

## Chapter 24

# To the Islands: The Archaeology of the Archipelagos of NW Australia and its Implications for Drowned Cultural Landscapes

Ingrid Ward and Peter Veth

**Abstract** In this chapter we consider the archaeological records of islands from three archipelagos lying off NW Australia and their implications for the submerged landscapes of which they were once a part. We draw attention to unique human-landscape configurations from circa 42,000 cal BP to 7500 cal BP, for which there may not be analogues in modern cultural landscapes. A holistic understanding of the genesis of maritime cultures is currently based on a truncated record in which the most significant part (the drowned landscapes) is usually missing. Here we make the case for renewed investigation of the drowned landscapes of the NW Shelf, in order to better understand the role of islands, archipelagos and coastlines in human history.

### 24.1 Introduction

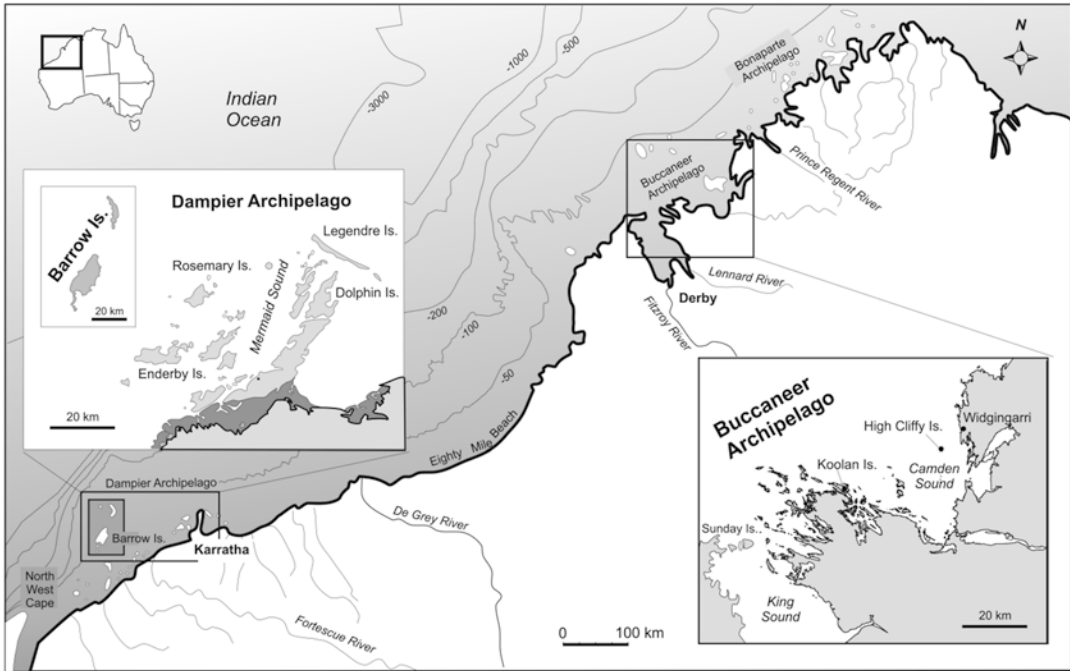
Since the earliest human occupation of Australia currently dated to circa 50,000 cal BP (Veth and O'Connor 2013) changing sea-levels have had dramatic effects on the Australian continental shelf, repeatedly exposing and drowning vast lowland areas. Prior to the most recent period of sea-level rise between 20,000 cal BP and 8000 cal BP (the postglacial transgression) the archipelagos and islands of NW Australia were part of an extensive lowland plain that extended in the south from NW Cape to as far north as the Bonaparte Gulf and westward well over 100 km from its current position (Jones 1973). This plain was dissected by riverine courses and scattered hills (Semeniuk et al. 1982; Semeniuk and Wurm 1987), some of which now make up the islands of the Dampier and Bonaparte Archipelagos and the Montebello and Barrow Island complexes (Fig. 24.1).

For many Indigenous Australians in the northwest, their 'country' is not conceptually restricted to the present landscape but includes the past, and correspondingly includes the landscapes drowned by postglacial sea-level rise. This 'Sea Country' or 'Saltwater Country' includes the mainland coastal, island and marine environments that together make up the traditional estates of maritime Indigenous groups in Australia (Smyth 1997). Like Hayward's (2012, p. 1) notion of the 'aquapelago', the Indigenous concept of Sea Country provides a framework for understanding the cultural continuum

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I. Ward • P. Veth (✉)

School of Social Sciences, M257, Faculty of Arts, The University of Western, Crawley, WA 6009, Australia  
e-mail: [ingrid.ward@uwa.edu.au](mailto:ingrid.ward@uwa.edu.au); [peter.veth@uwa.edu.au](mailto:peter.veth@uwa.edu.au)



**Fig. 24.1** Archipelagos of NW Australia. (a) Dampier Archipelago, Barrow Island and Montebello Islands and (b) the Buccaneer Archipelago

between land and sea by emphasising ‘the interrelation of marine and terrestrial spaces in areas of the planet in which small fragments of land are aggregated’ (Hayward 2012, p. 1).

From an archaeological perspective, land and sea shed light on each other but, as argued by Dawson (2012, p. 19), we are more likely to find evidence of maritime cultural interactions on the islands than underwater, and this has certainly been the case for NW Australia so far. However, archaeologists in Australia are now beginning to explore these submerged landscapes (Ward et al. 2013, see also Flemming, Chap. 18) and a range of shelf edge sites (Veth et al. 2014; Ward et al. 2016). Indeed, we argue that the investigation of these former coastlines and submerged landscapes is critical to our understanding of maritime adaptations in this region (Ward et al. 2015, 2016, see also Benjamin et al. 2011).

Archaeological evidence demonstrates a continuity of marine resource exploitation in the north-west, from as early as ~42,000 cal BP (Veth et al. 2007, 2014, Morse 1988, 1993, Przywolnik 2002, 2005). At the same time, new understandings about the nature of human settlement of the plains and past coastlines, and reliance on maritime versus terrestrial resources of the now drowned NW Shelf are emerging from midden records and macrofaunal remains on Barrow and Montebello Island complex (Veth et al. 2007, 2014, 2016; McDonald and Veth 2009; Ward et al. 2016) and from some of the extensive engraved rock art (petroglyphs) in the Dampier Archipelago region (Mulvaney 2013, 2015). In this chapter, we summarise the evidence for maritime adaptations from the archipelagos of NW Australia and their implications for drowned cultural landscapes of northern Australia more generally. In contrast to the wealth (>3000) of submerged sites in the northern hemisphere (Benjamin et al. 2011), there are still no documented underwater sites from Australian waters that date to before mid-Holocene sea-level stabilisation.

