

Aboriginal Heritage of the Tasmanian Wilderness World Heritage Area (TWWHA)

A literature review and synthesis report

March 2017

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Foreword from the Aboriginal Heritage Council

The Aboriginal Heritage Council (AHC) welcomes the Aboriginal Heritage of the Tasmanian Wilderness World Heritage Area (TWWHA): a literature review and synthesis report.

Archaeological research projects have made a significant contribution to the Tasmanian Aboriginal community's knowledge of ancestral practices by complementing stories and traditions passed down through families.

At times in the past the relationships between researchers and Aboriginal people have been in conflict with different expectations and priorities. However, when co-operation and mutual respect guide the focus, methodologies and use of research, the benefits to Aboriginal people and the research community can be significant.

This literature review and synthesis report provides a helpful synthesis of previous archaeological research in the Tasmanian Wilderness World Heritage Area. The Council looks forward to further co-operative research projects in the TWWHA and the benefits these can provide to Aboriginal people and the wider Tasmanian, Australian and international community.

A handwritten signature in black ink, reading "Rocky Sainty", enclosed within a thin black rectangular border.

Rocky Sainty
Chair – Aboriginal Heritage Council

Executive Summary

This is a review of the archaeological research that has been undertaken in the Tasmanian Wilderness World Heritage Area (TWWHA) over the last thirty-five years. This report was prepared with financial support from the Australian Government Department of the Environment and Energy as part of *The Assessment of Aboriginal Cultural Values (AACV) Project*. The AACV project was commissioned in response to the July 2016 request by the World Heritage Committee for a 'synthesis report of all available information on cultural sites of the property' to be submitted to the World Heritage Centre by mid-2017.

Archaeological research has shown that Aboriginal people occupied the TWWHA for at least the past 35,000 years and were, for 20,000 years, the southernmost people on Earth. Archaeological excavations have shown that the area contains a rich suite of Australian Pleistocene (ice age) sites, with occupation deposits providing significant information on Aboriginal life in Tasmanian and mainland Australia during this period. The area can be considered a Pleistocene 'province' as the sites share many attributes in common.

During the Pleistocene, Tasmanian Aboriginal people lived under alpine conditions when temperatures averaged 6°C below those of today. Detailed archaeological studies of faunal assemblages have revealed the hunting and butchering practices of the inhabitants, as well as the timing of their seasonal visits. Aboriginal people predominantly hunted wallaby so this archaeological evidence offers an interesting comparative dataset and research opportunity in relation to select mainland Australian sites and the northern hemisphere sites associated with the reindeer hunters of Europe. Studies of their lithic material shows that, while most was locally obtained, Aboriginal people carried favoured stone up to 100 kilometres from the source.

As the ice age waned, the predominately alpine environment was overtaken by encroaching wet forests. These forests are likely to have driven away the prey species, with Aboriginal people potentially unable to turn back these forests with their firesticks. Based on current evidence, Aboriginal people may subsequently had to abandon large areas in the TWWHA for as long as 10,000 years. At the same time the sea had risen and created the island of Tasmania, isolating the Tasmanian Aboriginal people from mainland Australia for the longest period in human history.

Current archaeological evidence suggests that it was not until about 4,000 years ago that Aboriginal people began to reoccupy the greater TWWHA, with a focus on the coastline. Importantly, while this suggests a period of hiatus, people may have remained within many areas of the TWWHA, with evidence of occupation either undiscovered and/or lost through inundation of coastline by rising sea levels. The presence of hundreds of middens containing the food remains of shellfish, birds, land, and marine mammals is testimony to the

abundant resources on the coastline, which is one of the richest heritage coastlines in Australia.

The TWWHA contains rock markings of particular significance to Aboriginal people today. These range in date from Pleistocene ochre hand stencils deep inside caves to pecked marks on rocks more recently executed with metal tools introduced by European people.

The research completed within the TWWHA has made an important contribution to our knowledge and understanding of Tasmanian Aboriginal culture and is a fundamental aspect supporting its listing as a mixed cultural and natural World Heritage property. This knowledge provides an opportunity for Tasmanian Aboriginal people to engage and connect with the cultural practices of the past both now and into the future.

Introduction

This document is a literature review and synthesis report of the archaeological and allied research that has been undertaken since the 1980s into the Aboriginal heritage of the Tasmanian Wilderness World Heritage Area (TWWHA). The document forms a contribution to the larger project entitled *The Assessment of Aboriginal Cultural Values (AACV) Project* and takes the form of a selective, narrative review of the literature supporting the inclusion of the TWWHA on the World Heritage List on the basis of cultural criteria. The literature is sourced mainly from the published, peer-reviewed, academic arena. It considers cultural resource management studies or consultancy reports only where relevant academic treatment is absent.

