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Calibrating Holocene human–environment interactions using ancient narratives: The example of Ngurunderi in South Australia

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ABSTRACT



The essence of stories of human–environment interactions can be preserved in oral contexts for millennia, creating novel opportunities for humanizing the past. This study examines stories (knowledge-rich narratives) about the ancestral being Ngurunderi, told by Ngarrindjeri peoples of South Australia. Three elements of the Ngurunderi narrative are considered. The first recalls his journey along a 170-km long coastal barrier (Younghusband Peninsula) when this was continuous. The second discusses Ngurunderi's encounters with what are now islands off the Fleurieu Peninsula, some of which he created, interpreted as memories of when sea level was lower and “islands” were contiguous with the mainland. The third refers to the crossing of a land connection between modern Kangaroo Island and the Fleurieu Peninsula, later submerged to form Backstairs Passage. Using paleogeographic data, the most recent times at which each narrative element could have taken place and observed by people are estimated. This research suggests that: (1) stories about Younghusband Peninsula may be >6700 years cal BP; (2) islands off the Fleurieu Peninsula were created 6800–10,400 cal BP; and (3) submergence of Backstairs Passage occurred 11,000–10,100 cal BP. Narratives are linked to the period of early Holocene sea-level rise, the rapid 8200-cal BP sea-level rise event, and stabilization of sea level 7000–6000 cal BP. These narratives humanize the past and provide information that can be interpreted as both observed coastal and seascape changes as well as past human responses to rising sea level that can inform our future encounters with coastal-landscape change.

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Introduction

Understanding the processes involved in Holocene landscape evolution depends largely on dating key sites/strata and inferring details of the events they represent. While this approach can yield robust science-based models of landscape change, they generally say little about the impacts on humans of these changes; such details are invariably topics for speculation. This study takes a contrasting approach, interpreting ancient stories (ancestral narratives) that include landscape descriptions to reconstruct components of that landscape at particular periods, and to show how humans—in their own words—were affected by and interpreted the landscape changes they observed. Building on recent studies which demonstrate that narratives recalling details of memorable landscape changes can in optimal contexts be passed down for thousands of years (Hamacher et al. 2023; Hemming, Jones, and Clarke 1989; Holdgate, Wagstaff, and Gallagher 2011; Nunn 2018; Roberts et al. 2020, 2023), this study explores the possibilities and constraints imposed by Holocene coastal-landscape change on human activities in parts of South Australia.

This research uses a detailed and comparatively well-documented narrative to answer questions about Holocene coastal-island landscape/seascape changes as well as human-environment interactions in South Australia, information that cannot be gleaned from any other source. Comparison between landscape changes recorded in the narratives and those deduced from conventional landscape-history analysis allows insights into the nature and succession of particular events and the antiquity of the stories in which their descriptions are preserved. Most of the events described are attributable to the effects of postglacial sea-level rise, which occurred around Australia between approximately 15,000 and 6000 years ago, and involved a net rise of 125–130 m, reducing the landmass of this already long-inhabited continent by almost a quarter.

The elements of the Ngurunderi narrative on which this paper focuses are described and illustrated in the next section. The ways in which ages are assigned to these elements, specifically the human-environment interactions and encounters they describe, are then explained. There follows a discussion of how ancient narratives (like the Ngurunderi narrative) can inform the understanding of deep-time landscape and seascape changes, and the ways these affected human existence.

Ngurunderi

Stories about a man named Ngurunderi (Ngurunduri/Nurunduri/Ooroondorie) are well known among the Indigenous (Aboriginal) peoples of South Australia, especially the Ngarrindjeri. The Ngurunderi narrative is essentially that recalling the journey of its eponymous ancestral being throughout South Australia, commencing in the upper parts of the River Murray (Roberts et al. 2023), an element not considered in this study, and then continuing from Lake Albert through the Coorong wetlands, along Younghusband Peninsula and the southern Fleurieu Peninsula, ending in Kangaroo Island (Figure 1). This study is concerned largely with three particular parts of the narrative, namely Ngurunderi's journeys along Younghusband Peninsula (from Kingston to Goolwa), that along the southeast coast of Fleurieu Peninsula (from Middleton to Kings Point), and that referring to the crossing of Backstairs Passage, which today separates the western



Figure 1. The study area extends along the coasts of the Coorong, Fleurieu Peninsula and Kangaroo Island (South Australia). Smaller map shows the location of the study area within the Asia-Pacific region.

end of Fleurieu Peninsula from Kangaroo Island. While European place names are used in this paper, we also privilege Ngarrindjeri toponyms (Table 1).

The oral traditions (and those recently transcribed) that comprise the Ngurunderi narrative are likely to include content from different places and time periods that became incorporated into the accounts of oral storytellers over several thousand years; Aboriginal oral traditions are flexible and stories may vary according to the time and place of telling (Roberts et al. 2023). Surviving versions of the narrative are likely to conflate events in the lives of several memorable individuals, maybe only one named Ngurunderi, to create a narrative palimpsest in which details of human encounters and observations of landscape, often over many millennia, have been preserved, a comparable situation to elsewhere in the world (Barber and Barber 2004; Cruikshank 2007; Taggart 2018).

While there are those who argue that such processes invalidate the preservation of empirical details in such stories (Henige 2009; Sansom 2006), most authorities have adopted more nuanced positions. The decolonizing of (non-Western) “myth” and the ways it was constructed (and misrepresented) are considered foundational to the recognition of the histories they represent as accounts of human pasts (Bacigalupo 2013; Echo-Hawk 2000; Marker 2015). Such invalidation also discounts the opportunities for “knowledge exchange” (or two-way learning) and approaches that explore the complementarity between Indigenous and Western knowledges, as well as their difference, in order to find ways for “Indigenous frameworks” to transform academia (Atalay 2020); it

Table 1. Synonyms and name variants for key people and places in the Ngurunderi narrative.

Common Indigenous name	Common English name	Alternative names (selected)
PEOPLE		
Ngurunderi	–	Ngurunduri, Nurundere, Nurunduri, Ooroondorie
Parampari	–	Parrimparrie, Evil One
PLACES		
Tjirbuk	Blowhole Creek	Tjirbuki
Kalawongk	Callawonga Creek	
Parewarangk	Cape Jarvis	
Dalwawangk	Coolawang Creek	Kulawangk
Kurangk	Coorong	
Kangjeinwal	Freemans Nob	Kandjeinwald, Kainjenauld
Kaiki	Granite Island	Kaiki, Kaikalamb
Latung	Hindmarsh River	
Muerang	Inman River	Muwerang
Karta	Kangaroo Island	Ngurungau, Ngurungaui
Walderineind	Kings Point	
Ratalang	Middleton	Ratalwar
Tapawal	River Murray Mouth	Tapalwora
Wetung	Pullen Island	Lipson's Island
Longkuwar	Rosetta Head	The Bluff, Longkewar, Kungkengguwar
Jundi	Seal Island	Yandi
Dangkalyewongk	Tunkalilla Beach	Tankalilla
Meralang	The Pages	Rhunjullang
Wittunggunggul	The Sisters	
Pultung	Victor Harbor	
Ulemur	Younghusband Peninsula	
Ngurunderwerkngali		Ngurunduwurkngali

is imperative that any consideration of traditional narratives be done with Indigenous peoples.¹ A related challenge has been to overcome the prejudices of researchers to recognize orally-communicated knowledges as information sources that enabled human societies to be sustained for most of the time they have existed—and often remain the most effective way for the future in particular contexts (Fakhriati et al. 2023; Sugiyama 2021).