## 24.2 Archaeology of the Archipelagos of NW Australia

### 24.2.1 Dampier Archipelago

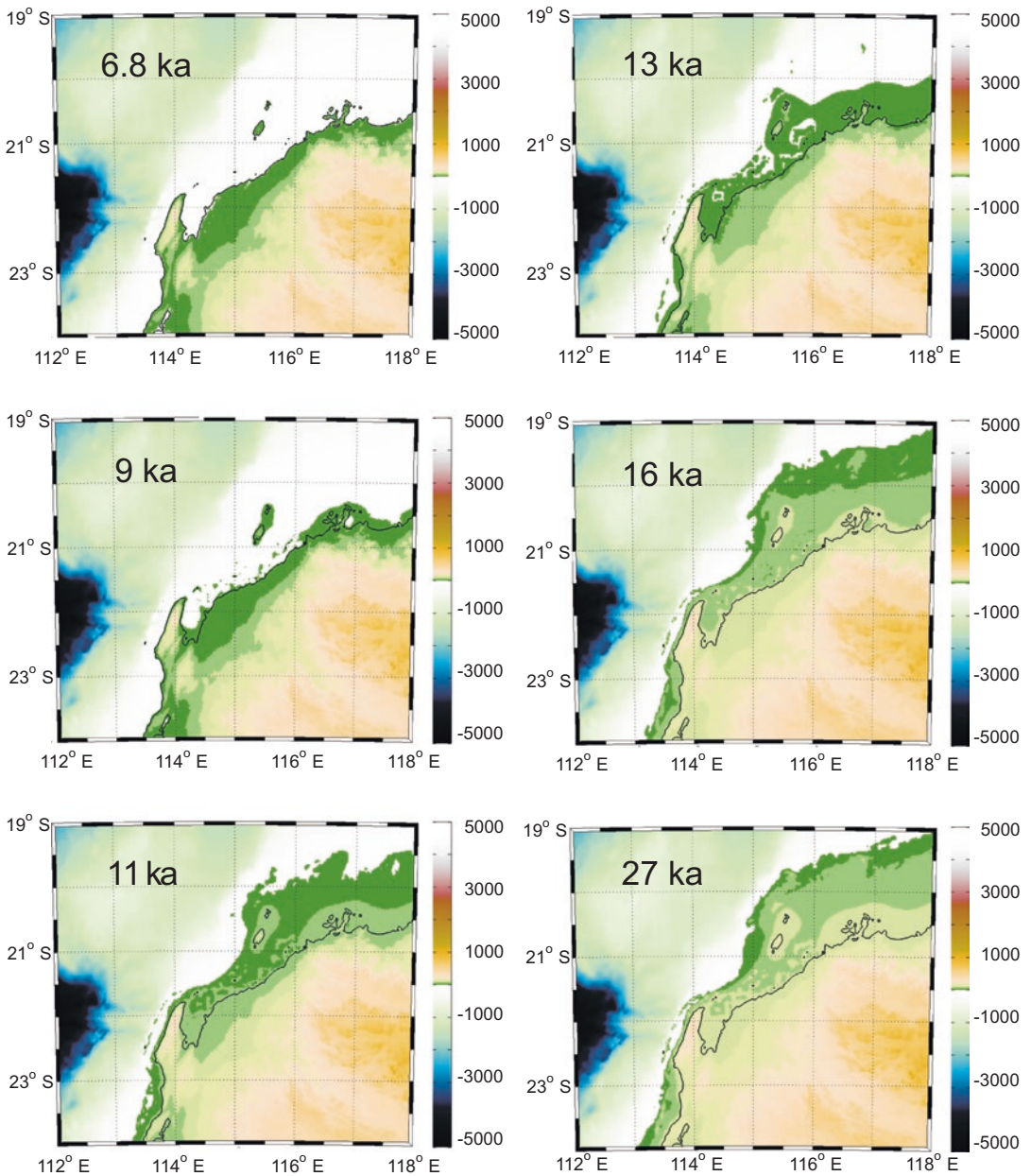
The 42 islands that make up the Dampier Archipelago (now known as *Murujuga*) are located within the Pilbara Offshore marine bioregion on the inner part of the North West Shelf (NWS) (Fig. 24.1). Legendre Island and some of the small outer islets (e.g., Kendrew Island, Brigadier Island, Cohen Island) are remnants of consolidated limestone ridges which delineate a previous coastline (Semeniuk et al. 1982). In contrast, the other islands and the Burrup Peninsula (formally Dampier Island) are predominantly composed of granophyres, gabbro and basalt (Donaldson 2011), cut by dolerite dykes which extend offshore (Semeniuk et al. 1982; Dortch 2002).

The Dampier Archipelago formed when rising seas flooded the coastal plain between approximately 8500 and 7500 years ago. Older formations dating to the terminal Pleistocene have been identified including lithified dune, beach and offshore bar deposits located within and immediately beyond the Dampier Archipelago. These provide a physical clue to the changing sea-levels and former shoreline systems around which people may have foraged (Kojan 1994). Indeed shell midden sites from Burrup, Enderby and Rosemary Islands dating to between 10,000 and 7500 cal BP (Vinnicombe 1987; Bradshaw 1995; McDonald and Veth 2009; McDonald 2015) show an intriguing proximal association to some of these submerged shorelines sequences (see Ward et al. 2013), suggesting continuous use of the coastline before it was completely cut off from the mainland. This is the same pattern recently identified for the nearby Carnarvon bioregion, containing the Barrow and Montebello island groups, where over 40,000 years of continuous reliance on marine resources has been identified (Manne and Veth 2015).

Rising seas would have first started to encroach on the outer islands of *Murujuga* around 9000 years ago (Fig. 24.2). The use of coastline resources is evident from *Terebralia* (mud whelk) middens on Rosemary Island (Bradshaw 1995) and Enderby Island (Ward et al. 2013). Rising sea-levels progressively separated bedrock hills (e.g., Enderby Island, Rosemary Island, Malus Island and West Intercourse Island) from the mainland (Semeniuk et al. 1982; Bird and Hallam 2006; Ward et al. 2013) and may have even been abandoned (McDonald 2015). Around 7000 cal BP, Dolphin and Dampier Islands still formed a peninsula but by 6000 cal BP the Archipelago took its present form (see Fig. 24.1).