The document has been prepared in response to the July 2016 request of the World Heritage Committee for a 'synthesis report of all available information on cultural sites of the property' to be submitted to the World Heritage Centre by mid-2017 (World Heritage Committee 2016). There are four maps to accompany this report with these found in Appendix A. Map 1 shows the geographical features referred to in the following text. Map 2 illustrates Tasmania at the height of the ice age, including the land bridge connecting Tasmania and mainland Australia. Map 3 shows Tasmania at the time that the land bridge is inundated. Map 4 is the distribution of known Aboriginal heritage sites in the TWWHA, specifically identifying those mentioned in the text. A glossary is provided as Appendix B. Importantly, the reader should note that dates provided within the text as BP (Before Present) are uncalibrated radiocarbon ages.

This is a story of the successful adaptation by Aboriginal people to extreme climatic change over almost 35 millennia. The review begins by describing the initial Aboriginal occupation of Tasmania during the Pleistocene with most of the evidence for this occupation coming from the areas now known as the TWWHA. The narrative continues by recounting the adaptation by Aboriginal people to their new land. While current archaeological evidence suggests that Aboriginal people lived in the area now known as the TWWHA for 20,000 years before the possible abandonment of the area towards the end of the Pleistocene, it remains unclear whether the area was completely abandoned. The possibility for ongoing occupation is reflected by the likelihood of undiscovered sites within this period that may or may not have been lost through environmental changes such as the encroachment of forests and inundation of coastline by rising sea levels.

The TWWHA is one of the world's great archaeological 'provinces' (Cosgrove 1995), containing many Aboriginal sites, each sharing many similar characteristics. The cave sites within the TWWHA contain rich, well-preserved, occupation deposits of bone and stone artefacts. The information contained in these deposits is comparable and regularly surpasses any in mainland Australia from the same period and finds parallels in relation to artefact

numbers and preservation only in sites within France and Spain (Holdaway, 2004; Holdaway & Cosgrove, 1997). The region and its sites offer an important southern hemisphere comparator to the better known Late Pleistocene sites of Europe. "The specific targeting onto reindeer by the European hunters bears comparison with the similar emphasis on wallabies by the sub-Antarctic palaeo-Tasmanians" (Kiernan, Jones, & Ranson, 1983:31).

Despite archaeological excavations in the area only commencing in the early 1980s and ceasing in the mid-1990s, continuing research on the excavated material is still being published in academic papers. The information from these sites has become an important component of general archaeological general text-books on Australian archaeology (Flood, 2004; Hiscock, 2007; Lourandos, 1997; Mulvaney & Kamminga, 1999) as well as specialist works (eg. Dennell & Porr, 2014; Gamble & Soffer, 1990).

Populating the new land

Cosgrove (2007) has argued that the human colonisation of the Sahul landmass (the earlier continent consisting of mainland Australia, Tasmania and Papua New Guinea) over the past 45,000 years was an important episode in human migration across the globe. The arrival of people into Tasmania represented the last phase of this movement and predates, by almost 20,000 years, human migration into the Americas (Dillehay et al., 2015; Meltzer, 2009). It was the southernmost point reached by people at this time. This expansion was facilitated by extreme climatic change. Large-scale variation in solar radiation received by Earth caused substantial change in global temperatures. During cold phases, enormous amounts of water were locked up in sea-ice and glaciers, substantially reducing sea levels across the globe. The arrival of Aboriginal people into Tasmania was facilitated by just such a massive drop in sea level between 40,000 and 36,000 years ago when, at 50-55 metres below present sea level, a land bridge was formed across the eastern edge of what is now Bass Strait (Lambeck & Chappell, 2001). Entry into and expansion across Tasmania by Aboriginal people appears to have been almost instantaneous, with two of the earliest occupation sites known in Tasmania, Warreen Cave and Parmerpar Meethaner, both in the TWWHA, dated to 34,790±501 BP (Allen, 1996a) and 33,850±420 BP (Cosgrove, 1995) respectively. At the time, Aboriginal people would have been living well inland and at a relatively high altitude. A vast heritage became submerged when seas rose again to their present level. Thus, the cultural heritage of the TWWHA holds even greater significance, as the surviving remnants of a much wider social and economic system.

It has been claimed that people arrived in Tasmania much earlier, around c.150,000 BP. This is based solely on the presence of charcoal in a pollen core from a wetland in the base of the Darwin Crater that is said to indicate increased firing of the landscape of a likely anthropogenic nature (Jackson,

1999). Cosgrove (1999:363) regards this interpretation as “extravagant” arguing there is no archaeological (i.e., clearly human) evidence for this early arrival into Tasmania. Of the 140 carbon dates from the earliest occupation sites in Tasmania, none show dates older than 35,000 BP. Currently there are a small but increasing number of sites on mainland Australia that have been confirmed as being older than 45,000 BP, with evidence to suggest colonisation approximately 50,000 years ago (Allen & Hiscock, 2016), however sea level studies show no available land bridge into Tasmania at that time.

