

Australian Aboriginal traditions about coastal change reconciled with postglacial sea-level history: a first synthesis

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Abstract

Like some other oral traditions of Australian Aborigines, those that relate to widespread and enduring coastal inundation appear to be several thousand years old. The best-documented traditions, some mythologized, are presented for six sites around the Australian coast (Bathurst and Melville Islands, Northern Territory; Rottnest, Carnac and Garden Islands, Western Australia; Spencer Gulf, South Australia; Kangaroo Island, South Australia; Port Phillip Bay, Victoria; Cairns and Fitzroy Island, Queensland). The minimum depths at which each tradition would have been true is determined from local bathymetry. These depths are then compared to postglacial sea-level history and minimum ages for each tradition calculated. These range from 7500-13,400 years Before Present and represent unique observations of postglacial sea-level rise and its effects that have significant implications for an appreciation of the longevity of such traditions in preliterate societies.

Introduction

Over the past few decades, the value of certain oral traditions to an understanding of natural phenomena, particularly the incidence and recurrence of extreme events, has become increasingly apparent¹. Traditions about memorable volcanic eruptions have been especially useful in informing science about events in the time before written records began. While most such traditions are less than 1000 years old, exceptions are found in societies in which cultural change has been comparatively slight. Examples include the Klamath traditions about Mt Mazama (Oregon, USA), which have endured in recognisable form for more than 7000 years, as well as ones from the Atherton Tableland (Queensland, Australia) and Kadavu Island (Fiji) that may be several thousand years old². Comparable traditions recalling observations of now-extinct animals have also been validated in Australia and elsewhere³. Traditions about the impacts of bolides (extraterrestrial objects) are accepted as being based on observations and have in some cases improved scientific understanding of the recurrence of such phenomena⁴.

In cultures from almost every part of the world, traditional stories about floods are found⁵ yet comparatively few such stories describe enduring changes in the position of a shoreline, something that might be regarded as surprising given the ubiquity and magnitude of sea-level changes along the world's coastline within the past few millennia. The main reason for the lack of such traditions is probably that the expression of changing sea level appeared unremarkable in many instances, perhaps barely detectable within a human lifespan, and therefore not competitive as a subject for the most-valued oral traditions. Yet a few traditions are found that describe 'rapid' flooding of coastal lowlands, often resulting in their permanent flooding and the 'destruction' of settlements and cities thereon. Unsurprisingly, these

¹ L. Piccardi and W.B. Masse, eds., *Myth and Geology* (London: Geological Society of London, 2007); D. Vitaliano. *Legends of the Earth: Their Geologic Origins* (Bloomington, Indiana: Indiana University Press, 1973).

² E.W. Barber and P.T. Barber. *When They Severed Earth from Sky: How the Human Mind Shapes Myth* (Princeton: Princeton University Press, 2004); Robert MW Dixon. *The Dyirbal Language of North Queensland*. Vol. 40 (Cambridge: Cambridge University Press, 1972); P.D. Nunn, 'Early Human Settlement and the Possibility of Contemporaneous Volcanism, Western Kadavu, Fiji', *Domodomo (Scholarly Journal of the Fiji Museum)* **12** (1999): 36-49.

³ David A Burney, 'The Kilopilopitsofy, Kidoky, and Bokyboky: Accounts of Strange Animals from Belo-Sur-Mer, Madagascar, and the Megafaunal "Extinction Window"', *American Anthropologist* **100** (1998): 957-66; Margaret Sharpe and Dorothy Tunbridge, 'Traditions of Extinct Animals, Changing Sea-Levels and Volcanoes among Australian Aboriginals: Evidence from Linguistic and Ethnographic Research', in R. Blench and M. Spriggs (eds), *Archaeology and Language I: Theoretical and Methodological Orientations* (London: Routledge, 1999), pp. 345-61.

⁴ W Bruce Masse and Michael J Masse, 'Myth and Catastrophic Reality: Using Myth to Identify Cosmic Impacts and Massive Plinian Eruptions in Holocene South America', in L. Piccardi and W.B. Masse (eds), *Myth and Geology* (London: Geological Society of London, 2007), pp. 177-202; Duane W Hamacher and Ray P Norris, 'Australian Aboriginal Geomythology: Eyewitness Accounts of Cosmic Impacts?', *Archaeoastronomy* **22** (2009): 60-93.

⁵ Alan Dundes, ed., *The Flood Myth* (Berkeley: University of California Press, 1988).

stories are found in places where coastal habitation was long established by culturally-similar groups of people who developed unusually lengthy bodies of oral traditions, often fortuitously preserved. Good examples of such traditions come from the coast of India⁶ as well as from the coasts of Australia, on which this study focuses.

Little attention has been paid by scientists to traditions describing coastal change in Australia. The purpose of this paper is to interrogate Aboriginal Australian traditions of this kind and to compare them to known (scientifically-derived) chronologies of sea-level change during the postglacial period for various parts of the Australian coast. This comparison will show which details of these traditions are credible, which probably apocryphal, and will permit approximate ages for the initial observations underlying these traditions to be determined.

Postglacial Australia: people and sea level

People arrived in Australia 40-50,000 years ago⁷, perhaps earlier, but significantly before the Last Glacial Maximum when sea level reached its lowest point (about 120 m below present) within the last 150,000 years (Figure 1). After the end of the Last Glacial Maximum, sea level started to rise, a trend that continued, albeit with notable interruptions, until about 6000-7000 years BP⁸ when it reached a maximum around most parts of Australia. Since this time, the dominant trend of sea level has been downwards. If, as appears likely (see below), most traditions about coastal change around Australia date from the long period of (earlier) postglacial sea-level rise, then we can cautiously bracket the age of these to between 18,000 and 6000 years BP. Postglacial sea-level changes were not synchronous around the Australian coast, some parts of which were simultaneously affected by land-level (tectonic) changes. For example, along parts of the coast of western and southern Australia, sea level has been falling for more than 7000 years, so it is unlikely that any observations of widespread and permanent inundation developed since this time.

[insert Figure 1]

Particularly during the last 10-15,000 years in Australia, people have routinely occupied coastal environments and utilized associated resources⁹. Owing to the gently-sloping nature of the (often) broad continental shelf around Australia,

⁶ AS Gaur and KH Vora, 'Ancient Shorelines of Gujarat, India, During the Indus Civilization (Late Mid-Holocene): a Study Based on Archaeological Evidences', *Current Science* **77** (1999): 180-85; S. Tripathi, 'Coastal Structural Remains on the East Coast of India: Evidence of Maritime Activities and Their Significances', in P.C. Reddy (ed.), *Saundaryashri: Studies of Indian History, Archaeology, Literature and Philosophy (Festschrift to Professor A. Sundara)* (New Delhi: Sharada Publishing House, 2009), pp.