In regard to Indigenous Australian stories of coastal-landscape change, a potent argument in favor of their empirical basis is the fact that, when divested of narrative embellishment, such stories tell essentially the same things. This implies that, in optimal contexts, observations of events which occurred millennia earlier may be preserved in such stories (Campbell 1967; Hamacher et al. 2023; Morphy et al. 2020; Nunn and Reid 2016; Sharpe and Tunbridge 1999). This shows that Indigenous interpretations of geological events often align with more recent retrodictive western-scientific reconstructions of these, underscoring the point that Indigenous people were and are expert observers of the lands they occupied and that Indigenous/traditional narratives can provide valuable insights into the nature and effects of such events in deep time (Masse 2007; Piccardi et al. 2008; Roberts et al. 2023). Independent dating of events such as volcanic eruptions, astronomical alignments, and postglacial sea-level rise show that the observations which seeded some of these stories occurred thousands of years ago (Hamacher 2022; Hamacher et al. 2023; Nunn 2018; Nunn et al. 2019; Wilkie, Cahir, and Clark 2020).

Indeed, recent scholarship has emphasized the links between archaeology and oral traditions, broadly framed, to discuss issues as varied as the symbolism of settlement

design and introduction of exotic macaws in the southwest USA (Bloch 2019; Kelley 2020), and the archaeological evidence “to support the view that the traditional narratives [of Polynesian peoples] relate to real persons and events” (Kirch 2018, 275).

While acknowledging the challenges, especially the unknowables, involved in the interpretations of such ancient stories, it is probable that the surviving stories represent only a small fraction of the range of stories that existed. Most extant details come from men who had opportunities to share them with non-Indigenous (mostly male) listeners who transcribed them. Women’s stories, while once equally numerous, made it through this cultural filter far less commonly, meaning that extant stories foreground masculinity in ways that are unlikely to represent their true diversity, either today or in the pre-contact past (Bell 1998). Similarly, in oral societies, there is not a single version of a particular narrative (as is often the case in literate societies) but multiple variants that may each privilege the interests of particular groups or a favored version of particular events. Once such stories start to be written down, there is commonly little interest in recording their diversity which has led to a situation where a single version, arbitrarily chosen, is by default considered the definitive one (Ong 1982).

Ngurunderi travels from Lake Albert through the Coorong and along the Younghusband and Sir Richard Peninsulas

The early part of the Ngurunderi narrative, recently been summarized by Roberts et al. (2023), involves him traveling down the River Murray valley in pursuit of a giant fish, the Murray Cod (*pondi*). The part relevant to this study begins when Ngurunderi smells fish (*tukeri*), forbidden to women, being cooked by his two wives at Kurelpang on the eastern shore of Lake Albert (see Figure 1). Knowing Ngurunderi was approaching and would be angry, the two women make a reed-raft and pole across the lake to evade him. They then head southeast into the Coorong, pursued at some distance by Ngurunderi (Berndt 1940; Clarke 1995; Woods 1879).

Close to Kingston, near Blackford according to Albert Karloan (Berndt 1940, 174), Ngurunderi encountered the sorcerer Parampari and the two quarreled, culminating in Ngurunderi slaying him. He placed the body on a blazing pyre at The Granites, a conspicuous outcrop of granitic rocks on the beach of Younghusband Peninsula 20 km north of Kingston (Dillenburg et al. 2020), before walking briskly north along its entire 170-km length at a time when it appears to have been a continuous barrier island extending to the River Murray Mouth, much as today.

Different versions of the Ngurunderi narrative have him collecting water and food in various places and spending some time at what may have been his home at Ngurunderwerknkali on the landward side of Younghusband Peninsula (Wilson 2017, 64). For example, at Wunjurem, Ngurunderi dug a hole (soak) in the sand to find fresh water for drinking; then, “as his head touched the sand, the concave depression it made ... was transformed to rock” (Berndt 1940, 176). Eventually, deciding to renew his pursuit of his wives, he walked northwest across the mouth of the River Murray and along the Sir Richard Peninsula to Goolwa, at the eastern extremity of Fleurieu Peninsula.

Ngurunderi and the formation of islands off the southeast Fleurieu Peninsula

Off the southeast coast of Fleurieu Peninsula lie several islands, the largest of which all feature in the Ngurunderi narrative, typically as places he created or visited. In both of these meanings, it is likely that at the time/s of Ngurunderi, what are now nearshore islands were attached to the mainland. The fact that they are today islands therefore means that, for the Ngurunderi narrative to appear factual to more recent audiences, these islands were either “created” by Ngurunderi at the time of his visit or “walked” to by him, perhaps as a giant capable of over-water strides, a detail featuring in some accounts. For example, one of the earliest written reports states that wherever Ngurunderi went “he spread terror among the people, who were dwarfs compared with him” (Meyer 1846, 205).

This is a common type of narrative motif in stories that have been passed down across sometimes hundreds of generations from times when (coastal) landscapes were different from those of today and people walked across places that were later submerged. It may represent an example of the rationalization syndrome, a post-observation rationalization of events (Barber and Barber 2004). It is common in coastal parts of northwest Europe where numerous stories interpreted as submergence memories involve giant beings able to effortlessly stride across what are today wide water/ocean gaps. For example in Australia, this explanation is explicit in Malgana (Shark Bay) stories about when their giant ancestors walked between Denham (on the mainland) and Dirk Hartog Island (Wirruwana); clay pans (*birridas*) in the landscape are interpreted as their footprints (Nunn et al. 2022). The reasoning is that, as oral stories about a time when an ocean gap was dry land become more strained (less plausible) in their retelling, storytellers will often introduce rationalizing elements to convince their audiences of the story’s foundation in truth. Thus, Ngurunderi must have been a giant if he walked to what is now a nearshore island or he must have been endowed with superhuman powers to have magically “created” islands if they did not exist when he was there but do so today.

