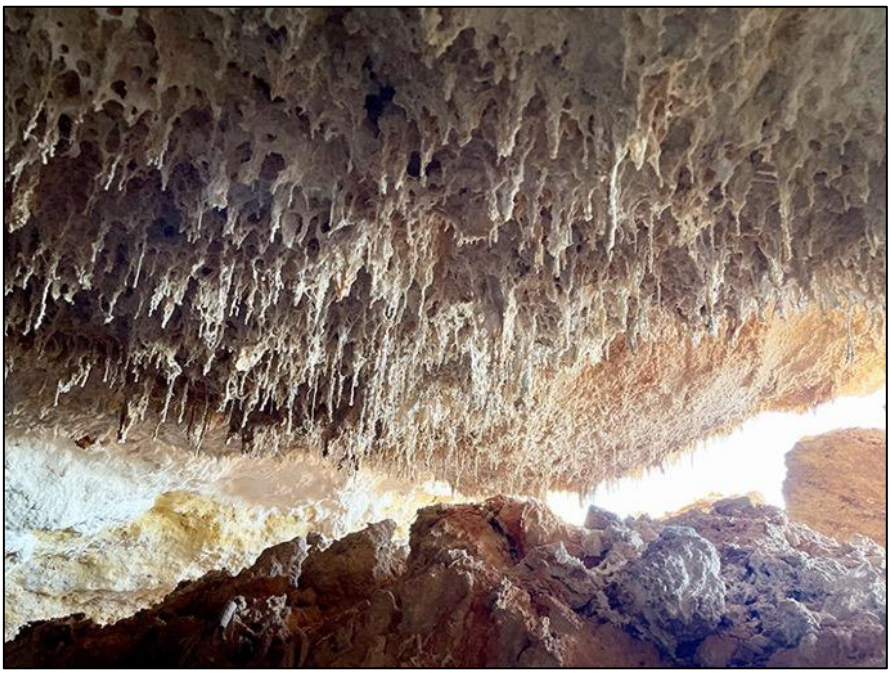
Source: E. Reed, 2023

Left: Gypsum crystals on the cave floor. Right: Fossil bone preserved in the sediment on the cave floor (gloved finger for scale).

Source: E. Reed, 2023.

PHOTOS

NAME: Munro Karst **PLACE NO.:** 26606



Calcite decorations formed on tree roots. Cave entrance 1 is visible at rear, Munro Karst.

Source: S. Bourne, 2023.

Calcite stalactite decorations formed on tree roots, Munro Karst.

Source: S. Bourne, 2023.

View within the chamber looking towards cave entrance 1, Munro Karst. Sediment deposits are preserved along the left wall and under the rubble floor. These contain vertebrate fossils.

Source: E. Reed, 2023.

View of the left wall of the chamber in the cave associated with cave entrance 1. The wall is covered with white, calcite moonmilk.

Source: E. Reed. 2023

PHOTOS

NAME: Munro Karst **PLACE NO.:** 26606

Cave entrance 2 showing the hole that was exposed and the infill breccia of red sediment.

Source: E. Reed, 2023.

Infill sediment and calcite fills above entrance 2 (left). Detail of the fill showing sediment and calcite crystal casing (right).

Source: E. Reed, 2023.

PHOTOS

NAME: Munro Karst **PLACE NO.:** 26606

Cave associated with entrance 2. Multi-level cave development (top left). Large passage development heading north from entrance 2 (top right). Cave ceiling showing solution features (bottom left). Sub-aqueous calcite crystal pocket in ceiling (bottom right).

Source: E. Reed, 2023.

NAME: Munro Karst **PLACE NO.:** 26606

Lower level of the cave leading from entrance 2. Pristine sediment floors and clusters of white calcite crystals on the walls are shown.

Source: S. Bourne, 2023.

Deposit of white calcite flowstone overlying sediment adjacent to cave entrance 3.

Source: E. Reed, 2023.

PHOTOS

NAME: Munro Karst **PLACE NO.:** 26606

Fossil breccia remnants found in the northeast rockpile. White coloured fossil bones are clearly visible within the hardened red sediment (top left and right). Fossil kangaroo tooth (bottom left). Bedded calcite crystal raft deposit (bottom right).

Source: E. Reed, 2023.

PHOTOS

NAME: Munro Karst **PLACE NO.:** 26606

Surface karst features in the block adjacent to the quarry. Surface pavement and solution features are visible.

Source: E. Reed, 2023.