When Aboriginal people arrived in Tasmania c. 35,000 years ago, the land was far different from today. The Pleistocene paleoecology has been well described (Allen, Cosgrove & Garvey, 2016; Colhoun & Shimeld, 2012; Cosgrove, 1991, 1999; Cosgrove, Allen & Marshall, 1994a; Porch & Allen, 1995). After the arrival of people, temperatures continued to fall during the Last Glacial Maximum (LGM) between 26,000 – 19,000 years ago (Clark et. al., 2009). At that time, the average temperature fell to between 4.5°C and 6°C below today’s average values (Colhoun & Shimeld, 2012). The sea level was about 120 metres below the present day level, rendering Tasmania a peninsula. The initial land bridge had widened into a substantial plain with a large, shallow lake in its centre (Blom, 1988) with glaciers present in the higher mountains (Kiernan, 1990; Mackintosh, Barrows, Colhoun & Fifield, 2006). The climate was drier, with precipitation at about 50% of today’s values, much of it falling as snow. Onshore westerlies were stronger (Colhoun & Shimeld, 2012), perhaps up to 30% windier (Wasson, 1986), mobilising substantial amounts of sand and dust particularly in northeast Tasmania (Bowden, 1983).

Vegetation across the land had a substantially different distribution from today and was dominated by alpine vegetation (Colhoun & Shimeld, 2012; Kirkpatrick, 1986). Dry grasslands along the Midland Valley split Tasmania in half extending northwards to cover the Bassian Plain to the north. The tree line was lower by approximately 750 metres (Gibson, Kiernan, & Macphail, 1987) and, in the west, much of the rainforest and wet sclerophyll forest seen in the TWWHA today was less than 100 metres above sea level (a.s.l.), on land now submerged below the present day sea level, and in refugia along creek lines.

The mammal population of ice age Tasmania comprised species that are found on the island today. The dominant prey species of Aboriginal people was *Macropus rufogriseus* (Bennett’s wallaby; Cosgrove & Allen, 2001). Whether giant marsupials coexisted with Aboriginal people and were brought to extinction by them, or by climate, or a combination of both, is widely contested by archaeologists on the mainland (Wroe & Field, 2006). This debate was recently extended to Tasmania when Turney et al. (2008) claimed that megafauna and Aboriginal people coincided there. This was strongly refuted by Cosgrove et al. (2010). Cosgrove’s conclusions have been confirmed by a recent meta-analysis determining that megafauna died out 1,000 years before the arrival of Aboriginal people (Lima-Ribiero & Diniz-Filho, 2014). Moreover, no correlation between human occupation deposits and megafauna has been found in Tasmania.

Pleistocene sites of the TWWHA

Commencing in 1981, a series of archaeological expeditions was mounted to find and record Aboriginal heritage sites in the Gordon and Franklin River catchments, which are located in what is now the TWWHA (Blain et al., 1983; Jones, 1981, 1982, 1984, 1987, 1990; Jones, Ranson, Allen, & Kiernan, 1983; Ranson, Allen, & Jones, 1983). In 1982, a pilot excavation was undertaken in Fraser (now Kutikina) Cave in an attempt to understand the chronology of Aboriginal occupation of the area (Kiernan et al., 1983). The expeditions were initiated in response to an inadequate environmental impact assessment made by the then Tasmanian Hydro-Electric Commission (HEC), which was proposing to impound the river valleys. The HEC assessment had denied the possibility of the presence of Aboriginal heritage in the area (Naqvi, 1979, as cited in Jones, 1982). When the archaeological surveys discovered a rich Pleistocene Aboriginal heritage in the proposed impoundment area, the HEC countered by searching for equivalent sites outside the proposed development, in order to justify work going ahead (Baynes, 1983; Foster, Cromer, & Summons 1983; Patterson, Underwood, Tanydes, Wilson & Baynes, 1983; Wilson, 1983). In response, an investigation by archaeologists found that most of the claims by HEC were spurious, with only two sites containing Aboriginal occupation found by the HEC, along with one new site found by the archaeologists (Jones & Allen, 1984). Subsequently, the Tasmanian National Parks and Wildlife Service extended the archaeological surveys to the Maxwell River (Harris, Ranson, & Brown, 1988) and Denison River catchments (Brown et al., 1991).