Figure 2 shows the southeast coast of the Fleurieu Peninsula between Middleton and Kings Point, and includes all the nearshore islands mentioned in one or other extant versions of the Ngurunderi narrative. Also shown is the route followed by Ngurunderi in pursuit of his two wives.

When Ngurunderi arrived at Freemans Nob, “he threw two small nets, called *witti*, into the sea, and immediately two small rocky islands arose, which ever since have been called Wittungenggul” (Woods 1879, 60). These islands are likely to be what are today called The Sisters although no known version of the narrative states this. Later, perhaps having caught enough fish and “having no further use of his fishing net, he walked across to Wetung (Pullen Island) and threw it on the first rock” (Berndt 1940, 178). It is not possible to walk to Pullen Island today, so it is inferred that this part of the narrative, involving the creation of The Sisters and the walking to Pullen, occurred when the sea level was lower and all three islands were contiguous with the mainland. It is also worth noting that this area is the only location known from surviving stories where an earlier ancestral being (Jekejere) is mentioned as having been in the area before Ngurunderi, the latter praising him for having created the fishing grounds there (Berndt

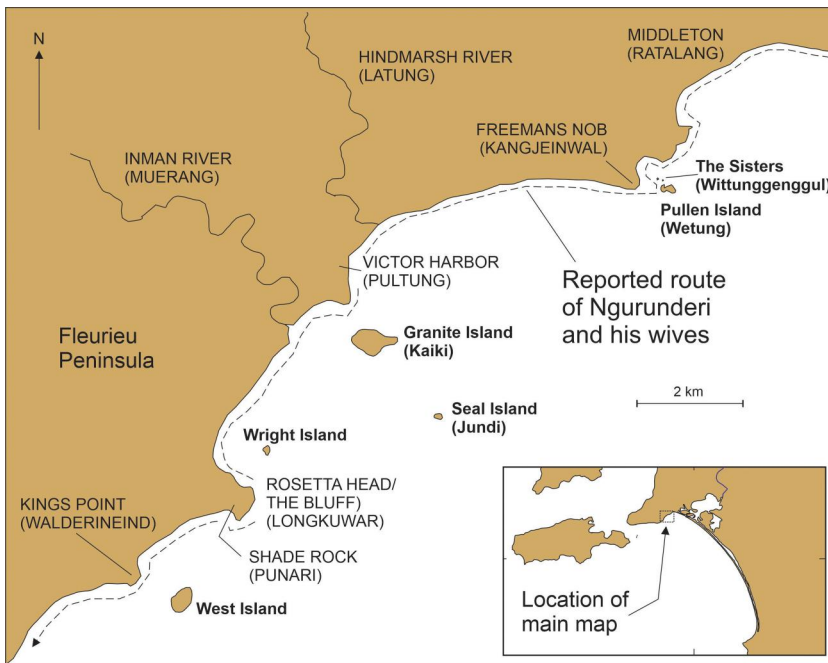


Figure 2. Islands off the southeast Fleurieu Peninsula.

1940, 178f; Tindale 1937, 115–6). Tindale (1937) recorded a song (19) from his main Tangane (Ngarrindjeri) informant, Milerum, which went as follows.

’Thuṅarei’nar ’nari’meiṅg ’parlpa’wulinar/eraijaṅanamp mi’niṅ’gund
 n’deitj’undal/’thuṅa’reinar ’nari’meiṅg ’parlpa’wulinar/ha! a! ’eik:’einin
 ṅere’gei ’njunum’pudung/’ṅeilin ’naṅana’bin ’jeke’jeril ’jaragara’ṅeil.

In translation—“Words [of Ngurunderi] shore edge completed/‘hill’ remain always/ words shore edge completed/‘early start of day’ [earliest dawn] wonderful work/for us did it Jekejere [man’s name] completed it.”

Three other ancestral beings in this area (Nurelli, Korna, Thukabi) may either have been synonymous with Ngurunderi or represent distinct ancestors (Clarke 1995). This may be a hint of the multi-generational character of the Ngurunderi narrative that was known to earlier storytellers (see above).

As Ngurunderi was leaving Freemans Nob, he heard his wives at (in the direction of?) Kings Point and said “Wul ‘*thlurnan*’” (*Down there those two*) and quickly walked to Victor Harbor where no islands existed at the time (Berndt 1940). In play, Ngurunderi threw his spear out to sea and as it hit the water, he commanded “*Pruk’ul ru’ind*” (*Rise up earth*) and Granite Island appeared. Then he walked to the top of this newly created island and threw another (wooden) spear (*jundi*) out to sea, repeating the same words and so creating Seal Island. Later, having crossed the mouth of the Inman River, he threw a (reed) spear (*kaiki*) into the ocean, creating Wright Island (Berndt 1940, 179).

Ngurunderi then climbed Rosetta Head (The Bluff) where he spent “much time” before walking to Kings Point and found evidence his wives had been there recently. From the tip of Kings Point, Ngurunderi threw a (reed) spear into the ocean to create

West Island and then, seeing his wives in the distance, he continued to follow them (Berndt 1940, 180). All islands mentioned in this subsection are pictured in [Figure 3](#).

Ngurunderi and the submergence of Backstairs Passage

Ngurunderi followed his wives around Newland Head, past Waitpinga, Callawonga, Balaparudda, and Tunkalilla ([Figure 4](#)). When the two women reached Blowhole Creek, they could see Kangaroo Island which “at that time ... was almost connected with the mainland, and it was possible for people to walk across” (Berndt 1940, 181), perhaps through a combination of “walking and wading” (Campbell 1967, 477).



Figure 3. Photos of islands off the southeast coast of Fleurieu Peninsula (A–E) and one (F) showing the coastal route taken by Ngurunderi and his wives from Rosetta Head to Newland Head (all photos by Patrick Nunn).

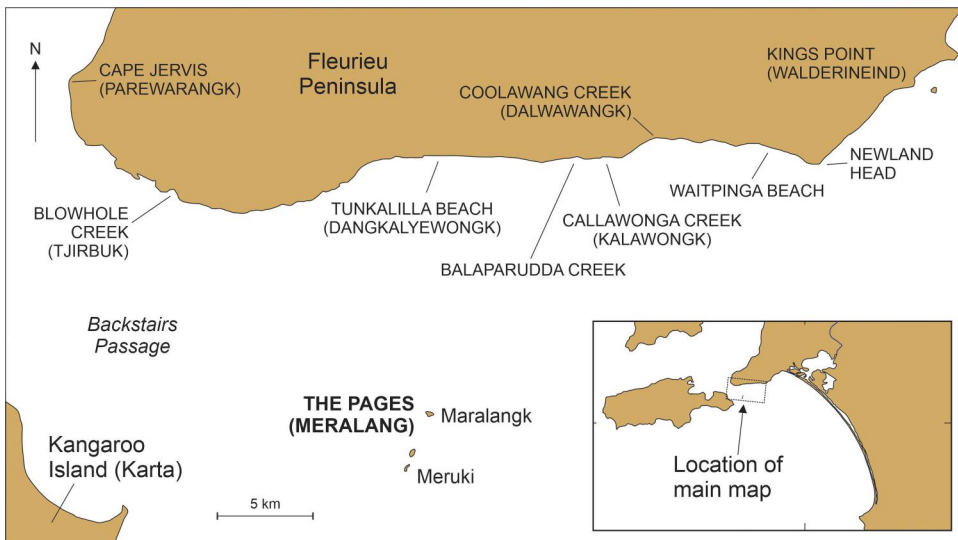


Figure 4. Geography of the western Fleurieu Peninsula, Backstairs Passage and the Pages.