⁷ J. F. O'Connell and J. Allen, 'When Did Humans First Arrive in Greater Australia and Why Is It Important to Know?', *Evolutionary Anthropology* **6** (1998): 132-46.

⁸ Years BP (Before Present) refers to calendar years before AD 1950.

⁹ Derek John Mulvaney and Johan Kamminga. *Prehistory of Australia* (Crows Nest, Australia: Allen and Unwin, 1999).

postglacial sea-level rise would have had a major impact on coastal subsistence economies; at Princess Charlotte Bay (northern Queensland), for example, rates of lateral shoreline displacement of 10-15 m per day during Late Glacial times have been suggested¹⁰. Innumerable ancient sites have been drowned and reconfigured, buried by sediment, and represent a part of the prehistoric record that is lost forever¹¹. Details of human-interactions with the coast during this period can only be inferred, perhaps by interpreting changes in inland (near-coastal) sites in terms of (rapid) coastal change¹², or by interpreting changes in offshore island prehistory in terms of increasing isolation enforced by sea-level rise¹³, or from (oral) traditions describing coastal change and the associated disruptions of coastal livelihoods.

Such traditions have been noted before by scientists but there has been only passing acknowledgement of their potential significance as records of the effects of postglacial sea-level rise on the Australian coast¹⁴. The traditions come in two forms: one as stories of narrated historical fact without obvious embellishment, the other as myths in which observed changes are interpreted as the actions of divine beings¹⁵. As presented here, these traditions are from written records of orally-transmitted knowledge that date from early in the post-European contact history of Australia after 1788 when “curious, observant, and relatively unprejudiced individuals in all parts of Australia wrote down descriptions of Aboriginal ceremonies, recorded versions of Aboriginal myths and tales and sometimes gave the texts and even occasionally the musical scores of songs”¹⁶.

The traditions are generally of two thematic types: one recalling how once two landmasses, now separated by a water gap, were once joined, the other recalling how people once crossed a water gap (by wading or swimming) from one landmass to another, a feat that would be impossible today. To date, such traditions have been collected from numerous locations around the Australian coast but for most the details are vague and the traditions cannot be readily authenticated. This paper therefore focuses on the best-documented traditions from six sites along the

¹⁰ John M Beaton, ‘Evidence for a Coastal Occupation Time-Lag at Princess Charlotte Bay (North Queensland) and Implications for Coastal Colonization and Population Growth Theories for Aboriginal Australia’, *Archaeology in Oceania* **20** (1985): 1-20.

¹¹ J. Allen and P. Kershaw, ‘The Pleistocene-Holocene Transition in Greater Australia’, in L.G. Straus, et al. (eds), *Humans at the End of the Ice Age: The Archaeology of the Pleistocene-Holocene Transition* (New York: Plenum Press, 1996), pp. 175-99.

¹² David Frankel, ‘Excavations in the Lower Southeast of South Australia: November 1985’, *Australian Archaeology* (1986): 75-87.

¹³ Sandra Bowdler, ‘Offshore Islands and Maritime Explorations in Australian Prehistory’, *Antiquity* **69** (1995): 945-58.

¹⁴ Alastair H Campbell, ‘Aboriginal Traditions and the Prehistory of Australia’, *Mankind* **6** (1967): 476-81; Sharpe and Tunbridge, ‘Traditions of Extinct Animals, Changing Sea-Levels and Volcanoes among Australian Aborigines: Evidence from Linguistic and Ethnographic Research’.

¹⁵ These two categories are the same as those of ‘ordinary stories’ and ‘sacred mythology’ described by R.M. Berndt and C.H. Berndt. *The World of the First Australians. Aboriginal Traditional Life: Past and Present* (Canberra: Aboriginal Studies Press, 1996)..

¹⁶ Margaret Clunies Ross, ‘Australian Aboriginal Oral Traditions’, *Oral Tradition* **1** (1986): 231-71.

Australian coast (Figure 2) in order to demonstrate the likelihood that most of these recall events that are likely to have taken place several thousand years ago.

[insert Figure 2]

The following sections give the essential details of Aboriginal traditions for each of the six sites. These are interpreted using local sea-floor bathymetry to estimate the minimum levels (below present sea level) at which these details would be true. By comparing these minimum levels to known postglacial sea-level change, an age range for the most recent time at which the particular traditions could have originated is determined. Details in the traditions about why and how inundation occurred at particular sites is also interrogated.

The reconstruction of postglacial sea level used to determine minimum ages of these traditions is a compilation of Australia data (see Figure 4) in which sea-level change is shown not as a line but as an envelope in order to capture uncertainties and regional variations¹⁷. This yields age ranges for negative sea-level positions, ranges that are extended by the imprecision of the position to which particular stories refer.

Bathurst and Melville Islands

The modern inhabitants of Bathurst and Melville Islands (Figure 3) are the Tiwi who are descended from the earliest people to live on these islands¹⁸. The Tiwi have no traditions stating that their ancestors first reached these islands from mainland Australia yet this seems likely, given that they have stories relating to both the formation and the shaping (carving) of these islands, both types of story being common analogues in oral traditions of islands being discovered and first occupied by people. In the Pacific Islands, for example, it is common for stories of island colonization to involve beings endowed with superhuman qualities pulling or pushing up islands, both likely to be analogues of initial island sightings¹⁹.

[insert Figure 3]

The Tiwi story of the formation of Bathurst and Melville Islands suggests that they were once part of the mainland but were then separated from it.

In the beginning of the Tiwi world there was complete darkness ...
Then one day an old blind woman, named Mudangkala, appeared
miraculously out of the ground carrying in her arms three babies, two

¹⁷ S. E. Lewis et al., 'Post-Glacial Sea-Level Changes around the Australian Margin: A Review', *Quaternary Science Reviews* **74** (2013): 115-38.

¹⁸ J. Morris. *The Tiwi: From Isolation to Cultural Change* (Darwin: NTU Press, 2001); M. Sims, 'Tiwi Cosmology', in L.R. Hiatt (ed.), *Australian Aboriginal Concepts* (Canberra: Australian Institute of Aboriginal Studies, 1978), pp. 164-68.

¹⁹ PD Nunn, 'Fished up or Thrown Down: The Geography of Pacific Island Origin Myths', *Annals of the Association of American Geographers* **93** (2003): 350-64.

females named Wurinpranala and Murupiangkala, and a male named Purukupali. As Mudangkala crawled along, the freshwater followed her ... The flow of water continued to increase and is today known as Clarence Strait. She continued to move over the land known as Bathurst Island till finally water flowed on to form what is now known as Apsley Strait”²⁰.