Following these initial surveys and the excavation at Kutikina Cave, members of La Trobe University commenced a program of excavations of a selected number of occupation deposits in the TWWHA, to gain a better understanding of the lifeways and chronology of these Pleistocene hunter-gatherers. The excavations included Parmerpar Meethenar rock shelter (Cosgrove, 1995) as well as four excavations undertaken under the aegis of the Southern Forests Archaeological Project (Allen 1996b; McNiven, Marshall, Allen, Stern & Cosgrove, 1993; McWilliams, Allen, Cosgrove & Holdaway, 1999). These were Bone Cave (Allen, 1996b, Stone Cave (Allen & Cosgrove, 1996a), Warreen Cave (Allen, 1996a), and Pallawa Trounta Shelter (Stern & Allen, 1996). Later descriptions of the deposits in these sites have been summarised in part by Allen, Cosgrove and Garvey (2016) and Cosgrove, Pike-Tay and Roebroeks (2014).

Most of the sites are contained in limestone/dolomite caves where preservation is excellent. The researchers noted that bone preservation was so extraordinary that even minute mouse bones were found in layers older than 30,000 years (Pike-Tay, Cosgrove, & Garvey, 2008). At the time of identification



Figure 1. Archaeologists excavating a limestone cave in the TWWHA (Photo: Richard Cosgrove, Southern Forests Archaeological Project).



Figure 2. A number of limestone caves containing ice age occupation deposits are found in the TWWHA (Photo: Aboriginal Heritage Tasmania).

these extremely rich deposits far exceeded any on mainland Australia (Holdaway & Cosgrove, 1997), and continue to be comparable and regularly surpass the majority in Australia from the same period. The locations of all of these sites are shown in Map 4 and short descriptions of the most scientifically significant sites follow.

Kutikina (formerly Fraser) Cave (AH485)

This is the best-known Pleistocene site and the first that was found in the area now the TWWHA. Occupation in this limestone cave occurred between $19,770 \pm 850$ BP and $14,840 \pm 930$ BP (Kiernan et al., 1983). Over 250,000 pieces of bone and 37,000 stone artefacts were recovered in a single, small, test pit of 0.65 cubic metres excavated in 1981 (Jones, 1984, 1990). The main prey species represented in the deposit was *M. rufogriseus* (Bennett's wallaby). Of special note was the discovery, for the first time in Tasmania, of small, disc-shaped 'thumbnail' scrapers. Also found for the first time in Tasmania were ancient occupation deposits, small flakes and tools of Darwin Glass, an impactite created by the collision of a meteorite with Earth, which formed the Darwin Crater, 25 kilometres to the north-west (Kiernan et al., 1983).

Warreen Cave (AH3786)

An extremely remote cave in a dolomite cliff was discovered in the Maxwell River catchment and first excavated in 1986 (Harris, Ranson & Brown, 1988; Ranson & Harris, 1986). A small test pit of 0.225 cubic metres revealed a very rich deposit containing approximately 10,000 pieces of stone and approximately 30,000 pieces of bone. The oldest date produced by the initial excavation was $22,370 \pm 470$ BP (Allen, Marshall & Ranson, 1989). Ninety-three percent of the stone artefacts were milky quartz, with Darwin Glass was again present. The faunal assemblage showed, as in other sites, the dominance of *M. rufogriseus* but, in addition, had a greater presence of minor prey species such as *Ornithorhynchus anatinus* (platypus) and *Vombatus ursinus* (common wombat) than at Kutikina Cave. Owing to the wealth of the site and the fact that this excavation had not reached the bottom of the deposits, a second excavation was undertaken in 1990 (Allen, 1996a). Again, this second excavation could not reach the bottom of the deposits because of an ancient intrusive rock fall. Nevertheless a date of $34,790 \pm 510$ BP was recovered at the base of the excavated layers, designating it the oldest site in Tasmania. The top of the deposit was dated to $15,960 \pm 310$ BP. The range of dates indicates that Warreen Cave is one of the few sites in Tasmania that was in repeated use by Aboriginal people throughout the Last Glacial Maximum.

Parmerpar Meethenar (AH 4434)

This is a large rockshelter located above the Forth River. It was first discovered by Kee (1990) and excavated in 1992-93 by Cosgrove (1995). Parmerpar Meethenar, along with Warreen Cave, is one of the oldest sites so far found in Tasmania. The site is unique to Tasmania in demonstrating repeated, long-term occupation from $33,850 \pm 450$ BP to 780 ± 50 BP, spanning the Pleistocene pre-

LGM, LGM and post-LGM climatic periods, into the Holocene, and up to recent times. It also marks the known northern boundary of the South West archaeological province and contains elements, such as stone material, brought in from northern Tasmania.