More detail is given by Ngarrindjeri author David Unaipon:

At the time of the story the Island [Kangaroo Island] was connected with the mainland but during a severe southerly storm the sea would cover the connecting strip of land. (In Gale 2000, Appendix 8.3, 118)

Such may have been the case on the afternoon when Ngurunderi's wives reached Blowhole Creek for they spent the rest of that day gathering honey. But as Unaipon notes, another reason for their delay was a "keeper" of the land bridge named Khowwallie (Knowallie), the Blue Crane, and how "no one would attempt to cross without his permission" (in Gale 2000, Appendix 8.3, 118). So, the following morning, the two women, having obtained this permission:

began laughing and chatting, anticipating the joy and pleasure and happiness that awaited them when they arrived upon the Spirit Land [Kangaroo Island], but most of all they would be free from the law [Ngurunderi] they were trying to escape. (In Gale 2000, Appendix 8.3, 118)

They began to walk across (Backstairs Passage) carrying "mats (for fish) and nets (to carry food in)" (Berndt 1940, 181).

When Ngurunderi reached a vantage point above Blowhole Creek, he could see his wives crossing to Kangaroo Island. When they were halfway across (what is today) Backstairs Passage, he

called out in a voice of thunder, saying: "*Pink'ul'uy'urn 'pranjukurn*" (*Fall waters-you*). Immediately the waters (sea) began to come in from the west, wave upon wave, driving the two women from their course. So rough, so strong, were the tempestuous waves, that the women tried to turn their faces towards the mainland. At last, fighting against the waves no more, they were carried to the open sea, taking with them their net baskets. (Berndt 1940, 181)

Ngurunderi's wives and their net baskets were transformed into The Pages (islands); the largest of the three is said to be the older sister and her basket, the middle island is the

younger sister, the smallest the basket she had been carrying. Writing in the 1920s, Unaipon notes that “many were the pilgrimages taken by the aborigines in days-gone by to see these stones [The Pages] and view and contemplate the way of the Great Teacher, Narroondarie [Ngurunderi]” (Gale 2000, Appendix 8.3, 119).

Similar versions of this part of the narrative are told in its earliest written renditions. For example, Cawthorne (1926 (for 1844)) recounts how the wives of Ngurunderi (Ooroondovil) “were drowned and turned into islands” (72). Meyer (1846) reported that Ngurunderi (Nurunduri) became tired of pursuing his wives so “he ordered the sea to flow and drown them ... they were transformed into rocks” (205). Taplin (1879) states that, after “his wives forsook him,” Ngurunderi (Nurunderi) “called upon the sea to overflow and drown them, and it obeyed” (38).

While most accounts name Blowhole Creek (Tjirbuk) as the place from which Ngurunderi’s wives started to walk across to Kangaroo Island, there are two other possibilities. In one, the wives of Ngurunderi flee from him “in terror, until they reached Cape Jervis” (see Figure 4), whence they “hurry across the land bridge to what is now Kangaroo Island” (Bell 1998, 92). In the other, told by Ramindjeri informant Reuben Walker to Tindale (quoted in Draper 2015, 239), the summoning of the waves to drown Backstairs Passage takes place earlier when Ngurunderi stood atop Granite Island (see Figure 2) and noticed his wives about to land on Kangaroo Island.

After the two women drowned, Backstairs Passage remained covered with ocean, requiring Ngurunderi to later dive and swim to Kangaroo Island (Berndt 1940; Flood 1995; Woods 1879). In the account of Reuben Walker (in Draper 2015, 239), Ngurunderi passed Waitpinga before diving off the cliff into the ocean to reach Kangaroo Island. In a detail which may have been inspired by the story about the parting of the Red Sea in the Christian Bible, Unaipon appears alone in suggesting that after his wives had been turned to stone, Ngurunderi commanded the waters to recede, allowing him to walk to Kangaroo Island (in Gale 2000, Appendix 8.3, 119).

Ngurunderi on Kangaroo Island

Once Ngurunderi reached Kangaroo Island and rested, he traveled west until he reached its southwest point near Cape du Couedic where he threw out his “last-remaining spear” to create a group of nearshore islands (Berndt, Berndt, and Stanton 1993, 226), known as the Casuarina Islets or The Brothers (Figure 5), whereupon “he jumped into the sea, dived, and finally reappeared as a star in the heavens” (Tindale and Maegraith 1931, 286). The formation of the Casuarina Islets by Ngurunderi is also alluded to by Spender, one of Tindale’s Aboriginal informants, although the islands are not identified (quoted in Clarke 1995, 151). It is conceivable that the departure of Ngurunderi from Kangaroo Island is (or was informed by) a memory of this island’s apparent abandonment that made it a “mystery” for later visitors (Draper 2015; Lampert 1981).

Determining ages for elements of the Ngurunderi narrative

Despite the Ngurunderi narrative being a composite narrative, comprising elements from different time periods involving multiple individuals (who may be telling stories

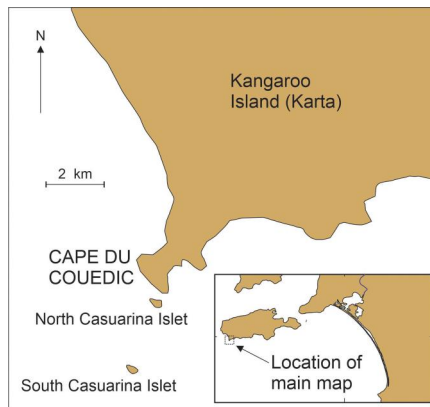


Figure 5. Islands off Cape du Couedic, Kangaroo Island.

for different purposes), it is possible to identify elements that appear common and consistent in several extant versions. Three elements, discussed in separate subsections below, refer respectively to the continuous nature of Younghusband Peninsula, the formation of (small) islands off mainland coasts, and the formation/inundation of Backstairs Passage. Geochronological research provides ages (or age ranges) for these events which can thus be considered as proxy ages for associated elements of the Ngurunderi narrative.