The wider use of the *Murujuga* landscape-seascape from the time before sea level rise through to islandisation is mirrored in the changing themes of the engraved rock art (petroglyphs) of the archipelago (McDonald and Veth 2009; Mulvaney 2013, 2015; McDonald 2015). A shift is seen through time from a preponderance of terrestrial species, including some not found in the region today such as the Emu, to increasing proportions of marine and wetland resources. Late Pleistocene (c. 47,000–11,700 cal BP) rock art, when *Murujuga* was just a small rangeland in the wider Abydos Plain, is focused around terrestrial fauna, anthropomorphic figures and simple geometric elements (Table 24.1). The early transgressive rock art phase (c. 11,700–8000 cal BP) has pecked birds and macropods, dynamic grouped humans and geometric designs but importantly sees the introduction of marine subjects and distinctive anthropomorphic types, such as the *Murujuga* ‘rainbow-man’ (Table 24.1, McDonald 2015).

The mid-Holocene (8000–6500 cal BP), when *Murujuga* truly forms an archipelago, is characterised by the dominance of fish and other marine fauna, and anthropomorphs with distinctive local stylistic traits. It is at this time that the outer islands (e.g., Rosemary, Enderby) are thought to have been abandoned. This phase of abandonment of distant outer islands is matched by the termination dates from both the Barrow and Montebello island groups further west on the NW Shelf. The final mid–late Holocene (6400 cal BP to Modern) rock art found on the inner islands accessible from the mainland is argued to represent a distinctive *Murujuga* style with distinctive maritime themes,



**Fig. 24.2** Modelled sea-level rise on the North West Shelf for key periods (Modelling after Jaqueline Austermann, Harvard University, Dec 5 2014, Fleming and Lambeck 2004; Peltier 2004; Mitrovica and Milne 2003; Kendall et al. 2005); D'Alpoim Guedes et al. 2016)

including large stylised water birds, more complex turtle compositions and crustaceans. Anthropomorphs show group behaviours and locally-distinctive headdresses and material culture combinations likely signalling the establishment of new territories after sea-level stabilisation (Table 24.1).

There is limited evidence that at some time during the most recent period (4000 cal BP to Modern) people from the coastal Pilbara region voyaged to some of the outer islands through the development

**Table 24.1** Landscape, sea level and climate, art phases and archaeological correlates

Period age (ka BP)	Landscape and climatic context	Archaeological context	Mulvaney's rock art phases
Late Pleistocene 47.0–22.0	Abydos Plain: coast 110 km away Increasingly arid Weak monsoon	Early colonisation and establishment of regional broad-based economy. Art shows broad regional connections and long distance chains of stylistic connection	Phase 1: Regional graphics include archaic faces, elaborate geometric and anthropomorphic figures; unique forms disarticulated blob-heads
Late Pleistocene 22.0–18.0	Abydos Plain: coast 160 km away Maximum aridity	Peak LGM occupational hiatus in many sites. Art demonstrates regional social connections between Dampier Range refugia and many major rock art complexes through the Pilbara and into the Western Desert	Phase 2: Regional style: Outline, large terrestrial faunal and anthropomorphic figures, simple geometric elements
Late Pleistocene 18.0–11.7	Marine transgressive: Rapid sea-level rise – coast within 30 km, reintroduction of summer monsoon	Small population groups, high residential mobility; social pressure through territorial retraction. Art used to establish territoriality but distribution extends beyond the boundaries of the current Archipelago	Phase 3a: 1st distinct Murujuga style: Outline, solid, internal patterned terrestrial faunal and anthropomorphic figures, simple geometric elements
Pleistocene – Holocene transition 11.7–8.0	Rapid sea-level rise – coast reaches outer 'islands'. Increasingly humid e return of monsoon	Larger population groups with decreasing residential mobility as territorial pressures increase and coastal resources are proximal and become more reliable: art and stone arrangements are used to assert territoriality. Art switches to marine focus	Phase 3b: Pecked intaglio stylised birds and macropods, dynamic grouped humans, simple and linear geometric designs
Mid Holocene 8.0–6.5	Wetter: continuing sea-level rise results in formation of the Archipelago. Outer islands become separated; Great Mangrove forest is primary resource focus	Increasingly coastal focus, with decreasing residential mobility. Distinctive local signaling in the art repertoire from increased territorial pressure. Stone structures delineate space on larger habitation sites and modification of landscape is widespread. Outer islands may have become inaccessible	Phase 4: Murujuga style but with coastal connections: Outline and solid fauna and geometric elements; anthropomorphs have distinctive local stylistic traits, marine faunas begin to dominate
Mid-late Holocene 6.5–4.0	Semi-arid with monsoonal influence. Sea-level highstand, results in reduction of mangal forests	Marine A – Predominant use of marine and intertidal (mangrove) resources: higher sea level creates an environmental change with apparent dire consequence for mangrove forests. Outer islands abandoned	Phase 5a: Distinctive Murujuga style: Outline and internal design marine and terrestrial fauna, anthropomorphs show group behaviours and distinctive headdresses and material culture
Late Holocene 4.0–0	Modern island configuration. The last 1500 years represents a stable sea-level at current height	Marine B – Predominant use of marine resources with switch to sand flat and rocky resources after highstand. Increased intensity of site occupation (e.g. large shell mound building) and accelerated ritual and ceremonial cycles	Phase 5b: Murujuga style: Outline, internal and solid design marine-dominated fauna with increasing schematisation; human figures have exaggerated anatomical features and different ceremonial paraphernalia to preceding phases

From McDonald (2015)

and use of log rafts, and an intimate knowledge of tides and currents (King 1827; Smyth 1997, 2007; Green 1998). Indeed, the different site patterning observed in the Holocene art repertoire across the Archipelago is argued to reflect the relative accessibility of the respective islands: by watercraft with respect to the outer and intermediate islands (e.g. East Lewis, Gidley and Malus); by swimming, to the intermediate islands; or by walking across low tidal flats, to Burrup Island and other proximal islands (e.g. Dolphin, West Intercourse).