The cultural assemblage of Parmerpar Meethenar exhibits an occupation history different from the other sites in the TWWHA, illustrating a successful human response to changing forest conditions. From 18,000 BP there is increasing discard of bone and stone material until 10,000 BP, at which point a dramatic decline occurs. This parallels the abandonment of sites such as Warreen and Kutikina Caves in the limestone/dolomite areas of the TWWHA to the south, at a time of expanding forests and a rise in sea level. Most of the stone artefacts throughout the occupation were manufactured from cobbles sourced from the nearby river. The excavation recovered many thumbnail scrapers. No Darwin Glass was present in Parmerpar Meethenar, although it was found in a nearby site on the Macintosh River 35 kilometres to the south. This suggested to Cosgrove (1995:93) that a behavioural boundary may have been operating close by during the ice age, in which Parmerpar Meethenar was not a fully integrated part of the economic system of the rest of the cave sites within the TWWHA. Parmerpar Meethenar is not as rich in faunal remains as the other sites because of poor preservation in acidic soils. No *M. rufogriseus* are present and low numbers of *V. ursinus* have been identified. The faunal assemblage consists mainly of smaller marsupials such as potoroo (*Potorous tridactylus*), pademelon (*Thylogale billardieri*), and ringtail possum (*Pseudocheirus peregrinus*). The presence of these species suggests that different ecological conditions were operating at this site than elsewhere in the TWWHA.

Bone Cave (AH1790)

Bone Cave is a small but extremely rich habitation site in a dolomite cliff on the banks of the Weld River, first excavated in 1988 (Allen, 1989). It was occupied by Aboriginal people by 29,000±500 BP. Its use remained sporadic until two main periods of occupation occurred from 24,000 to 23,000 BP and 15,500 to 14,000 BP, after which it appears to have been abandoned (Allen, 1996b). The break between the main periods of occupation occurred during the LGM, when environmental conditions were probably too extreme for the site to be easily accessed. Bone Cave has one of the highest elevations among Pleistocene sites in the TWWHA at approximately 400 metres a.s.l and, at the time, local glaciers had descended to approximately 600 metres a.s.l within a few kilometres of the cave. Densities of bone specimens recovered were approximately 340,000 per cubic metre and stone artefacts approximately 30,000 per cubic metre (Allen, 1996b). Bone points, made from sharpened ends of wallaby limb bones, were found in the deposits.

Stone Cave (AH3612)

This is a very small cave that is contiguous with Bone Cave. It was excavated in 1988-89 (Allen & Cosgrove, 1996a). Occupation commenced at 16,670±70 BP.

A very small test pit of approximately 0.13 cubic metres produced 984 stone artefacts (7,800 per cubic metre) and 10,909 bone specimens (87,000 per cubic metre). A single piece of Darwin glass was found which had been brought from the Darwin Crater 85 kilometres to the north-west.

Pallawa Trounta Shelter (AH2448)

The shelter is a large dolomite overhang on the banks of the Acheron River, part of the Franklin River catchment. It was discovered by Tasmanian Hydro-Electric Commission (HEC) geologists in 1984 (see above) but went unrecognised by them as an archaeological site. It was relocated by archaeologists (Jones & Allen, 1984) and excavated in 1991, with three small pits excavated to sample different parts of the site (Stern & Allen, 1996). One of the pits was unusual in that it comprised detailed micro-stratigraphic layers in its 1.1 metre deep deposit, which provided a well dated, fine-resolution sequence. Pallawa Trounta Shelter was occupied between $29,800 \pm 720$ BP and $13,410 \pm 330$ BP and thus was visited by Aboriginal people through the Last Glacial Maximum. The site had a rich faunal and lithic assemblage (Stern & Allen, 1996).

Most of the evidence for human occupation has been found inside caves and rock shelters. This highlights the difficulty of locating Pleistocene sites in open areas amongst the dense vegetation characterising the wet forests of the TWWHA. Only one open site has been discovered, serendipitously found as it eroded out of sediment on the bank of the Franklin River (Blain et al., 1983). Named the Flying Fox Site (AH 1839), it was represented by a stone artefact scatter visible in cross-section, and was dated to $17,100 \pm 1350$ BP (Jones, 1990).

Pleistocene faunal assemblages

Analysis of the rich faunal assemblage from Aboriginal habitation sites in the TWWHA has enabled the reconstruction of the hunting and butchering practices of the region's hunter-gatherers as well as the timing of their seasonal visits to the valleys. Analysis of approximately 950,000 bones from the Southwest sites has created an exceptional zooarchaeological database (Allen, Cosgrove, & Garvey, 2016). Faunal analyses of four sites from the TWWHA have been published: Bone Cave, Stone Cave and Warreen Cave (Cosgrove & Allen, 2001) and Kutikina Cave (Garvey, 2006, 2007). These four sites contributed over 487,000 bones, just over half of the total assemblage.