Continuity of Younghusband Peninsula

Together with Sir Richard Peninsula, the dune-covered core of Younghusband Peninsula comprises an uncommonly long coastal barrier system formed here after the postglacial sea level reached its present level around 7000 years cal BP (Bourman, Harvey, et al. 2018; Bourman, Murray-Wallace, et al. 2018; Harvey, Bourman, and James 2006; Short and Hesp 1984). In most versions of the Ngurunderi narrative, he is said to have walked the entire length, around 170 km, of Younghusband Peninsula from around its southern terminus near Kingston to the River Murray Mouth (see Figure 1). Several versions of the narrative refer to the speed with which Ngurunderi covered this great distance, possibly a narrative proxy for the continuity and comparative monotony of the Peninsula.

Although other interpretations are possible, all available evidence suggests that when Ngurunderi walked the length of Younghusband Peninsula, it was a continuous barrier. So, the earliest age of continuous barrier formation provides a maximum age for this element of the Ngurunderi narrative. Ages from the core beach sequence within Younghusband Peninsula include dates of ~6000 BP from Baynton Bluff (Short and Hesp 1984) that are in broad agreement with Aboriginal midden ages of 5910 ± 70 BP from Hack Point and 5545 ± 140 BP from Cantara (Harvey, Bourman, and James 2006; Luebbers 1981, 1982). Yet midden shellfish analysis suggests periodic flushing of the Coorong lagoon with seawater occurred around 6000 years ago, implying that the “Younghusband Peninsula was not a continuous barrier early in its history” (Harvey, Bourman, and James 2006, 43), a view supported by the notion that the early stages of

barrier evolution here after sea level stabilized about 6000 years ago may have been marked by the formation of “isolated barrier islands” that subsequently coalesced (Bourman, Murray-Wallace, et al. 2018, 74; Harvey 2006).

An alternative interpretation, important to the present study, is that “the barrier was initially formed ... as a single island extending from the Murray mouth to Kingston” (Dillenburg et al. 2020, 8), meaning that Ngurunderi could have walked its length from The Granites to the Murray mouth somewhat earlier. The latter condition may have been achieved around 6700 cal BP, providing a possible maximum age for this element of the Ngurunderi narrative. Since sea level at this time was at least 1.23 m (at The Granites) higher than today, if Ngurunderi did then walk briskly along the length of Younghusband Peninsula it would have been much narrower; the briskness may allude to avoiding seawater incursions at high tide.

A third possibility assumes that the stories about Ngurunderi walking the length of Younghusband Peninsula were close in age to those recalling his role in the creation of Backstairs Passage more than 10,000 years ago (see below), so it may be that the former stories refer to an earlier time, more than 7000 years ago when sea level was lower and Ngurunderi walked the length of a proto-barrier, now covered by ocean, between Kingston and Goolwa.

In all known versions of the Ngurunderi narrative, the River Murray Mouth is stated as breaking the continuity of the sedimentary barrier comprising Younghusband and Sir Richard Peninsulas, just as it does today. Details of how Ngurunderi and his wives (whose footprints he found on the northern side of the river mouth) crossed the Murray Mouth are vague in most versions of the narrative. For example, one recalls Ngurunderi merely “crossing the mouth of the lakes (Murray Mouth)” (Berndt 1940, 176). But in another version, unquestionably that of David Unaipon (Gale 2000), it is stated that Ngurunderi “prayed to make it possible for him to walk across,” a prayer that was answered when a bridge then formed across the river (Smith 1930, 327). It is possible that the existence of a “bridge,” implicitly temporary, recalls a narrator’s experience of one of the short-lived closures of the Murray Mouth (in its original pre-European condition), as happened when it periodically became blocked by a plug of inner-shelf marine sediments that was not easily dislodged by river flows. The sole pre-European inference of mouth closure within the past 6000 years is thought to have occurred around 3500 years ago during a period of conspicuous aridity and reduced river flow (Bourman, Harvey, et al. 2018; Cann, Bourman, and Barnett 2000; Murray-Wallace et al. 2010) and it may be that the bridge element of the story dates from this time. Yet alternatively, just as argued above, it may be that the “bridge” was a later rationalization of the time when Ngurunderi walked along a proto-barrier that existed before the modern Younghusband Peninsula took shape.

Formation of nearshore islands

Off the southeast coast of the Fleurieu Peninsula lie six islands (see Figure 2) that are stated in various versions of the Ngurunderi narrative to have been created or visited by him. Off the southwest tip of Kangaroo Island, two islands (see Figure 5) are also said to have been created by Ngurunderi. Creation of islands is interpreted here, as

elsewhere (Nunn and Cook 2022), as meaning that places which later became islands were contiguous with the mainland at the time people first saw them. The minimum depth of ocean between such an island and the adjacent mainland can be plotted on a curve/envelope of postglacial sea-level history to allow calculation of a minimum age for island development, an approach used for numerous Australian coastal sites/stories (Nunn 2018; Nunn and Reid 2016) and elsewhere (Nunn 2022; Nunn et al. 2021, 2022).

For the eight islands associated with the Ngurunderi narrative, minimum depths and ages are listed in Table 2 and shown graphically in Figure 6. There are considerable uncertainties in the age estimates, arising from the imprecision of depth and paleosea-level data as well as contestable interpretations of narrative details, but it is nevertheless considered that these estimates provide a realistic chronology for these elements of the Ngurunderi narrative.

Submergence of Backstairs Passage

Before Ngurunderi summoned the ocean to flood Backstairs Passage and drown his wives, the narrative explains that people were able to walk across it from Fleurieu Peninsula to Kangaroo Island. In all stories bar one, Backstairs Passage remains inundated thereafter, a succession of events that can be interpreted as marking the point during the period of postglacial sea-level rise at which this land bridge was first wholly submerged (Nunn 2018; Nunn and Reid 2016). Based on Figure 6, this event is dated to at least 11,000–10,100 cal BP.

In this section, acknowledging that variants of the Ngurunderi narrative have the land bridge starting in the east from *either* Cape Jervis *or* Blowhole Creek, minimum depths and ages are re-evaluated using more detailed bathymetric information. Figure 7 shows the bathymetry of Backstairs Passage, interpreted and redrawn from Australian Hydrographic Service chart AUS126 (revised 2010). The bathymetry shows that when sea level was 30 m lower than today, Backstairs Passage was much narrower; the modern Fleurieu Peninsula was contiguous with The Pages (islands) and with Yatala Shoal where minimum water depths of 4–5 m are found today. The east coast of Kangaroo Island also extended seawards, especially in the northeast. While Cape Jervis could well have been a place on the route to Kangaroo Island, the more central point of departure

Table 2. Nearshore islands referenced as having been created/visited by Ngurunderi with details of minimum depths that allow calculation of minimum ages for islandization (from Figure 6).