Another version of this story notes that “as she [Mudangkala] crawled about searching for food for herself and her infant children, she gradually carved out the outlines of the Tiwi Islands ... water flowed in behind [her] to surround the islands”²¹.

This story can be interpreted as recalling the discovery and occupation of these islands by Mudangkala and her family, initially by crossing Clarence Strait and then at a later stage along Apsley Strait that separates modern Bathurst and Melville Islands (see Figure 3A). It is not clear whether Mudangkala’s group was the earliest to settle these islands or whether these were connected at the time to the Australian mainland. Yet the repetition of the detail that, as Mudangkala crawled or moved over the land looking for food (what someone previously unfamiliar with these particular places might do at first), water followed does suggest that this story incorporates observations of sea level rising and flooding both the Clarence and Apsley Straits. Since there is no reference to crossing water gaps or even to the use of watercraft, a plausible explanation is that this tradition recalls a time when sea level was lower and it was possible – perhaps through a combination of walking, wading and swimming – to traverse the (wider, deeper) Clarence Strait. As suggested by the bathymetry shown in Figure 3B, a sea level 10 m lower than today would still have left water gaps of 2-3 km to be crossed. It therefore seems more probable that, if the proposed interpretation of this story is correct, the sea level would have to have been lower, at least 12-15 m below present to have allowed people to cross the Clarence Strait by walking, wading and swimming.

Another Tiwi tradition refers to the Vernon Islands, which lie between the mainland and southern Melville Island, and which are likely to have been important island stepping stones for anyone crossing the Clarence Strait in the past. This tradition recalls that the Vernon Islands “broke away from Mandiupi, in south-eastern Melville Island, as a result of an earthquake in the distant past”²². In an area where seismic activity is uncommon²³ and unlikely to have the effect of severing (through abrupt coseismic subsidence) connections between landmasses, this explanation may indeed recall the time when the land connections between the Vernon Islands and Melville Island became drowned, more likely as the sea rose over the land. The seismic explanation is likely to be a later detail added on to an original story,

²⁰ Sims, ‘Tiwi Cosmology’. p 165

²¹ Morris, *The Tiwi: From Isolation to Cultural Change*. p 14

²² Ibid. p 10

²³ Mark Leonard, ‘One Hundred Years of Earthquake Recording in Australia’, *Bulletin of the Seismological Society of America* **98** (2008): 1458-70.

intended to give it credibility. As inferred for the earlier, it is likely that this latter tradition also dates from when sea level was at least 12-15 m lower than today.

Sea level was last 12-15 m lower in the Clarence Strait between about 8200-9650 years BP (Figure 4). Sea-level reconstructions from the South Alligator River (see Figure 3A for location) show that the sea reached its present mean level about 7400 years BP initiating widespread mangrove swamp development across northern Australia²⁴.

[insert Figure 4]

Rottnest, Carnac and Garden Islands

At the time of the first written accounts of the area around modern-day Perth and Fremantle, off the coast of which lie the islands of Rottnest, Carnac and Garden, there were no resident populations on these islands although there had been at various times in the past²⁵. There is an Aboriginal tradition

“that Rottnest, Carnac and Garden Island, once formed part of the mainland, and that the intervening ground was thickly covered with trees; which took fire in some unaccountable way, and burned with such intensity that the ground split asunder with a great noise, and the sea rushed in between, cutting off these islands from the mainland”.²⁶

It is unfortunate that only this one story regarding this tradition is extant but it is widely quoted and has not been contradicted. The insistence that all these islands once formed part of the mainland may suggest that a dry-land connection is being recalled, although it may be a generalization and not a detail worthy of close scrutiny. Yet the detail that this dry-land connection was ‘covered with trees’ does, if true, strengthen the interpretation of this tradition as dating from a time when sizeable areas of the present sea floor here were emergent to such an extent that they were beyond the reach of high tide and were able to support a lowland forest that could burn, as many Australian forests are designed to do periodically.

The catastrophic detail in this story describing how the ‘ground split asunder’ is unlikely to be an authentic detail, perhaps even an embellishment added by the (non-indigenous) recorder of this story. Yet the idea that the ‘sea rushed in’ could

²⁴ Colin Dix Woodroffe et al., ‘Relative Sea Level in the South Alligator River Region, North Australia, During the Holocene’, *Search* **18** (1987): 198-200.

²⁵ L. Collard, ‘Aboriginal History and Prehistory of Rottnest Island’, *Homo - Journal of Comparative Human Biology* **61** (2010): 206-06.

²⁶ George Fletcher Moore. *Diary of Ten Years Eventful Life of an Early Settler in Western Australia; and Also a Descriptive Vocabulary of the Language of the Aborigines* (London: Walbrook (facsimile edition 1978 by University of Western Australia Press), 1884). Dictionary, p 8

well be based on observations of *either* extreme waves at a time when postglacial sea level was slightly below the level of the land surface connecting these islands to the mainland *or* the final inundation of this land surface as sea level finally reached it. Either way, it is clear that it is a later detail than that describing the existence of a forested land connection, so it is this that should be dated in order to determine the antiquity of the tradition.

The bathymetry of the area is shown in Figure 5. While a sea level less than 5 m lower than today would probably allow a determined person to cross from the mainland to Rottnest (the island farthest from the mainland) through a combination of wading and swimming, for the island to have ‘formed part’ of the mainland, the sea level would have to have been 5-10 m deep, most likely 7-8 m deep if walkers kept to the (now-shallower) middle parts of the routes. Both Carnac and Garden Islands could have been reached when the sea level was less than 5 m below present.

[insert Figure 5]

Assuming that the tradition described derives from an observation during a time when sea level was at least 7-8 m below present, then this tradition must date from at least 7500-8900 years BP (see Figure 4), considerably older than an earlier published estimate for this tradition of 6500 years ago²⁷.

Spencer Gulf

The form of Spencer Gulf today is comparable to many lowland river valleys that existed during the Last Glacial Maximum and were subsequently drowned by postglacial sea-level rise, the outlines of the original valley still clearly visible. The valley was comparatively deep and is likely to have accommodated a wide-channel river that meandered across a broad floodplain. All this is now underwater yet can be inferred from bathymetry (Figure 6).

[insert Figure 6]

The Narrangga people who once inhabited Yorke Peninsula “had a story that has been handed down through the ages. It is a tale of ... when there was no Spencer’s Gulf, but only marshy country reaching into the interior of Australia”.²⁸ Although no other details of how this ‘country’ appeared seem to have been recorded – unlike the situation elsewhere along the Australian coast – the observation that it was marshy is consistent with a low-gradient river crossing a broad low-relief floodplain.

In other versions of this story, it is noted that at the time Spencer Gulf was dry, it was

²⁷ P.E. Playford, ‘Geological Research on Rottnest Island’, *Journal of the Royal Society of Western Australia* 66 (1983): 10-15.