The predominant prey species in these sites is Bennett's wallaby (*M. rufogriseus*) contributing more than 93% of identified fragments of human prey species in Bone, Warreen and Kutikina Caves (Allen et al., 2016). The remainder (just over 6%) is made up predominately of wombat (*V. ursinus*) with only the occasional

taking of the now extinct emu (*Dromaius novaehollandiae diemenensis*), pademelon (*T. billardieri*), brushtail possum (*Trichosurus vulpecula*), ringtail possum (*P. peregrinus*), eastern quoll (*Dasyurus viverrinus*) and platypus (*O. anatinus*; Allen et al., 2016).

The reasons for the relative difference in the numbers of the two major species, wallaby and wombat, lie partly in their behaviour. Bennett's wallabies congregate in numbers and are predictably tethered to small, local areas of vegetation throughout their life and, being crepuscular, are comparatively easy to locate and hunt. In contrast, wombats are solitary, nocturnal, and difficult to capture as they live in deep burrows (Allen et al., 2016).

The examination of faunal remains has provided the opportunity to develop a strong understanding of the hunting strategies, resource selection and food processing of Aboriginal people in the TWWHA. With Bennett's wallaby there is a clear preference for the meat on the lower limb bones, minus tarsals, carpals and phalanges, to be taken back to the caves, suggesting that preliminary processing of a carcass commonly took place in the field (Allen et al., 2016). Thus, despite the animal being small enough to carry over the shoulders, the hunters were selective in the body parts they returned to base with (Garvey, 2010). In a study of the economic utility of Bennett's wallaby, Garvey showed that the hindquarters have the greatest amount of attached meat while the long bones of the legs held the most marrow. Wallaby long bones at these sites are often smashed to extract marrow. Since wallaby meat is very lean and high protein consumption can be deleterious to human health, supplementation with the high concentrations of essential fatty acids contained in marrow would have been essential. In a later study Garvey (2011) underlined the importance of Bennett's wallaby for its high meat ratio and unsaturated fatty acids. She showed that this species was a dependable resource varying little in meat and marrow quality throughout the year and across different environments and altitudinal regimes. This broader contextualisation further underlines the economic importance of Bennett's wallaby to the Pleistocene inhabitants of the TWWHA.

Wombats, were handled differently (Garvey, Roberts and Cosgrove, 2016). The forequarter of a wombat, that is, the forelimbs, head and pectoral region, were brought to the caves, perhaps because they contained a higher fat content. The meatier pelvic girdle and hind limbs were rarely brought back, suggesting that they may have been consumed in the field. Besides wombats being more difficult to capture than Bennett's wallaby, wombat meat was probably also less favoured. Nutritional analysis of the flesh and marrow of wombat suggest they have a lower fatty acid content than Bennett's wallaby. Meat high in fatty acids, particularly oleic acid, is more nutritious and palatable and satisfies hunger for longer. Possibly for this reason, few wombat bones were smashed for the extraction of marrow.

A very small number of bones have been found to exhibit palaeopathology. In the first record from Tasmania, Garvey and Sandy (2009) noted anomalies on



Figure 3. Bennett's Wallaby (*Macropus rufogriseus*) was a major source of meat during the Pleistocene (Photo: Don Ranson).



Figure 4. Studies of Bennett's Wallaby (*Macropus rufogriseus*) have helped to understand the hunting behaviour of Aboriginal people during the Pleistocene (Photo: Richard Cosgrove, Southern Forests Archaeological Project).

some wallaby metatarsals, tibiae and fibulae, as well as on wallaby and wombat ribs, from Kutikina Cave that were suggestive of bacterial osteomyelitis. Wallaby tibiae and fibulae from that site also showed evidence of osteoarthritis; this is likely to have rendered the animals lame and therefore easier to hunt.

Archaeological investigations have determined that some bones were used as tools. Webb and Allen (1990) studied thirteen bone tools recovered from Bone Cave and six from Warreen Cave and, in doing so, defined and described types new to Australia. Through microscopic examination, Webb and Allen discerned distinctive patterns of wear caused by the use to which tools were put. By comparison with tools manufactured under experimental conditions, they were able to assign functions to the tools. Four tool types were described: a 'fine point' was made from a *M. rufogriseus* fibula and sharpened at the tip; a 'non-formal' point was made by sharpening a long-bone fragment that was a by-product of marrow extraction; a 'flat-tipped' point was created by snapping the ends off a long bone fragment forming a straight chisel-like edge; and a 'spatula', a flat spoon shaped point was created by abrasion on fibulae. The polish and striations on most of the fine points suggested that they were used for puncturing of dry skin (possibly to create clothing), with the spearing of mammals seeming to be the most likely activity. Two of the nine fine points additionally showed coarse striations on the base that was suggestive of hafting. However, Cosgrove (1999) has argued that hafted bone spear points are an unlikely tool. He would expect bone point numbers to increase when hunting is more intense and more prey is brought back to a cave, but no correlation between prey animal numbers and bone points can be found. One fine bone point in Webb and Allen's study was used to pierce bark, although the purpose of this activity is unknown. One of the non-formal points was used to pierce dry skin while the other seems to have been a multi-purpose tool. One of the two flat bone points showed polish and striations consistent with the scraping of subcutaneous layers from skin. The position of the use-wear on four of the bone artefacts suggested that they were used as toggles or cloak fasteners. In a separate study, a proportion of the eleven bone points recovered from Kutikina Cave were found to have modified scooped ends that may have been used to extract marrow from long bones (Garvey, 2010).