Site	Minimum water depth between island and mainland (m)	Minimum age of island formation (years BP), derived graphically from Figure 6 (years BP)
Southeast Fleurieu Peninsula islands		
Pullen Island	3–4	7100–8300
The Sisters	2–3	7000–8200
Granite Island	1–2	6800–8000
Seal Island	8–9	7800–9000
Wright Island	3–5	7100–8500
West Island	15–16	8600–9600
Kangaroo Island		
North Casuarina Islet	20–25?	9200–9900
South Casuarina Islet	28–30?	9800–10,400

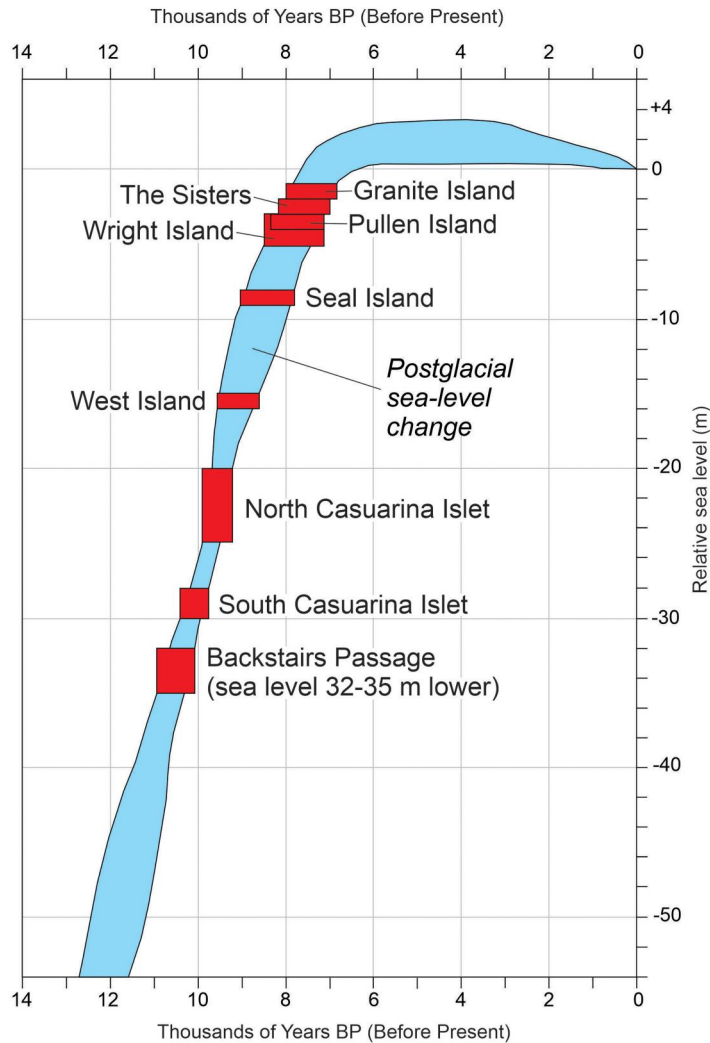


Figure 6. Sea-level changes around the coast of Australia within the past 13,000 years (after Lewis et al. 2013; Nunn and Reid 2016); the blue/shaded envelope represents the uncertainty of sea levels at particular points in time. Red/shaded boxes show the sea levels (as in Table 2) at which each of the eight island-formation stories and that referring to the crossing of Backstairs Passage would most recently have been true. Ages in Table 2 are calculated graphically from this figure.

from (modern) Fleurieu Peninsula would have been Blowhole Creek, as most known variants of the Ngurunderi narrative state.

The optimal crossing route involves a land bridge that would have still been passable when sea level was 32–35 m lower than today, calculated to have been approximately 11,000–10,100 cal BP (see Figure 6). No other parts of Backstairs Passage would have been passable on foot at this time. Sea-level rise would have led to the progressive narrowing of the land bridge and made its crossing increasingly riskier until a point at which it became impassable, a memorable occurrence worthy of encoding in contemporary oral traditions that came to underpin the Ngurunderi narrative.

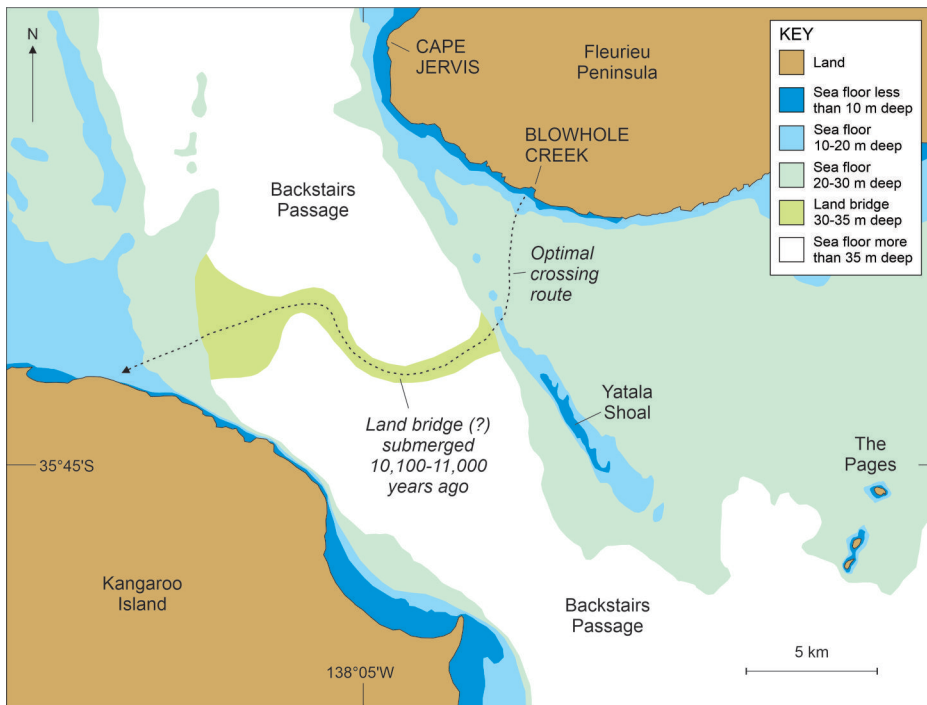


Figure 7. Current bathymetry of Backstairs Passage showing its geography today and when sea level was 10, 20 and 30 m lower. Based on published depth soundings (from Australian Hydrographic Service chart AUS126 [2010]), a land bridge across Backstairs Passage would have existed when the sea level was 32–35 m lower, estimated to have been at least 10,100–11,000 years ago (see Figure 6 and Table 2). A likely crossing route is shown as a dashed line and suggests that the detail in most versions of the Ngurunderi narrative stating that this route began at Blowhole Creek (Tjirbuk) is correct.