²⁸ W.R. Smith. *Myths and Legends of the Australian Aborigines* (London: Harrap, 1930).p 168-9

“filled with a line of fresh-water lagoons, stretching northwards for a hundred miles or more. Each lagoon was the exclusive territory of a species of water bird. One lagoon belonged to the swans and the ducks, another to the grebes and the cormorants, still another to the water-hens, coots and reed-warblers. The trees belonged to the eagles, crows and parrots, while in the open country between the lagoons lived emus, curlews and mallee fowls. Further out were the animals, the dingoes and many kangaroo-like creatures, and in the thick grass by the waters were snakes, goannas and lizards”.²⁹

If this represents an authentic tradition, then it also is quite consistent with the landscape inferred from the bathymetry and with the likely organization of the lowland terrestrial ecosystem.

There are various traditions describing how Spencer Gulf was flooded by the sea, two of which contain all salient details. The older traditions ascribes the flooding to the action of a ‘huge’ kangaroo that possessed a ‘magic bone’ with which it dug a furrow along the ground.

“The sea broke through, and came tumbling and rolling along in the track cut by the kangaroo-bone. It flowed into the lagoons and marshes, which completely disappeared”.³⁰

The other tradition states that a ‘kangaroo-man’ “pointed the bone at the isthmus, which slowly split open. The sea poured through the opening, flooding the entire valley”³¹. There are two details in these accounts which, if they represent distant memories of observations of inundation, are worth interrogating.

The first is that the sea surface was obviously quite close to the level of the valley floor when initial inundation occurred – something that allows us to estimate its level (relative to today) and thus infer the antiquity of the observed event – because it had such a memorable effect on the land. It caused the marshes and lagoons to disappear ‘completely’ suggesting a sizeable overwash. It is tempting to regard this as a tsunami or other large wave event, which do affect the coasts of southern Australia³², but it still seems that this would have to have been superimposed on a sea level that was below yet close to the lowest level of the valley floor.

A second detail is the implication that prior to the inundation, sea level actually stood higher outside Spencer Gulf than the land within, perhaps held back by a barrier. In the first tradition, a breach in this barrier is implied as the sea then washed onto the

²⁹ A. Roberts and C.P. Mountford. *The Dawn of Time: Australian Aboriginal Myths* (Blackwood, South Australia: Art Australia, 1989).p 18

³⁰ Smith, *Myths and Legends of the Australian Aboriginals.*: p 172

³¹ Roberts and Mountford, *The Dawn of Time: Australian Aboriginal Myths.*p 18

³² E. A. Bryant and J. Nott, ‘Geological Indicators of Large Tsunami in Australia’, *Natural Hazards* **24** (2001): 231-49.

land along the newly-cut furrow. The second story is more explicit, talking of an 'isthmus' being 'split open'. Isthmuses (barriers) can develop in such situations, particularly as a result of (terrigenous) sand accumulating at the mouth of an estuary, and can become impenetrable by the sea allowing a dry land surface to exist below sea level on their landward side. For example, geoarchaeological studies of the Gulf of Gdańsk, northern Poland, linked the growth of offshore barriers to an influx of people into previously-waterlogged areas during Late Bronze/Early Iron Age times³³. And along the coast of southern Australia at Port Phillip Bay, there is evidence that this happened 2800-1000 years BP³⁴, perhaps giving rise to the Aboriginal oral traditions about this bay being dry, discussed further below.

The simplest model for the inundation described for Spencer Gulf might assume that the inundation occurred close to the 50-m isobath that marks the outer edge of the Gulf today. This is possible although the great age that would then be implied for the antiquity of this tradition makes it less likely than an inundation that occurred after the sea had already submerged the lower part of the Gulf. A intuitively more plausible scenario is therefore one that envisages a barrier at the entrance to the narrow part of the valley/gulf near the neck of Yorke Peninsula (perhaps along line AB in Figure 6) being breached and the valley inundated.

If this is the part of Spencer Gulf to which the inundation story refers, then its present maximum depth of 22 m is likely to be a minimum for the time of inundation, given that sediments have undoubtedly filled the valley since it was inundated. A conservative figure of 22-25 m for sea level at the time of the observation which inspired this tradition would mean that it originated 9550-9900 years BP. If the tradition does in fact refer to the inundation of the mouth of Spencer Gulf, then contemporary sea level would have been around 50 m below that of today, requiring that the tradition date from as much as 11,150-12,450 years BP (see Figure 4).

Kangaroo Island

The tradition about a former dry-land crossing between the Australian mainland and (now) offshore Kangaroo Island (Figure 7) is one of the best known of its type, much repeated and probably significantly embellished in some accounts since it was first written down. This is thought to have been in the 1840s and was obtained from the Raminyerar people of Encounter Bay just east of the Fleurieu Peninsula³⁵. The most comprehensive account and analysis of the tradition came later and is based on

³³ G. Miotk-Szpiganowicz, J. Zachowicz and S. Uscinowicz, 'Palynological Evidence of Human Activity on the Gulf of Gdansk Coast During the Late Holocene', *Brazilian Journal of Oceanography* **58** (2010): 1-13.

³⁴ GR Holdgate, B Wagstaff and SJ Gallagher, 'Did Port Phillip Bay Nearly Dry up between 2800 and 1000 Cal. Yr Bp? Bay Floor Channelling Evidence, Seismic and Core Dating', *Australian Journal of Earth Sciences* **58** (2011): 157-75.

³⁵ H.E.A. Meyer. *Manners and Customs of the Aborigines of the Encounter Bay Tribes, South Australia* (Adelaide: Dehane, 1846).

stories told by the Jaralde people³⁶. This account focuses on the pursuit by a man named Ngurunderi of his two wives westwards along this part of the south Australian coast.

[insert Figure 7]

The progress of Ngurunderi is marked by his 'creation' (a metaphor for discovery/naming) of various landscape features such as headlands and offshore islands. Ngurunderi's wives did not wish their husband to catch them and sought to find refuge on Kangaroo Island, the 'spirit-land', which was then "almost connected with the mainland, and it was possible for people to walk across".³⁷ Carrying their belongings (mats and nets), the two women began to cross to Kangaroo Island but Ngurunderi saw them from afar and called out '*Pink'ul'uŋ'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 into the open sea, taking with them their net baskets... and were at last drowned".³⁸

The women were transformed into the islands named The Pages (see Figure 7), the largest being the elder wife with her basket, the middle one being the younger wife, the smallest being the basket she dropped. What is significant in this account is the detail that the place where the women drowned was not where the crossing was located but in the 'open sea' where they were carried by waves coming from the (north) west. This locates the former land connection in Backstairs Passage, the narrowest point between the mainland and Kangaroo Island (see Figure 7). Other accounts, which are likely to have been collected from other sources, contain more details about both the nature of the former land connection and the way in which it became submerged.