Supporting the evidence for the possible piercing of skins and manufacture of toggles, Gilligan (2007, 2011) has suggested that cold temperatures encountered in this area during the Pleistocene and exacerbated by wind chill would have required the inhabitants to wear protective covering. Given the resources and the technology available to the Aboriginal people such clothing would have been simple, loosely draped garments made from joined skins. This is consistent with late eighteenth century European accounts that note that some Tasmanian Aboriginal people had a wallaby skin draped over their shoulders.



Figure 5. Bone points made from wallaby fibula (Photo: Richard Cosgrove, Southern Forests Archaeological Project).

One of the problems encountered in excavating cave deposits is that a significant proportion of bones in the deposits may have been introduced by non-human agency. While skeletal remains of marsupial mice (*Antechinus* sp.), pygmy possum (*Cercartetus* sp.), quolls (*Dasyurus* sp.) and swamp rat (*Rattus lutreolus*) are common in the deposits (Cosgrove, 1999), they may not have been brought in as the prey of humans. For example, the Tasmanian devil (*Sarcophilus harrisii*) will have denned in caves when people were absent. The Tasmanian devil is a carrion eater with powerful jaws that can finely crush bones and thus may have introduced small fragments of bone into the cave deposits via its scats (Marshall & Cosgrove, 1990). Similarly, raptors such as owls (*Tyto* sp.) roost in caves and regurgitate bones of small animals in pellets (Marshall, 1986). The increase in small mammal remains in the deposits, particularly rodents (*Muridae*), at the end of the Pleistocene, probably reflects the change to the forested ecosystems rather than human activity. The onset of wetter and warmer conditions created an environment preferred by these animals and their predators such as owls (Cosgrove, 1999).

Hunting behaviour and the periodicity of occupation

A summary picture of the hunting behaviour and periodicity of occupation of the Pleistocene inhabitants of the TWWHA has been built up (Allen et al., 2016). Using skeletochronology, the study of growth marks and other structures of bone, selected faunal assemblages found in the TWWHA have been analysed in order to understand the age profiles of the prey animals and the seasonality of hunting visits to the region. In a pilot study, Pike-Tay and Cosgrove (2002) examined Bennett's wallaby mandibles from Warreen Cave. Using molar eruption as an age indicator they found that most animals were taken from the 1 to 2-year and the 6-year-plus age cohorts. Microscopic analysis of thin-sections of wallaby teeth has revealed annual rings in the dental cementum which permit seasonality studies (Allen et al., 2016; Pike-Tay, Cosgrove, & Garvey, 2008).

The age profile of the teeth found in the wallaby mandibles, compared to modern culls, is suggestive of a regime reflecting low hunting pressure on the wallaby populations (Pike-Tay & Cosgrove, 2002). The analysis of the rings in the dental cementum show that in Warreen and Kutikina caves 93% of wallabies were killed between autumn and spring, with most (73% of the total) in winter and spring. In the upland site of Bone Cave, 100% of kills occurred in the warmer months of spring to late summer. Bone Cave too, a greater proportion of younger animals were preyed upon. In studies of modern hunters, this suggests that comparatively higher hunting frequencies were occurring there.

Valley floors were characterised by discontinuous patches of comparatively fertile soils that were surrounded by poorer soils supporting dense scrub. The fertile soils were derived from alluvium and limestone base rock and supported Poa grasslands on which the economically important wallaby and wombat would have congregated and fed. Wallaby, in particular, exhibit behaviour that is 'tethered' to a particular grassy location. They tend to range over an area of only 15-20 hectares with their centres of feeding moving less than 30 metres over a 2 to 3 year period (Cosgrove, 1999). This behaviour allowed for predictable prey location and capture by Aboriginal people. Carcass processing occurred in the field with removal of wallaby hind quarters and wombat fore quarters to base camp, with the residual body parts either being consumed or abandoned in the field. While evidence of hunting from occupation sites at lower altitudes appears to have been undertaken all year round at sites such as Warreen Cave, a clear understanding of the intensity of occupation at this and other sites in the TWWHA remains unknown. Data suggests that hunting was undertaken intensively in particular months, suggesting fluctuating, short term occupation events followed by periods of limited or no occupation. Hunting from occupation sites at higher elevations occurred during late spring/summer only. Optimal foraging theory suggests

that once it became uneconomic to continue hunting a particular patch, another patch would have been selected. In this way, an Aboriginal group would move sequentially around their territory, appropriate to the season.