There is a remarkable parallel from Scotland that supports this chain of inference, one involving the progressive submergence of the land bridge (or isthmus) connecting the Monach (Heisker) Islands to North Uist Island in the Outer Hebrides (Nunn 2022). Stories collected in the 1880s from one of the last remaining residents of the Monach Islands recalled that the isthmus-skerry (*aoi-sgeir* in Gaelic) connecting the two disappeared gradually and that “tradition still mentions the names of those who crossed these fords last, and the names of persons drowned in crossing” (Carmichael 1884, 464). Similar memorialization of ancestral beings may help explain why the story of the drowning of Ngurunderi’s wives has lasted so long, possibly more than 10 millennia, passed down orally across perhaps more than 400 generations. These Hebridean stories are estimated to have endured orally for around 7000 years (Nunn and Cook 2022).

Unpacking Ngurunderi: The time structure of the narrative

Having identified approximate ages for particular elements of the Ngurunderi narrative, it is now possible to look at the distribution of these and see whether anything can be discerned about its structure. Figure 8 shows each of the 12 dated elements organized from left to right in descending age order. Three groups of elements involving shoreline

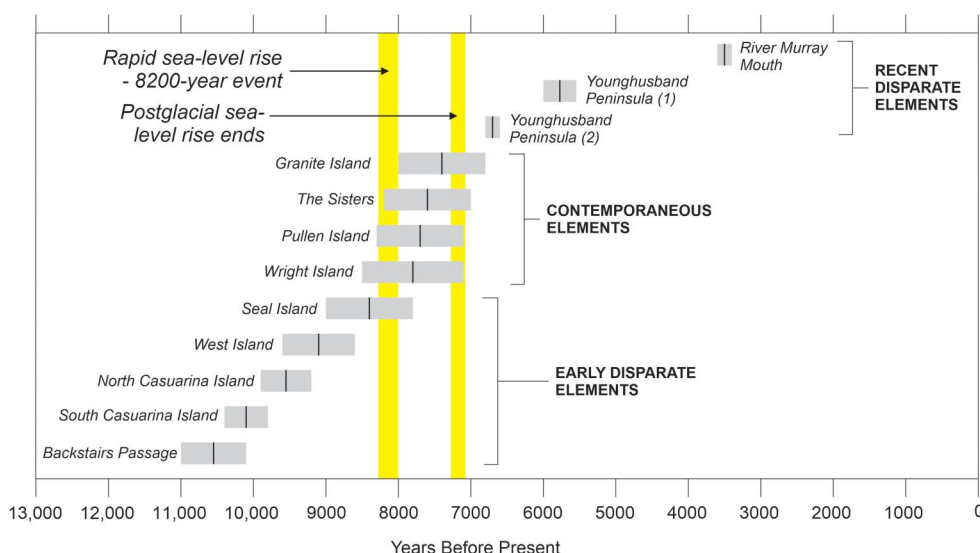


Figure 8. Dated elements of the Ngurunderi narrative arranged in descending-age order. Three groups of elements may be significant in understanding the evolution of the Ngurunderi narrative. The middle group (contemporaneous elements) may have been associated with rapid sea-level rise during the 8200-year event and the later group (recent disparate elements) with the end of postglacial sea-level rise.

change are distinguishable and may be significant to understanding the evolution of the Ngurunderi narrative through time.

The earliest group is one of five *early disparate elements* in which the oldest is the submergence of the last remaining land connection between Fleurieu Peninsula and Kangaroo Island. This may be the anchor event, the earliest and most transformative of the sequence that guided the interpretation of subsequent submergence events by local people. For example, once such events were ascribed to human action/control, then it was legitimate for later ones, such as the submergence of land bridges, to be attributed to a similar cause. Yet, given the incompleteness of the narrative record, it may be there was an even earlier anchor event, the rationalization of which by local people informed that of the submergence of Backstairs Passage. Such an event might have been the (rapid) submergence of either Gulf St Vincent or Spencer Gulf, the latter of which is estimated to have occurred at least 9330–12,460 cal BP and would likely have separated different Aboriginal groups and submerged some of the area's most productive wetland ecosystems (Nunn 2018; Roberts et al. 2020).

The second group that can be recognized in Figure 8 is that of the four *contemporaneous elements* that occurred around the same time. While the fact of their submergence is dependent on geography, specifically coastal geomorphology, the likelihood of the memories of this submergence being preserved for more than seven millennia is more worthy of analysis. For it may well be that a trigger like the comparatively rapid short-lived rise of sea level during the (near-global) 8200-year event, in which sea level rose 6.5 m in 140 years (Alley et al. 1997; Smith et al. 2011), led to a series of rapid and irreversible coastal changes that greatly impacted local societies. As argued elsewhere, this so traumatized people in Australia and in parts of northwest Europe (Nunn 2018; Nunn et al. 2021),

that these events would feature large in the collective resident psyche for generations, not least in case they should occur again (Nunn 2020); evidence for the effects of the 8200-year event has been detected along the Australian coast (Sanborn et al. 2020).

An alternative explanation for these contemporaneous elements is that stories about submergence had been continually remembered and retold, as expressions of human experience or trauma, but that these were regularly forgotten as new examples of submergence replaced them. Only the most recent of these stories are remembered today because they date from around the end of submergence; they were never displaced by later submergence stories because postglacial sea-level rise ended. This explanation acknowledges the likelihood that we are today looking only at a tiny subset of what was once a massive body of stories created by the peoples of South Australia within the past 12,000 years or more. For example, off the south coast of the Fleurieu Peninsula where six nearshore islands, each associated with Ngurunderi and shown in Figure 2, exist today, there were formerly other islands, now wholly submerged, about which earlier generations undoubtedly had stories; perhaps when those islands vanished completely, the stories passed from the realm of remembered history into myth, a process described for submerged places in many other parts of the world (Nunn 2021).

The final group recognizable in the Ngurunderi narrative and shown in Figure 8 comprises the three *recent disparate elements*, which are regarded as opportunistic events, worth remembering and incorporating into oral traditions but not part of a coherent set of historically linked observations. Postglacial sea-level rise had ceased, coastal landscapes were now evolving in ways that presented new livelihood opportunities or constraints for local residents.

Discussion: Holocene human–environment interactions illuminated by ancient stories

While the approach taken in this paper is novel in its multidisciplinary approach to the use of ancient stories to illuminate environmental changes and human responses to these during the early Holocene, it is not unprecedented. Particularly among First Nations people of Canada, there has been considerable research that demonstrates many of their oldest narratives represent memories of past landscape-altering events, including those of coastline changes (Gauvreau and McLaren 2016) and the movements of ice bodies (Cruikshank 2001). Australia also provides similar examples, including Palawa memories of when Tasmania was connected to the mainland that may be 12,500 years old (Hamacher et al. 2023), and more detailed and inevitably more compelling analyses of more recent bodies of knowledge (Kearney, O’Leary, and Platten 2023; Smith 2019). Recent research demonstrates the potential of similar research in the Pacific Islands (Ballard 2020; Lancini et al. 2023; Urwin 2019).