Arguably *Murujuga* only represents Hayward's (2012) 'aquapelagic' society from the terminal Pleistocene when people began to make use of the coast and later as they navigated to the islands of the Archipelago, whilst remaining fundamentally connected to the mainland. However, there is increasing archaeological evidence that connection to Sea Country in the Pilbara was in place from as early as 42,000 cal BP (Veth et al. 2014), with artefacts fashioned from shellfish found up to 50 km inland. Regardless of whether they were utilitarian or dietary in nature, the inland presence of shellfish (including *Pinctada* sp., *Trochus* sp. and *Melo amphora*) indicates that people were both familiar with, and reliant on, coastal resources from a very early period (Veth et al. 2007, 2014, 2016, see also Ward et al. 2015, 2016).

### 24.2.2 Barrow Island: Montebello Island Complex

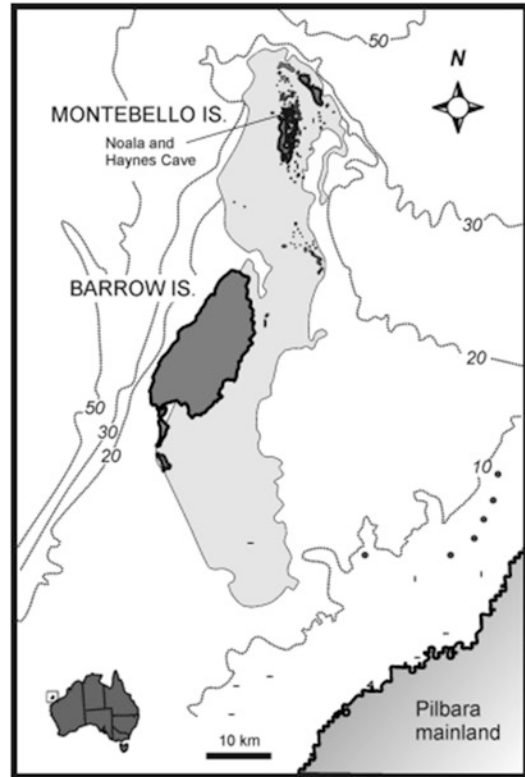
Contrasting Dampier Archipelago's predominant volcanic geology, the offshore Barrow and Montebello Islands are comprised entirely of limestone (calcarenite), which has had a major influence on the preservation of certain landforms and zooarchaeological remains (Manne and Veth 2015; Ward et al. 2016). Barrow Island is the largest island on the inner shelf with nine smaller islands nearby (Fig. 24.3). Measuring some 20 km by 10 km in area, Barrow island is the second largest island off the entire Western Australian coastline. Lying 20 km north of Barrow Island, the Montebello Island group comprises 265 distinct, low lying islands and islets (Fig. 24.3).

Virtually all coastlines dating between about 130,000 and 15,000 cal BP now lie submerged and distant from the modern coast (Erlandson 2001), hence the record from Barrow and Montebello Island complex is particularly important because of its position on the continental shelf edge (Fig. 24.1). Moreover, the abandonment of these islands around 7500 cal BP, probably coinciding with the timing of insolation, provides a unique 'time capsule' of terminal Pleistocene behaviours without admixture from later Holocene occupation (Veth 1993, Veth et al. 2007, 2014, 2016). Indeed the high diversity of near-continental shelf rockshelters, islands and prograding shorelines in the wider region indicates at least 42,000 years of contact with the coast and a unique window into marine resource-use through long periods of glacio-eustatic and climate change (Veth et al. 2014, 2016).

Early occupation is registered at Noala Cave on the Montebello Island to 31,400 cal BP (based on an AMS date from *Melo amphora*, Veth et al. 2014). At this time, sea-level would have been ~80 m below present and the then limestone plateaux would have been a topographic highpoint in an ecologically-rich and diverse coastal sand plain, as represented in the zooarchaeological record by burrowing bettong (*Bettongia lesueur*), spectacled hare wallaby (*Lagorchestes hirsutus*), western barred bandicoot (*Paremeles bougainville*), rock wallaby (*Petrogale* sp.), northern quoll (*Dasyurus hallucatus*), and Olive Python (*Liasis olivaceus*), a species that frequents permanent springs in rocky outcrops (Manne and Veth 2015).

After this early human presence, there is a hiatus until 14,500 cal BP, after which time episodic occupation is registered at Noala Cave up to 8700 cal BP and at nearby Haynes Cave until 8300 cal BP just prior to the insolation and inundation of the Mary Ann Passage (Veth et al. 2007; Manne and Veth 2015). Like the Dampier Archipelago, there is a clear shift in the representative faunal assemblages over the Pleistocene–Holocene transition, as distance to the coast decreased. Between ca. 11,500 and 8300 cal BP, there is a clear increase in exploitation of marine resources—particularly the

**Fig. 24.3** Map with bathymetric data for the Barrow-Montebello Islands, as well as the locations of Noala, Haynes and Boodie Caves (Sourced from Veth et al. 2007, 2014)

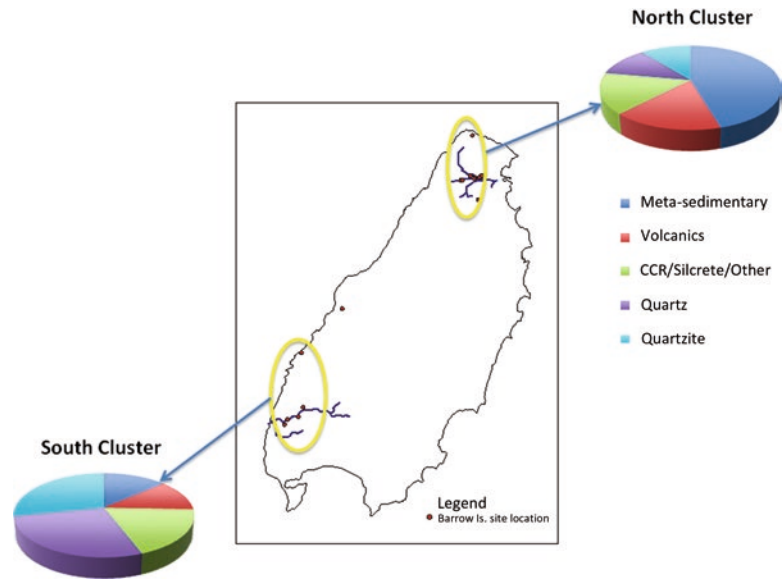


mangrove mudwhelk *Terebralia* sp.— in the Montebello Island record as the sea approached its current position (Veth et al. 2014; Manne and Veth 2015). At nearby Barrow Island, the archaeological record indicates that *Terebralia* sp. was consumed from as early as 17,000 cal BP—if not earlier (see Veth et al. 2016), with continuous exploitation of the transgressive coastal resources for both technological (*Melo* sp.) and economic purposes for a further 9000 years until it too was abandoned c. 7400 cal BP (Veth et al. 2014, 2016).