A tradition reported in 1930 recalls a time when a land connection existed between Kangaroo Island and the mainland but that this connection was periodically inundated during storms³⁹, suggesting it was low, one that could be crossed by 'walking and wading'.⁴⁰ This is consistent with the description of this connection as "a line of partly submerged boulders".⁴¹ Comparing this information with the bathymetry (Figure 7) suggests that the Ngurunderi tradition dates from a time when

³⁶ R.M. Berndt, 'Some Aspects of Jaralde Culture, South Australia', *Oceania* **11** (1940): 164-85.

³⁷ *Ibid.* p 181

³⁸ *Ibid.* p 181

³⁹ Smith, *Myths and Legends of the Australian Aboriginals*.

⁴⁰ H.M. Cooper. *The Archeology of Kangaroo Island, South Australia*. Vol. Records of the South Australian Museum 13 (Adelaide: South Australian Museum, 1960).

⁴¹ Roberts and Mountford, *The Dawn of Time: Australian Aboriginal Myths*. p 24

the passage between Kangaroo Island and the mainland was narrower than today, perhaps allowing people to walk from the mainland near Cobbler Hill to Yatala Shoal, thence crossing the deeper part of Backstairs Passage through a combination of wading and swimming, and then being able to reach the island at Antechamber Bay. For this to be possible it is probably necessary for sea level to be around 30 m lower than today.

Details about the submergence of the land connection are understandably vague, some stating the waves came from the (north) west, some implying they were storm surges from the south. What is perhaps more germane is the detail in almost all accounts that, following the drowning of the wives of Ngurunderi, he dived into the ocean and swam to Kangaroo Island; there was perhaps no longer a land connection he could cross. This could be interpreted as meaning that the events described in this tradition recall the time when this land connection was finally inundated, clearly a significant event for people on both sides of Backstairs Passage who had been accustomed to traversing it.

Assuming that the Ngurunderi stories do recall the (final) submergence/destruction of the land connection between Kangaroo Island and the adjacent mainland, it seems most likely that this would have occurred when the sea level was 28-32 m below its present level. This would have therefore been 9800-10,650 years BP (see Figure 4). Interestingly, it was once considered that the land connection (Investigator Passage) between the north coast of Kangaroo Island and the Yorke Peninsula to the north was the last to be severed, this event occurring when the 'sill' at 28-33 m was inundated⁴². It seems likely that both Investigator Passage and Backstairs Passage became impassable for people on foot at approximately the same time.

Port Phillip Bay

There are numerous traditions about a time when Port Phillip Bay, at the head of which is the mouth of the Yarra River around which the city of Melbourne now lies, was dry land (Figure 8).

[insert Figure 8]

Perhaps the earliest extant account is that of William Hull in 1858 in his statement to the Legislative Council which included the information that the Yarra and Coast (Aboriginal) tribes "say that their progenitors recollected when Hobson's (Port Phillip) Bay was a kangaroo ground" – they say "Plenty catch kangaroo and plenty catch opossum there;" and that "the river (Yarra) once went out at the Heads, but that the

⁴² R. Jones, 'Man as an Element of a Continental Fauna: The Case of the Sundering of the Bassian Bridge', in J. Allen, J. Golson and R. Jones (eds), *Sunda and Sahul: Prehistoric Studies in Southeast Asia, Melanesia and Australia* (London: Academic Press, 1977), pp. 317-86.

sea broke in, and that Hobson's Bay, which was once a hunting ground, became what it is".⁴³

A later account came from one of the Woiworrung tribes, whose traditional lands surround much of the Bay, that

"Plenty long ago ... men could cross, dry-foot, from our side of the bay [in the east] to Geelong [in the west]'. They described a hurricane – trees bending to and fro – then the earth sank, and the sea rushed in through the Heads, till the void places became broad and deep, as they are today".⁴⁴

Comparable stories describe how once the people who lived in the area "had excellent hunting grounds on the lovely flat which is now Port Phillip Bay",⁴⁵ a place where "the Kulin [people] were in the habit of hunting kangaroos and emus".⁴⁶ A tradition was collected in the 1950s from the Aborigines living at Dromana, who recalled having formerly hunted throughout the Portsea and Queenscliff 'terrain' (see Figure 8); in crossing the mouth of the bay, a person had to "walk a little, swim a little".⁴⁷

Given the wealth of comparable stories from similar former lowlands along the Australian coast that appear to recall times several thousand years ago when postglacial sea level had not yet risen to within 5-10 m of its present level, it is tempting to assume that the same automatically applies to Port Phillip Bay. This may be the case, in which case a sea level 8-12 m lower would provide a minimum age for the time when postglacial sea level was just below the outer lip of the Bay at the western end of South Channel⁴⁸. If 8-12 m is assumed to be correct as the depth below present sea level at which the inundation of Port Phillip Bay recalled by the traditions recounted above took place, then those traditions date from 7800-9350 years BP (Figure 9). Dating of marine and freshwater palaeoenvironmental indicators on either side of entrance to the Bay show that at the time when sea level reached the level of the entrance, this became blocked and inundation was delayed for about 1000 years; this occurred finally at 7217 years BP⁴⁹.

⁴³ William Hull, 'Report of the Select Committee of the Legislative Council on the Aborigines, 1858-9 (Victoria)', *Committee of the Legislative Council on the Aborigines* (Melbourne: Government of Australia, 1859), pp. 12.p 12

⁴⁴ H. McCrae, ed., *Georgiana's Journal: Melbourne a Hundred Years Ago [Diary of Georgiana McCrae]* (Sydney: Angus and Robertson, 1934).p 176

⁴⁵ J. Isaacs. *Australian Dreaming: 40,000 Years of Aboriginal History* (Sydney: Lansdowne Press, 1980).p 115

⁴⁶ A. Massola. *Bunjil's Cave: Myths, Legends and Superstitions of the Aborigines of South-East Australia* (Melbourne: Lansdowne, 1968).p 46

⁴⁷ Hunter Rogers. *The Early History of the Mornington Peninsula* (Mornington, Melbourne: Mornington Leader, 1957).p 49

⁴⁸ estimated from data in GR Holdgate et al., 'Marine Geology of Port Phillip, Victoria', *Australian Journal of Earth Sciences* **48** (2001): 439-55.

⁴⁹ GR Holdgate, B Wagstaff and SJ Gallagher, 'Did Port Phillip Bay Nearly Dry up between 2800 and 1000 Cal. Yr Bp? Bay Floor Channelling Evidence, Seismic and Core Dating', *ibid.***58** (2011): 157-75.