This study shows that elements of ancestral Aboriginal Australian narratives, which include descriptions of landscape change, are plausibly based on observations made thousands of years ago, in some cases perhaps more than 10,000 years ago. The details in these stories include recollections of when modern islands were once part of the mainland and, conversely in the case of Younghusband Peninsula, when what were perhaps once islands became a continuous coastal barrier. Here we reiterate that such traditions convey much more complexity and nuance—they may relate to later

interpretations and deep understandings of landscape transformations or relay the importance of social rules, for instance (Roberts et al. 2023).

While acknowledging the complexities inherent in Aboriginal traditions and the unavoidable unknowns involved in unpacking them, it seems likely that part of people's motivation for preserving their memories of these transformative events was to inform subsequent generations that such things periodically occur and, while disruptive, are survivable. This motivation is explainable by the importance of conveying all knowledge held by one generation to the next to optimize its chances of survival (Charles and O'Brien 2020; Ross 1986). With specific reference to postglacial sea-level rise and the trauma felt by coastal dwellers who experienced its consequences, there are clear lessons for today when many coastal peoples are feeling apprehension for similar reasons (Nunn 2020; Woodroffe and Murray-Wallace 2012).

An important insight from this study is that ancient ancestral narratives like the Ngurunderi narrative are not mere fantasies or simply “articulate a relational ontology” (Taylor 2013, 94). They should not be marginalized for they represent knowledge systems and/or interpretations of memorable events in particular places as observed and understood by people whose means of acquiring and communicating important information was principally oral. Several studies refute the supposedly self-evident idea that information storage and understanding are less in oral than literate contexts (Kelly 2015; Vansina 1985) and lay the foundations for more balanced treatments of what has often been dismissed by scientists as myth or legend (Piccardi and Masse 2007; Vitaliano 1973). In this study, it is argued that the Ngurunderi narrative contains information about the formation of Younghusband Peninsula, possibly a pre-modern blockage of the Murray Mouth; it contains reference to a time when at least eight now-nearshore islands were formerly contiguous with adjacent mainlands; and it recalls the time when the land bridge which last connected modern Kangaroo Island and Fleurieu Peninsula was submerged. All such events can also be inferred from models of postglacial landform evolution in South Australia.

Knowing that Aboriginal people lived in South Australia long before the Last Glacial Maximum (LGM, ~22–18,000 cal BP) when sea level was more than 125 m lower than today (Hamm et al. 2016; Hope et al. 1977; Westell et al. 2020) allows the Ngurunderi story to be put into context. People would likely have occupied the whole of the Lacepede Bay/Shelf at the time until sea level started rising (post-LGM) and drove people slowly inland (Bourman, Murray-Wallace, et al. 2018; Ngarrindjeri Nation and Hemming 2018; Wilson 2017). The Ngurunderi narrative recalls and interprets only episodes from the last part of this process (see Figure 8) so it is almost certain that comparable stories existed before this time, recalling people's anxieties about coastal land loss² and their (evolving) understanding about how it might be stopped. Fragments of extant stories elsewhere in Australia articulate this trauma: for example, the report from the fringe of the Nullarbor Plains that only “prompt action” stopped the ocean from “inundating the country completely” (Berndt and Berndt 1965, 401). Stopping continuing inundation was both something that many Aboriginal groups saw as a practical challenge—some erected artificial barriers—but also as a “spiritual” one, as might be represented by the stone arrangements along the Australian coast likely to be “associated with ritual control of extreme tidal regimes” (McNiven 2008, 155). Similar

interpretations are used to explain coastal stone arrangements in northwest France and elsewhere (Cassen et al. 2011; Nunn 2021).

Conclusion

Histories of multi-millennial landscape change are conventionally calibrated using a range of techniques based on geological/stratigraphic or radiometric principles. While unquestionably robust, such approaches cannot answer all questions about landscape evolution, sometimes because there is insufficient high-resolution material (typically sedimentary) available to analyze, sometimes because it is uncertain what particular strata represent. But perhaps most profoundly, such approaches cannot humanize the past; they cannot tell us how particular events may have affected particular groups of humans, perhaps by either constraining or broadening their activities, and, conversely, they cannot tell us what role humans may have played in landscape evolution (perhaps through de-vegetation or the intentional modification of landforms) and their motivations for doing so (Nikulina et al. 2022; Prober et al. 2016; Rosen et al. 2017).

In one sense, such challenges map the interface of archaeology/history and the geosciences, a place where some attempts at crossover have occurred although most researchers avoid such territory, favoring the security of their disciplinary mainstreams. In another sense, such challenges also map the cultural interface between Indigenous/traditional knowledges and western science-based knowledges, not in order to validate one with the other, but to demonstrate the true nature of Indigenous/traditional knowledges as science filtered through contrasting worldviews and contextualized within particular places (Nakata et al. 2012). Yet in the Anthropocene, where humans are massively implicated by global change and where global change will have profound impacts on future generations of humans, the need to reassess the past in similar terms has never been more pressing. There are innumerable lessons for managing our collective future that we can draw from the experiences of ancestors around the world in encountering and responding to landscape change (Fletcher et al. 2021; McMillen, Ticktin, and Springer 2017; Nunn 2020; Yunkaporta 2019). A future in which all available and relevant knowledges are equally respected by all and become “braided” to develop the best possible plans for coping with climate adversity is achievable (Atalay 2020; Roberts et al. 2023).

Almost 150 years ago, it was noted that stories about Ngurunderi (Nurundere) “are fast fading from the memory of the Aborigines” and that “it is only from the old people that the particulars of them can be obtained” (Woods 1879, 58). Yet the stories and teachings of Ngurunderi live on amongst Ngarrindjeri today and community members continue to honor the knowledge contained within them (Ngarrindjeri Nation and Hemming 2018). Similar stories exist elsewhere in the world and might also be worth unpacking to allow a fuller understanding of late Quaternary landscape evolution.

Notes

1. In this regard the work undertaken for this article has been permitted and supported by the Ngarrindjeri Aboriginal Corporation (which is also a co-author of the research) and Ngarrindjeri scholar, Dr Chris Wilson.
2. It has been estimated that around 10,000 years ago off the Nullarbor coast of southern Australia, the coastline was moving landwards at the rate of more than 1 m every week.

Another study suggests that during the more rapid periods of postglacial sea-level rise, people living along the Arnhem Land coast in northern Australia would have witnessed the shoreline moving landwards by 5 km every year (Flood 2006, 194).

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