Not only do the archaeological records provide evidence of movement of people outward to the contemporaneous coastline, but the flaked and ground stone record also shows movement of people landward. Preliminary analysis of the lithic assemblages on Barrow Island indicates that artefacts are manufactured from both local limestone and also a significant proportion of exotic materials including quartz, volcanic and metasedimentary rocks (Veth et al. 2007; Basgall et al. 2014; Zeanah et al. 2014). The sources of these materials are found inland of the current Pilbara coastline and may thus have been traded over larger distances (Veth et al. 2007), and likely even from the Dampier Archipelago.

Lithic records show two distinct systems of lithic circulation and possibly two periods of occupation corresponding to a period when the island was part of the extensive NW Shelf, and a subsequent period when it was increasingly insulated. The model entertains two distinct stone transport systems (Fig. 24.4). A working hypothesis sees these distributions reflecting riverine sources that may have once run south and north of Barrow Island, with Ashburton and Cane Rivers in the south predominantly draining through metamorphic and sedimentary bedrock geology, and the Fortescue and Robe Rivers to the north draining through igneous bedrock geology. While there is no doubt that palaeoriver channels and coastal estuaries would have been a key resource focus for any past occupants, there is a clear need to research the past morphological extension of fluvial and estuarine systems across the shelf to be fully confident of any interpretation of past resource use (see Ward et al. 2015).

**Fig. 24.4** Pie charts showing different proportions of rock types within the lithic assemblages on different parts of Barrow Island, based on preliminary data (Reproduced with permission from Mark Basgall, David Zeanah and David Glover)



### 24.2.3 *Buccaneer Archipelago*

The Buccaneer Archipelago occurs further north in the Kimberley Marine bioregion (KIM) in remote northwestern Australia (Fig. 24.1). The rocky sandstone islands of the Buccaneer Archipelago number over 800 and cover over 50 km<sup>2</sup> between King Sound and Camden Sound (Fig. 24.1). The largest of these, Koolan Island (22 km<sup>2</sup>), is no more than 1 km from the mainland, with Round Island providing a stepping stone to the mainland.

Archaeological surveys on Koolan Island provide some of the earliest evidence for the use of marine shellfish in northern Australia, with dates from a mangrove dwelling bivalve (*Geloina coxans*) of 27,300 ± 1100 cal BP (O'Connor 1999). This age estimate demonstrates the existence of developed mangrove communities, the shellfish of which were then transported considerable distances. At this time, sea level would have been about 125 m below present and over 150 km further northwest. However, King Sound has one of the largest tidal ranges (maximum tidal range 11.5 m) of any tide-dominated delta in the world (Brocx and Semeniuk 2011) and the tidal range may have been even larger during the LGM (Ward et al. 2013). Hence it is highly likely that complex intertidal facies were available for exploitation during the period leading into the LGM. Even now, many traditional marine activities in NW Australia revolve around the huge tidal range and gently sloping seabed, which results in vast areas of intertidal land and reef flats available for exploitation (Smyth 2007, p. 15). Thus coastlines with large tidal ranges are likely to have offered very attractive resources, and to have been intensively used throughout the Late Pleistocene and Holocene.

However, contrary to the implied expectation of continued coastal use, there is an apparent occupational hiatus between 24,600 cal BP and 10,900 cal BP in the SW Kimberley (O'Connor 1999). Whether this represents cultural abandonment or sedimentary stasis and differential preservation of archaeological sites along this tide-dominated shelf is not certain (O'Connor 1999, see also Ward and Larcombe 2003) although a change in sediment composition between the Late Pleistocene and mid-Holocene layer (shell midden) implies the latter. If people followed the coastline as it retreated and transgressed back again (see also Bowdler 1977) then a large part of the Pleistocene evidence for occupation may either be destroyed or lie buried and submerged on the drowned shelf. It should be noted



that the date of 27,300 cal BP at Koolan shelter is not a basal date and depth-age curves indicate that it may have been in use 40,000 years ago, when the sea was again close to the site (O'Connor 1999).

King Sound (Fig. 24.1) itself formed when rising sea levels flooded the coastline at the end of the LGM around 12,000 years ago (Semenuk 1980) and the sea reached the northern coastline of Koolan about 1000 years later, which is when the records of coastal occupation—and, importantly, net sediment accumulation—are re-established (O'Connor 1999). In the Pacific, many islands became inhabitable only when their coastal plains emerged sufficiently for them not to be inundated at high tide, something called the 'crossover point' (Nunn 2009). The attainment of the crossover point is coincident with the earliest-known date for the human settlement of many such islands (Dickinson 2003), and perhaps by inference, the re-establishment of coastal occupation along many parts of the mainland following the post-glacial transgression.

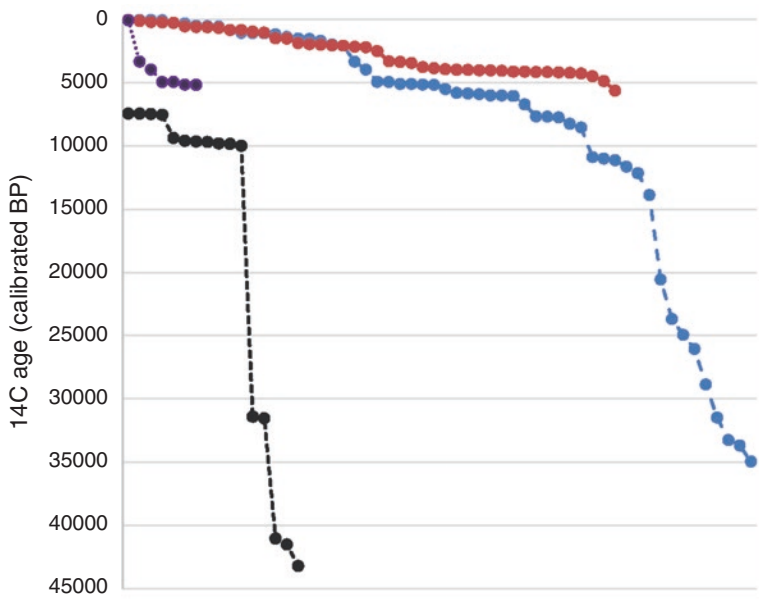
Other islands, including the outermost islands of the Archipelago, have not been systematically excavated. Hence there is both a temporal and spatial gap in the record for the Buccaneer Archipelago that, if filled, may provide new insights in regard to maritime adaptation associated with changing sea-level and changing tidal regimes (e.g. Fa 2008). Indeed a more precise understanding of past tidal regimes and past intertidal environments that may have been used by past occupants is necessary along all parts of this tide-driven continental shelf (see also Ward et al. 2013).