[insert Figure 9]

But another explanation is possible here. This involves the possibility that the entrance to Port Phillip Bay became blocked comparatively recently causing it to largely dry out⁵⁰. It is estimated that the eastern end of South Channel could have become blocked after remaining at present sea level for about 1400 years with similar terrestrial sediment inputs to today, perhaps assisted by (tectonic) uplift. The central part of Port Phillip Bay would have become a lake, fed by the Yarra River, but over time this lake would have shrunk owing to an excess of evaporation over river/rain inputs. In the model of Holdgate et al.⁵¹, the connection between Port Phillip Bay and the sea is blocked about 2800 years BP, a lake forms at -20 m below present sea level about 2000 years BP but this has shrunk to a smaller lake at -22 m by about 1000 years BP when seawater breaches the gap and floods the bay once again (see Figure 9). If this is the case, then the traditions described may originate from less than a millennium ago rather than the earlier date discussed above although it is possible that the later reinforced the earlier.

Whether the Aboriginal traditions quoted refer to the earlier or the more recent flooding of Port Phillip Bay, if the latter indeed occurred, then the detail of the water 'rushing' or 'breaking' in is likely to be similar to what actually happened, given that in both cases the sea level outside The Rip would have been considerably higher than the land level within the Bay.

Cairns and Fitzroy Island

Off the coast of Queensland in the northern part of eastern Australia stretches the Great Barrier Reef, islands on which were occupied in the past by Aboriginal groups⁵², many of which "have stories recounting how the shore-line was once some miles further out; that it was – on the north-east coast – where the barrier reef now stands".⁵³

Specifically for the Cairns area, where the edge of the Great Barrier Reef is 50 km from shore, an early report states that "the Googanji natives ... say that before the flood the Barrier Reef was the original coastline, and that a river entered the sea near what is known as Fitzroy Island".⁵⁴ More details come from a later story collected from the Yidjndj people -

"a theme running through all the coastal Yidjndj myths is that the coastline was once where the barrier reef now stands ... but the sea

⁵⁰ Ibid.

⁵¹ Ibid.

⁵² M.J. Rowland, R. Baker and S. Wright, 'The Timing and Use of Offshore Islands in the Great Barrier Reef Marine Province, Queensland', *Quaternary International* (2014).

⁵³ Robert MW Dixon. *The Languages of Australia* (Cambridge: Cambridge University Press, 1980).p 46

⁵⁴ E.R. Gribble. *The Vanishing Aboriginals of Australia* (Sydney: Australian Board of Missions, 1933).p 7

then rose and the shore retreated to its present position. The only common noun denoting 'island' is *ḍaruway*, which also means 'small hill' – contrasting with *bunda* 'mountain, big hill'. The proper name of Fitzroy Island is *gabaṛ* 'lower arm', so called because most of this geographical feature [a promontory of the mainland] was submerged and only one extension remains above water. Note also that there was a place half-way between Fitzroy Island and King Beach that was called *mudaga* ('pencil cedar') after the trees which grew there; it is now completely submerged. Again Green Island is said to have been at one time four times as big as it is now – only the northwest portion remains above water".⁵⁵

The present geography of the area is shown in Figure 10A. For Fitzroy Island to be connected to the mainland, as the latter tradition states, the sea level would need to be 23-25 m lower than today. For Green Island to be four times larger in area, it is not necessary for the sea level to be any lower although it would certainly be more credible were it 2-5 m lower and the reef surface from which the modern island rises was emergent. Yet for the coast to be 'where the barrier reef now stands', it is probably necessary for sea level to be at least 50 m lower than today, depending on what people recognized as the 'barrier reef'.

[insert Figure 10]

It has been argued that during the Last Glacial Maximum, when what is now the Great Barrier Reef was emergent, the coast would have been cliffed and markedly unattractive to humans⁵⁶. Only later, as sea level rose over the edge of the continental shelf and a lowland terrestrial landscape developed that was both easy to access and contained diverse ecosystems, would people have been encouraged to occupy the area (Figure 10B).

If the stories quoted and the others that exist⁵⁷ recalling a time when the coastline was at the Great Barrier Reef, these would have to date from a time when sea level was perhaps somewhere in the range 30-65 m below present. As shown in Figure 10B, most of the shelf/reef off Cairns would have been dry land when sea level was 65 m lower yet large parts of the area would still have been emergent when sea level was 30 m lower. Much depends on how modern storytellers conceptualize what is and what was formerly meant by the (barrier) reef. With such a large range of former sea level, there is a massive range of minimum ages for these particular traditions, 9900-10,450 years BP if they refer to a time when sea level was 30 m lower, 12,600-13,400 years BP if they refer to a time when (as shown in Figure 10B) sea level was 65 m lower (see Figure 4).

⁵⁵ R.M.W. Dixon. *A Grammar of Yidiny*, Cambridge Studies in Linguistics (Cambridge: Cambridge University Press, 1977).p 14-15

⁵⁶ Bowdler, 'Offshore Islands and Maritime Explorations in Australian Prehistory'.

⁵⁷ Dixon, *The Languages of Australia*.

Discussion

Were there only a single isolated Aboriginal tradition in Australia about coastal inundation that might be associated with postglacial sea-level rise, then in all likelihood it would be regarded as an anomaly, lacking credibility and perhaps invented significantly more recently. Yet there are numerous traditions and all report much the same thing.

While there is understandably some uncertainty about the likely/possible ages of traditions from particular sites, there seems little doubt that they do actually recall the time when rising postglacial sea level attained the level of the continental shelf locally and rapidly inundated coastal lowlands. This is a view reported by many people, both in well-regarded texts of archaeology/prehistory and linguistics⁵⁸ as well as several scientific papers⁵⁹. The lack of any systematic analysis of these traditions, as is given here, may be due to the scepticism with which most scientists might instinctively regard the attribution of scientific credibility to oral traditions that date back several thousand years.

Yet the grounds for such scepticism are far less today than they were up until two decades ago. For example, the proposition of Oppenheimer⁶⁰ that certain types of land-raiser myths found throughout the Asia-Pacific region developed only following postglacial submergence of the former Sunda continent (in what is now island Southeast Asia) more than 12,000 years ago has found some empirical support⁶¹. More convincing, better-documented examples have been described subsequently, including the Klamath Indian myth about the last eruption of Mt Mazama (Oregon, USA) that occurred 7,700 years BP⁶² and the possibility that oral traditions on Flores (Indonesia) preserved observations of *Homo floresiensis* thought to have become

⁵⁸ Catherine H. Berndt and Ronald M Berndt. *The Speaking Land: Myth and Story in Aboriginal Australia* (Rochester, Vermont: Inner Traditions/Bear & Co, 1994); Berndt and Berndt, *The World of the First Australians. Aboriginal Traditional Life: Past and Present*; J. Flood. *Archaeology of the Dreamtime: The Story of Prehistoric Australia and Its People*. Revised ed (Sydney: Angus and Robertson, 1995); Isaacs, *Australian Dreaming: 40,000 Years of Aboriginal History*; Dixon, *The Languages of Australia*; Mulvaney and Kamminga, *Prehistory of Australia*.