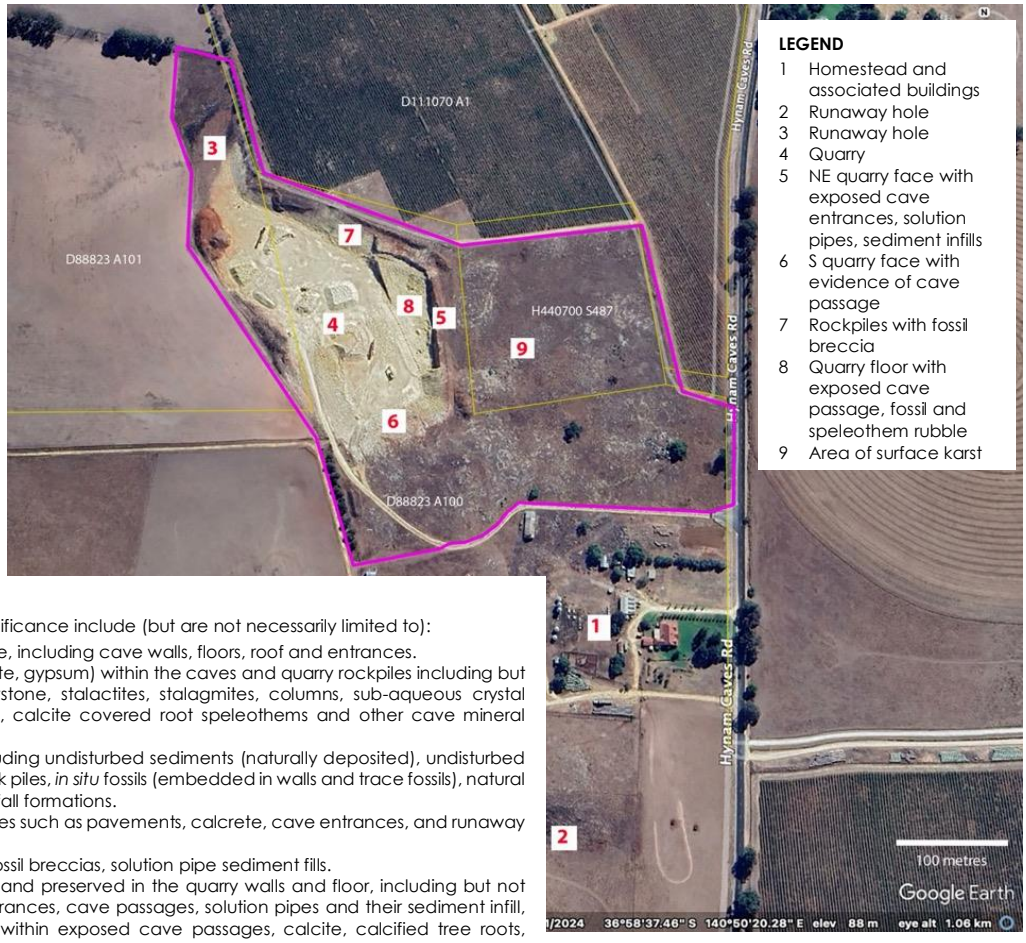
NAME: Munro Karst **PLACE NO.:** 26606

Map showing the approximate extent of the Hynam Range (yellow) and areas of surface karst along that range (white). Munro Karst is indicated, clearly showing the largest portion of remaining surface karst on the range. Adapted from Google Earth imagery.

Source, E. Reed 2024.

SITE PLAN

NAME: Munro Karst **PLACE NO.:** 26606



Elements of Significance:

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

- Caves within the site, including cave walls, floors, roof and entrances.
- Speleothems (calcite, gypsum) within the caves and quarry rockpiles including but not limited to flowstone, stalactites, stalagmites, columns, sub-aqueous crystal deposits, moonmilk, calcite covered root speleothems and other cave mineral features.
- Cave features including undisturbed sediments (naturally deposited), undisturbed cave floors and rock piles, *in situ* fossils (embedded in walls and trace fossils), natural collapses and rockfall formations.
- Surface karst features such as pavements, calcrete, cave entrances, and runaway holes.
- Vertebrate fossils, fossil breccias, solution pipe sediment fills.
- Evidence exposed and preserved in the quarry walls and floor, including but not limited to cave entrances, cave passages, solution pipes and their sediment infill, sediment deposits within exposed cave passages, calcite, calcified tree roots, limestone rocks, marine fossils, intact limestone rocks.
- Rock piles and limestone rubble with evidence of fossils, breccias, and cave minerals or features.

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

- Built structures.
- Fences, agricultural and residential infrastructure.

Munro Karst, 407 Hynam Caves Road, Mount Light, 5271, South Australia.
CT 6100/748, D88823 A100, CR 5677/773, H440700 S487, CT 6100/749 D88823 A101
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LEGEND

Parcel boundaries (Indicates extent of Listing)

Elements of Significance for State Heritage Place (indicated by numbers and legend).

See Summary of State Heritage Place for final Site Plan