### 24.3 Continuity Versus Contiguity

Hayward's (2012) emphasis is on the archipelago as an entity constituted by human presence whereby the utilisation of the environment matters more than the islands as a geographical entity. Yet they are not mutually exclusive because archipelagos, to paraphrase Hayward (2012, p. 6, added emphasis) '*wax and wane as climate patterns [and hence sea-level] alter and as human socio-economic organisations and technologies, and/or the resources they rely on change and develop in these [changing coastal] contexts*'. The examples we have profiled briefly above illustrate that coastlines, coastal ecosystems and coastal occupation records are dynamic (see also Manne and Veth 2015; Ward et al. 2015, 2016).

This leads to the question of continuity and contiguity in the 'aquapelagical' record. Continuity relies heavily on the resolution of the available archaeological, environmental and chronological data (Stein 1993). Natural and cultural processes are necessarily coupled and operate irregularly over space and time, hence no single island or site can be expected to provide a continuous record of occupation. Rather these individual island records need to be linked with records from adjacent contexts both above and below water. It is this interdisciplinary 'contiguous landscape approach' between the terrestrial and marine, island and mainland, past and present that provides the best opportunity to resolve a significant missing element within Australia's ancient and rich archaeological heritage (McDonald and Veth 2009).

This *contiguous* approach can be well demonstrated for the Barrow Island and Montebello Island complex. Fig. 24.5 shows the pooled archaeological radiocarbon data for the wider northern Carnarvon bioregion lying to the west and south of the Pilbara island chains. It illustrates the break in radiocarbon dates from the island records precisely when they cut off from the mainland, with post-insulation dates being picked up immediately from the coastal mainland records at nearby Onslow and Cape Range. Here steep offshore shelves and prograding shoelines have preserved the earliest post-transgression records of marine resource use. The inference is that maritime people retreated to the hinterland as transgressive seas cut off the islands but maintained their reliance on coastal maritime resources. The presence of exotic materials in the lithic records indicates ongoing links with the mainland, either through long-distance movements of groups or exchange networks, even before the islands were abandoned (see also Veth et al. 2014). This is the 'coastal coalescence' described by Veth et al.



**Fig. 24.5** Pooled archaeological radiocarbon frequency data for the Carnarvon bioregion (current for 2014), which show a ‘switching off’ of the islands (*black line*) to Holocene mainland records (*purple and red lines*). NW Cape’s steep offshore profile registers continuous occupation. Dates are calibrated (at 95%) using Oxcal v. 4.2, using the Marine Calibration, with a regional offset ( $\delta R$ ) of  $54 \pm 30$  based on Squire et al. (2013)

(2014) in which Aboriginal people developed ‘hybrid’ maritime-desert societies focused both on the plentiful littoral zone and more dispersed arid interior resources.

Hence archipelagos and island complexes provide an insight into the spatio-temporal mosaic that is presented as the residue of extinct patterns and processes (McGlade and van der Leeuw 2013, p. 6). At the macro-scale, these are the effects of addition/loss of accessible lands such as LGM refugia and archipelagos or islands, and at the micro-scale, they are the effects of variable survival and exposure of occupation within any geomorphic unit. As such, any extrapolation between present-day terrestrial and maritime archaeological landscapes, particularly in shallow shelf areas, must be based on sound geological and geomorphological principles. Wherever possible, exhaustive and precise chronologies must be obtained across multiple sample points (Bates et al. 2007; Ward et al. 2015, 2016). In offering multiple sample points in the form of relict shelf islands (archipelagos), nearshore uplifted coral terraces with steeply shelving profiles and procumbent prograding shorelines, a unique window into past marine cultural and resource configurations has been uncovered from the Carnarvon bioregion and is also likely to be found in the Kimberley bioregion.

## 24.4 Conclusion: Drowned Cultural Landscapes and Human Dispersals

Hayward (2012) indicated that the study of cultural seascapes should not stop at its surface but should delve deeper. While he was mainly referring to aquaculture and fisheries in a modern context, we argue that any study of ‘aquapelagic societies’ would be incomplete without considering the submerged landscapes of which these archipelagos and island complexes were once a part (see also Erlandson and Fitzpatrick 2006). At present our understanding of the genesis of maritime cultures is inevitably

based on a truncated record in which the most significant part (the drowned landscape) is usually missing (Ward et al. 2013, 2015). Whilst underwater exploration for traces of Indigenous societies on the now-submerged shelf is still nascent in Australia, it is unquestionably necessary to fully understand the role of oceans, islands and coastlines in human history.

The islands and archipelagos of NW Australia are geologically, ecologically and archaeologically unique, linked together by their common development through postglacial sea-level rise. There is no question that, at times of lower relative sea level, the extended coastal shelf of NW Australia was occupied by Aboriginal groups relying on both marine and land-based resources (McDonald 2011, p. 12; Veth et al. 2014, 2016). The archaeological records from the archipelagos of NW Australia are testament to this. To this extent islands are not necessarily entities with ‘defined geographical parameters’ (Bowdler 1995, p. 945) but rather entities where our understanding of their past is limited by our lack of knowledge of their former geographic extent. The present and past coast and islands all in effect constitute Sea Country.

Yet until there is systematic study of drowned cultural landscapes, these islands and archipelagos provide the only real link with the submerged context, and the only means of inferring, indirectly, the nature of that submerged landscape, for which we only have limited geological and chronological data, at present, and still no cultural records. What is missing is an archaeology of the *seabed* to match that of the land (following Dawson 2012), i.e., a systematic exploration of the now-submerged landscapes occupied by anatomically modern humans for the first 45,000 years of the occupation of Sahul. In short, the islands and archipelagos of NW Australia are not simply isolates of land surrounded by a mass of sea, but rather are all part of a complex tapestry with a long-standing connection to both the mainland and the seas that connect them.