⁵⁹ Sharpe and Tunbridge, 'Traditions of Extinct Animals, Changing Sea-Levels and Volcanoes among Australian Aboriginals: Evidence from Linguistic and Ethnographic Research'; Campbell, 'Aboriginal Traditions and the Prehistory of Australia'; Holdgate, Wagstaff and Gallagher, 'Did Port Phillip Bay Nearly Dry up between 2800 and 1000 Cal. Yr Bp? Bay Floor Channelling Evidence, Seismic and Core Dating'; P Memmott et al., 'Understanding Isolation and Change in Island Human Populations through a Study of Indigenous Cultural Patterns in the Gulf of Carpentaria', *Transactions of the Royal Society of South Australia* **130** (2006): 29-47.

⁶⁰ S. Oppenheimer. *Eden in the East: The Drowned Continent of Southeast Asia* (London: Weidenfeld and Nicolson, 1998).

⁶¹ Edwina Palmer, 'Out of Sunda? Provenance of the Jōmon Japanese', *Nichibunken Japan Review* **19** (2007): 47-75; P.D. Nunn. *Vanished Islands and Hidden Continents of the Pacific* (Honolulu: University of Hawai'i Press, 2009).

⁶² Douglas Deur, 'A Most Sacred Place: The Significance of Crater Lake among the Indians of Southern Oregon', *Oregon Historical Quarterly* **103** (2002): 18-49; Barber and Barber, *When They Severed Earth from Sky: How the Human Mind Shapes Myth*.

extinct at least 12,000 years BP⁶³. While these examples should not be regarded as a licence for the incautious interpretation of the antiquity of oral traditions or indeed that the belief all such 'myth' has empirical foundations, it does allow for some traditions in some cultures to have survived far longer than it was once thought any such traditions could.

Oral traditions seem to have had an uncommon longevity among Australian Aborigines. In addition to the inundation myths described above, another good measure of this comes from volcanic eruptions, which can be precisely dated. For example, Aboriginal traditions about the eruption-linked formation of crater lakes on the Atherton Tableland (Queensland) may date from 13,000 years BP⁶⁴ recalling times before the area became cloaked with rainforest about 7600 years BP^{65 66}. In another example, there are Aboriginal traditions that describe an eruption of Mt Gambier in South Australia 4300-4600 years BP⁶⁷. Aboriginal traditions also recall encounters with extinct megafauna several thousand years ago⁶⁸.

The antiquity of such Aboriginal traditions is clearly exceptional among the corpus of such traditions globally, requiring that exceptional conditions for the preservation of ancient traditions existed in Australia. The practice and nature of Aboriginal storytelling is likely to be key, particularly the ways in which it was ritually embedded in cultural practice, both routine and occasional, which encouraged the learning and onward transmission of particular traditions by successive generations⁶⁹. In addition, it is noted that the common incorporation of such material into dance rhythms and song had "a conventionalizing effect on the transmission of ideas"⁷⁰ that made them endure.

The vast size of Australia – roughly equivalent to the conterminous United States – militates against the sharing of such myths among widely-dispersed human groups.

⁶³ G. Forth, 'Hominids, Hairy Hominoids and the Science of Humanity', *Anthropology Today* **21** (2005): 13-17.

⁶⁴ R.M.W. Dixon. *Words of Our Country: Stories, Place Names and Vocabulary in Yidiny, the Aboriginal Language of the Cairns-Yarrabah Region* (St Lucia: University of Queensland Press, 1991).

⁶⁵ Sharpe and Tunbridge, 'Traditions of Extinct Animals, Changing Sea-Levels and Volcanoes among Australian Aborigines: Evidence from Linguistic and Ethnographic Research'.

⁶⁶ These particular traditions are widely regarded as authentic and have been included on the Register of the National Estate by the Australian Heritage Commission.

⁶⁷ J. Smith. *Booandick Tribe of South Australian Aborigines: A Sketch of Their Habits, Customs, Legends and Language* (Adelaide: Government Printer, 1880); L. Sutherland. *The Volcanic Earth* (Sydney: University of New South Wales Press, 1995).

⁶⁸ Flood, *Archaeology of the Dreamtime: The Story of Prehistoric Australia and Its People*; P. Vickers-Rich and N.W. Archbold, 'Squatters, Priests and Professors: A Brief History of Vertebrate Palaeontology in *Terra Australis*', in P. Vickers-Rich, et al. (eds), *Vertebrate Palaeontology of Australasia* (Lilydale, Victoria: Pioneer/Monash University, 1991), pp. 1-43; Sharpe and Tunbridge, 'Traditions of Extinct Animals, Changing Sea-Levels and Volcanoes among Australian Aborigines: Evidence from Linguistic and Ethnographic Research'.

⁶⁹ Special attention is given to enculturating children in Australian Aboriginal societies which is also likely to have encouraged the preservation of oral traditions Ross, 'Australian Aboriginal Oral Traditions'. Berndt and Berndt, *The Speaking Land: Myth and Story in Aboriginal Australia*.

⁷⁰ Berndt and Berndt, *The World of the First Australians. Aboriginal Traditional Life: Past and Present*.p 387

The linkages between narrative and local-area places in most Aboriginal myths⁷¹ also suggests that sharing between tribal groups is not responsible for traditions describing similar events (like coastal flooding) in different places. Likewise the fact that oral traditions are sacred and owned by particular clans reduces the likelihood of them being widely diffused although there is evidence that this occurred within particular sub-regions of Australia⁷².

It can therefore be concluded that the various thematic categories of Aboriginal myths (such as inundation and eruption myths) are most likely to have developed independently of one another. This means that any shared characteristics most likely result from similarities in the phenomenon being observed rather than from details being shared between groups post-observation, a conclusion that justifies the interpretation given here.

The significance of this research is apparent in both an Australian and a global context. In Australia, claims of multi-millennial continuity of Aboriginal cultures has implications for the understanding of cultural evolution as well as claims about rights to land. In terms of the evolution of culture, there are numerous implications, ranging from insights into 'dreamtime' stories and the transgenerational transmission of knowledge to environmental influences on the ways in which landscapes are mind-mapped and their resource potential remembered⁷³. Several instances of land claims that hinge on the demonstration of sustained occupation of lands involving the naming of landmarks and the recollection of their historical associations before European colonization in 1788 have been made⁷⁴.