The archaeological record for near-continuous use of maritime resources by peoples of NW Australia from at least 42,000 cal BP may be ascribed to highly adaptable foragers who comfortably switched between productive coastal, sub-coastal and often more resource-patchy interior habitats. The settling of a vast and relatively arid continent by people armed with advanced marine skills acquired from the increasingly poor terrestrial returns of the Wallacean islands (O’Connor and Veth 2000) sets the conditions for both early coastal resource exploitation and penetration deep into the continent. These early dates for use of dietary marine molluscs are the oldest for AMHs (anatomically modern humans) outside of Africa and are seen to be one of the signatures for the ‘super-charged’ dispersal of modern humans along the southern coastal route. They also raise the spectre of coastal colonisation models again (e.g., Bowdler 1977), as these were previously found wanting due to older dates being returned from interior sites (Veth et al. 2007). As coastal chronologies match those of the interior, and which now appear to contain some dietary molluscan assemblages (in addition to utilitarian and ornamental uses), the centrality of marine competencies in the dispersal of humans through southern and South East Asia must again be critically re-examined.

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## References

- Basgall ME, Zeanah DW, Glover DW (2014) Technological organisation of artefact surface scatters on Barrow Island: Barrow Island Archaeology Project (2013–2015) Western Australia. In: Paper presented to the 79th Annual Meeting of the Society for American Archaeology Austin, TX
- Bates MR, Bates RC, Briant RM (2007) Bridging the gap: a terrestrial view of shallow marine sequences and the importance of the transition zone. *J Archaeol Sci* 34:1537–1551

- Benjamin J, Bonsall C, Pickard C, Fischer A (eds) (2011) *Submerged prehistory*. Oxbow, Oxford
- Bird C, Hallam SJ (2006) A review of archaeology and rock art in the Dampier Archipelago. A report prepared for the National Trust of Australia (WA)
- Bowdler S (1977) The coastal colonisation of Australia. In: Allen J, Golson J, Jones R (eds) *Sunda and Sahul: prehistoric studies in Southeast Asia, Melanesia and Australia*. Academic Press, London, pp 205–246
- Bowdler S (1995) Offshore islands and maritime explorations in Australian prehistory. *Antiquity* 69:945–958
- Bradshaw E (1995) Dates from the archaeological excavations on the Pilbara coastline and islands of the Dampier archipelago, Western Australia. *Aust Archaeol* 41:37–38
- Brocx M, Semeniuk V (2011) The global geoheritage significance of the Kimberley coast, Western Australia. *J R Soc West Aust* 94(2):57–88
- D'Alpoim Guedes J, Austermann J, Mitrovica J (2016) Lost foraging opportunities for East Asian hunter-gatherers due to rising sea level since the last glacial maximum. *Geoarchaeology* 31(4):255–266
- Dawson H (2012) Archaeology, aquapelagos and island studies. *Shima: Int J Res Res Island Cult* 6(1):17–21
- Dickinson WR (2003) Impact of mid-Holocene hydro-isostatic highstand in regional sea level on habitability of islands in Pacific Oceania. *J Coast Res* 19:489–502
- Donaldson M (2011) Understanding the rocks: rock art and the geology of Murujuga (Burrup peninsula). *Rock Art Res* 28(1):35–43
- Dortch C (2002) Preliminary underwater survey for rock engravings and other sea floor sites in the Dampier archipelago, Pilbara region, Western Australia. *Aust Archaeol* 54:37–42
- Erlandson JM (2001) The archaeology of aquatic adaptations: paradigms for a new millennium. *J Archaeol Res* 9(4):287–350
- Erlandson JM, Fitzpatrick SM (2006) Oceans, islands, and coasts: current perspectives on the role of the sea in human prehistory. *J Island Coast Archaeol* 1:5–32
- Fa DA (2008) Effects of tidal amplitude on intertidal resource availability and dispersal pressure in prehistoric human coastal populations: the Mediterranean–Atlantic transition. *Quat Sci Rev* 27:2194–2209
- Fleming K, Lambeck K (2004) Constraints on the Greenland ice sheet since the last glacial maximum from sea-level observations and glacial-rebound models. *Quat Sci Rev* 23:1053–1077
- Green N (1998) Aboriginal affiliations with the sea in Western Australia. In: Gray F, Zann L (eds) *Traditional knowledge of the marine environment in northern Australia*. Proceedings of a workshop held in Townsville, Australia. Workshop Series No. 8, pp 19–29
- Hayward P (2012) Aquapelagos and aquapelagic assemblages. *Shima: Int J Res Res Island Cult* 6(1):1–10
- Jones HA (1973) Marine geology of the northwest Australian continental shelf. *Bur Miner Resour Geol Geophys Bull* 136:102
- Kendall RA, Mitrovica JX, Milne GA (2005) On postglacial sea level: II. Numerical formulation and comparative results on spherically symmetric models. *Int Geophys J* 161:679–706
- King P (1827) *Narrative of a survey of the inter-tropical and western coasts of Australia, performed between the years 1818 and 1822* (2 volumes). John Murray, London. Facsimile reprint-Adelaide: Libraries Board of South Australia, 1969
- Kojan CJ (1994) The geology and mineral resources of the proposed Dampier Archipelago National Park. Record 1994/2. Geological Survey of Western Australia, Dept. Minerals and Energy, p 43
- Manne T, Veth P (2015) Late Pleistocene and early holocene exploitation of estuarine communities in northwestern Australia. *Quat Int* 385:112–123. doi:10.1016/j.quaint.2014.12.049
- McDonald J (2011) Study of the outstanding universal values of the Dampier Archipelago Site, Western Australia. Report to the Australian Heritage Council. Available at: <http://www.aasdenvironment.gov.au/heritage/ahc/national-assessments/dampier-archipelago/pubs/outstanding-universal-values.pdf>. Accessed 12 Apr 2012
- McDonald J (2015) I must go down to the seas again: or, what happens when the sea comes to you? Murujuga rock art as an environmental indicator for Australia's north-west. *Quat Int* 385:124–135. doi:10.1016/j.quaint.2014.10.056
- McDonald J, Veth P (2009) Dampier archipelago petroglyphs: archaeology, scientific values and national heritage listing. *Archaeol Ocean* 2009(Supplement):49–69
- McGlade J, van der Leeuw SE (2013) Time, process and structured transformation in archaeology. Routledge, London
- Mitrovica JX, Milne GA (2003) On postglacial sea level: I general theory. *Geophys J Int* 154(2):253–267
- Morse K (1988) Mandu Mandu creek rockshelter: pleistocene human coastal occupation of north west cape, Western Australia. *Archaeol Ocean* 23:81–88
- Morse K (1993) New radiocarbon dates from north west cape, Western Australia: a preliminary report. In: Smith MA, Spriggs M, Fankhauser B (eds) *Sahul in review: Pleistocene archaeology in Australia, new Guinea and island Melanesia*, Occasional papers in prehistory, vol 24. Department of Prehistory, Research School of Pacific Studies, ANU, Canberra, pp 155–163
- Mulvaney K (2013) Iconic imagery: pleistocene rock-art development across northern Australia. *Quat Int* 285:99–111

- Mulvaney K (2015) *Murujuga Marni: rock art of the macropod hunters and mollusc harvesters*. University of Western Australia Press, Crawley
- Nunn PD (2009) *Vanished islands and hidden continents of the Pacific*. University of Hawai'i Press, Honolulu
- O'Connor S (1999) 30,000 years of aboriginal occupation: Kimberly, North-West Australia. Canberra: Department of Archaeology and Natural History and Centre for Archaeological Research, Australian National University. *Terra Australis* 14
- O'Connor, S, Veth P (2000) The world's first mariners: savanna dwellers in an island continent. In: O'Connor S, Veth P (eds) *East of Wallace's Line: studies of past and present maritime societies in the Indo-Pacific region*. *Modern Quaternary Research in South East Asia* 16:V–VI. A.A. Balkema, Rotterdam. pp 99–137
- Peltier WR (2004) Global glacial isostasy and the surface of the ice-age earth: the ICE-5G (VM2) model and GRACE. *Annu Rev Earth Planet Sci* 32:111–149
- Przywolnik K (2002) Patterns of occupation in Cape Range Peninsula (WA) over the last 36,000 Years. Unpublished PhD thesis, Department of Archaeology, University of Western Australia, Nedlands
- Przywolnik K (2005) Long-term transitions in hunter-gatherers of coastal northwestern Australia. In: Veth P, Smith M, Hiscock P (eds) *Desert peoples: archaeological perspectives*. Blackwell, Oxford, pp 177–205
- Semeniuk V (1980) Quaternary stratigraphy of the tidal flats, king sound, Western Australia. *J R Soc West Aust* 63:65–78
- Semeniuk V, Wurm PAS (1987) The mangroves of the Dampier archipelago. *J R Soc West Aust* 69(2):29–87
- Semeniuk V, Chalmer PN, Le Provost I (1982) The marine environments of the Dampier archipelago. *J R Soc West Aust* 65(3):97–114
- Smyth D (1997) Saltwater country aboriginal and Torres Strait islander interest in ocean policy development and implementation. Socio-cultural considerations, Australia's ocean policy issues paper 6. Environment Australia, Canberra
- Smyth D (2007) Sea countries of the North-West. Literature review on Indigenous connection to and uses of the North West Marine Region. Report for Australian Government Department of Environment and Water Resources. Available at <http://www.environment.gov.au/resource/sea-countries-north-west>. Accessed 18 Sept 2014
- Squire P, Joannes-Boyau R, Scheffers AM, Nothdurft LD, Hua Q, Collins LB, Scheffers SR, Zhao J-X (2013) A marine reservoir correction for the Houtman-Abrolhos archipelago, East Indian Ocean, Western Australia. *Radiocarbon* 55(1):103–114
- Stein JK (1993) Scale in archaeology, geosciences and geoarchaeology. *Geol Soc Am Spec Pap* 283:1–10
- Veth P (1993) The aboriginal occupation of the Montebello Islands, Northwest Australia. *Aust Aborig Stud* 2:39–50
- Veth P, O'Connor S (2013) The past 50,000 years: an archaeological view. In: Bashford A, Macintyre S (eds) *The Cambridge history of Australia*, vol 1. Cambridge University Press, Melbourne, pp 17–42
- Veth P, Aplin K, Wallis L, Manne T, Pulsford T, Chappell A (2007) Late quaternary foragers on arid coastlines: archaeology of the Montebello Islands, Northwest Australia, *British archaeological reports international series S1668*. Archaeopress, Oxford
- Veth P, Ditchfield K, Hook F (2014) Maritime deserts of the Australian northwest. *Aust Archaeol* 79:156–166
- Veth P, Ward I, Manne T (2016) Coastal feasts: a pleistocene antiquity for resource abundance in the maritime deserts of north West Australia? *J Island Coast Archaeol*. doi:10.1080/15564894.2015.1132799
- Vinnicombe P (1987) Salvage archaeology of the Burrup peninsula. *Aust Archaeol* 25:53–79
- Ward I, Larcombe P (2003) A process-orientated approach to archaeological site formation: application to semi-arid northern Australia. *J Archaeol Sci* 30:1223–1236
- Ward I, Larcombe P, Mulvaney K, Fandry CA (2013) The potential for discovery of new submerged archaeological sites near the Dampier archipelago, Western Australia. *Quat Int* 308–309:216–229
- Ward I, Larcombe P, Veth P (2015) A new model for coastal resource productivity and sea-level change: the role of physical sedimentary processes in assessing the archaeological potential of submerged landscapes from the north-west Australian continental shelf. *Geoarchaeology* 30:19–31
- Ward I, Veth P, Manne T (2016) To the islands born: unique records of past landscapes and human habitation from the islands of northwestern Australia. In: Harff J, Bailey G, Lüth F (eds) *Geology and archaeology: submerged landscapes of the continental shelf*. Geological Society, London, Special Publication, 411, pp 251–263. First published online September 19, 2014, updated October 12, 2015. <http://dx.doi.org/10.1144/SP411.4>
- Zeanah DW, Basgall ME, Seah I (2014) Lithic landscape of Barrow Island: a view from the open scatters: Barrow Island Archaeology Project (2013–2015) Western Australia. Paper presented to the 79th Annual Meeting of the Society for American Archaeology Austin, TX