In a global sense, this research demonstrates the capacity for memories to be sustained in preliterate societies far longer than generally supposed, suggesting that it may be worth having a 'second look' at their oral traditions to determine whether they might indeed have been built around observations of events that are still recognizable⁷⁵. Such considerations in turn feed into debates about the evolution of human cognition and language and whether in fact we have underestimated our ancient ancestors' cognitive abilities and, as a result, undervalued their capacity for innovation and misinterpreted some of their greatest achievements⁷⁶.

⁷¹ Berndt, 'Some Aspects of Jaralde Culture, South Australia'.

⁷² Ross, 'Australian Aboriginal Oral Traditions'.

⁷³ D. Rose, 'Phylogensis of the Dreamtime', *Linguistics and the Human Sciences* **8** (2013): 335-59; B. Sansom, 'The Brief Reach of History and the Limitation of Recall in Traditional Aboriginal Societies and Cultures', *Oceania* **76** (2006): 150-72; Chris S. M. Turney and Douglas Hobbs, 'Enso Influence on Holocene Aboriginal Populations in Queensland, Australia', *Journal of Archaeological Science* **33** (2006): 1744-48.

⁷⁴ D. Mercer, 'Aboriginal Self-Determination and Indigenous Land Title in Post-Mabo Australia', *Political Geography* **16** (1997): 189-&; J. F. Weiner, 'Conflict in the Statutory Elicitation of Aboriginal Culture in Australia', *Anthropological Forum* **21** (2011): 257-67.

⁷⁵ Barber and Barber, *When They Severed Earth from Sky: How the Human Mind Shapes Myth*.

⁷⁶ Iain Davidson, 'Peopling the Last New Worlds: The First Colonisation of Sahul and the Americas', *Quaternary International* **285** (2013): 1-29; Cecilia Heyes, 'New Thinking: The Evolution of Human Cognition Introduction',

There are also two caveats about this study that should be noted. First is that there will likely remain in the minds of many readers an instinctive sense of implausibility about stories that appear to have endured so long, especially since sea level has not been rising for several thousand years. The answer here would be that memories of place are, as elsewhere, key to Aboriginal group identity in Australia: a belief that people removed from ancestral lands lose cultural integrity, they 'lose themselves'⁷⁷. Second is whether stories of coastal drowning might in fact be post-colonial inventions inspired, as elsewhere, by the introduction of Christianity and the story of the Noachian Deluge. The response to this is that these stories were gathered from Aboriginal sources that had not been missionized⁷⁸ and that 'flood stories', also probably uninfluenced by Christianity, are documented in Australian Aboriginal cultures and are clearly separated from those recounted in this study⁷⁹.

Conclusions

There is good evidence that Australian Aboriginal traditions recalling coastal inundation date from several thousand years ago at the time when rising postglacial sea levels overwhelmed low-relief continental fringes. These traditions contain details that provide insights into the nature of the landscapes of pre-inundation coastlines and the terrestrial ecosystems with which people interacted. They also provide details of how inundation took place and in some instances of the challenges that arose for the occupants of these areas after they became flooded.

This study bears out the suggestion that certain oral traditions in particular cultural contexts can survive several thousand years in forms that allow the observations on which they were based to remain recognizable. This has implications for the interpretation of similar traditions in Australia and elsewhere that may allow unique insights into memorable aspects of deep history. Future work will focus on compiling and gathering further traditions about coastal inundation along the Australian coast

Philosophical Transactions of the Royal Society B-Biological Sciences **367** (2012): 2091-96; Dietrich Stout, 'Stone Toolmaking and the Evolution of Human Culture and Cognition', *ibid.* **366** (2011): 1050-59.

⁷⁷ Dixon, *Words of Our Country: Stories, Place Names and Vocabulary in Yidiny, the Aboriginal Language of the Cairns-Yarrabah Region*; K.T. Carlson. *The Power of Place, the Problem of Time: Aboriginal Identity and Histori-Cal Consciousness in the Cauldron of Colonialism* (Toronto: University of Toronto Press, 2010); G. Morgan. *Unsettled Places: Aboriginal People and Urbanisation in New South Wales* (Kent Town: Wakefield Press, 2006).

⁷⁸ Aboriginal Australia was characterized by a 'rather unremarkable history of conversion': Carolyn Schwarz and Francoise Dussart, 'Christianity in Aboriginal Australia Revisited', *Australian Journal of Anthropology* **21** (2010): 1-13.

⁷⁹ Some flood traditions are found in compilations of Australian Aboriginal myths like Smith, *Myths and Legends of the Australian Aboriginals*. Others celebrate the annual monsoonal floods in northern Australia like some in C.P. Mountford. *Records of the American-Australian Scientific Expedition to Arnhem Land, Volume 1 - Art, Myth and Symbolism* (Carlton: Melbourne University Press, 1956).. Others recall tsunamis like that for Montgomery Island in P. Lucich. *Children's Stories from the Worora* (Canberra: Australian Institute of Aboriginal Studies, 1969).

and other locations (like the coast of India) where there is reason to suppose ancient traditions of this kind may also be extant.

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⁸⁰ G. Singh, A. P. Kershaw and R. Clark, 'Quaternary Vegetation and Fire History in Australia', in A.M. Gill, R.A. Groves and I.R. Noble (eds), *Fire and the Australian Biota* (Canberra: Australian Academy of Science, 1981), pp. 23-54.

⁸¹ A. Thorne et al., 'Australia's Oldest Human Remains: Age of the Lake Mungo 3 Skeleton', *Journal of Human Evolution* **36** (1999): 591-612.

⁸² R. G. Roberts et al., 'The Human Colonization of Australia: Optical Dates of 53,000 and 60,000 Years Bracket Human Arrival at Deaf-Adder Gorge, Northern Territory', *Quaternary Science Reviews* **13** (1994): 575-83.

⁸³ R. Roberts et al., 'Single-Aliquot and Single-Grain Optical Dating Confirm Thermoluminescence Age Estimates at Malakunanja li Rock Shelter in Northern Australia', *Ancient TL* **16** (1998): 19-24.

⁸⁴ J. Balme, 'Excavations Revealing 40,000 Years of Occupation at Mimbi Caves, South Central Kimberley, Western Australia', *Australian Archaeology* **51** (2000): 1-5.

⁸⁵ Lewis et al., 'Post-Glacial Sea-Level Changes around the Australian Margin: A Review'.

traditions of coastal inundation in six places along the Australian coast. Ages for traditions are derived graphically. Note that additional analysis of the Port Phillip traditions is shown in Figure 9.

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⁸⁶ Ibid.

⁸⁷ Holdgate, Wagstaff and Gallagher, 'Did Port Phillip Bay Nearly Dry up between 2800 and 1000 Cal. Yr Bp? Bay Floor Channelling Evidence, Seismic and Core Dating'.

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