The argument that cave sites were not being continuously occupied is strengthened by faunal assemblages excavated from within rock shelters in the TWWHA. As mentioned above, intermingled with the remains of prey of humans are thousands of predominately small bones that were most likely sourced from owl (*Tyto* sp.) pellets and scats of the Tasmanian devil (*S. harrisii*; Marshall & Cosgrove, 1990). This natural waste indicates that the caves were abandoned from time to time and for periods of unknown length, possibly years or decades. This use may indicate variable and adaptive use of both open and rockshelter sites and their associated environments within the landscape.

At a micro-level there appears to have been an increase in rate of discard of material at these sites during the post-LGM. Cosgrove (1995) has suggested these increases in activity might be linked to 'flickers' of intense climatic change that lasted between less than five years and up to 20 years, with temperatures varying by up to 7°C above the average of the time.

Holdaway and Porch (1995) claimed that the archaeological deposits in the TWWHA and the techniques with which they have been studied, have yielded a rare opportunity to examine cyclical patterns of occupation on a regional scale which is unavailable elsewhere in Australia and in most of the rest of the world. Confounds have been minimised by the capacity to sample similar types of site within a tightly circumscribed geographical region across which the environment was broadly uniform. Likewise, the occupation sites were excavated using comparable excavation strategies and sampling procedures, with similar strategies for collecting dating material from stratigraphic features. There were 103 radiocarbon (C^{14}) dates from 12 sites, most of which were sent to one laboratory. This minimises the statistical errors or 'noise' component that inevitably arises from variations between laboratories in processing techniques and equipment.

In a first for Australia, Holdaway and Porch (1995) employed a moving-sum analysis of these radiocarbon determinations, at a 500-year resolution across the entire group of sites. This permitted the emergence of patterns among the dates that would be impossible to discern in a dating sequence from a single cave or rock-shelter site, or from a simple comparison of sequences from different sites. While there is on-going debate about the efficacy of this type of analysis both on statistical (Williams, 2012) and methodological grounds (Attenbrow & Hiscock, 2015; Smith, 2016), Holdaway and Porch (1995) claim that the occupation of the TWWHA region during the Pleistocene ebbed and flowed on a 3,000-year cycle. These cycles varied in amplitude, possibly representing differing occupation intensities at different times. The cycles appear to be correlated to known environmental changes. Holdaway and Porch suggest that the lower occupation intensities relate to periods of reduced spring discharge from the ice-fed rivers. In contrast, there appears to have been increased occupation during periods of higher spring discharge

rates. In addition, Holdaway and Porch note that the occupation intensity of the region overall increased through time. This is based on the increase through time in dateable organic material incorporated into the occupation sites and increased discard of stone artefacts. The maximum occupation took place around 15,500 BP before plummeting to close to zero when the region was abandoned as the forests displaced the hunting grounds. However, Cosgrove (1999) suggests that this scenario of site abandonment during drought was a local not a regional phenomenon. Where moisture was sufficient and reliable, such as in the Franklin-Gordon catchment, the presence of hearths in caves at the height of the glacial period point to continuing use of this smaller area during hard times.

In a separate study, Holdaway and Porch (1996) examined large-scale periodicity at Bone Cave and Pallawa Trounta along with two sites outside the TWWHA and found that bursts of occupation lasted between 700 and 1,500 years. They further suggested that reduced site use or abandonment for long periods was the norm: at Bone Cave, for instance, episodes of low or zero occupancy were longer than episodes of occupation. This may indicate adaptive use of the wider environment including occupation of a variety of both open and rockshelter sites depending on factors such as environmental conditions.

Stone artefact technology

Pleistocene sites in the TWWHA are invariably rich in stone artefacts. Only one site, Bone Cave, has been comprehensively analysed throughout its sequence (Holdaway, 2004). In an earlier study of a sample of stone artefacts from the site, McNiven (2000) noted that the vast majority, 98% of the Bone Cave assemblage, was made by free-hand percussion. In free-hand percussion, a selected rock is held in one hand and hit by a hammer-stone held in the other, in order to strike off flakes. The flakes were either used directly or further modified (retouched) to form an edge for a specialised use. The rock from which the flakes were struck is termed a 'core'. At Bone Cave 1% of the stone material were cores. From this small proportion of cores was struck a large amount of material, 92% flakes and 4% retouched flakes (McNiven, 2000).

McNiven (2000) found that the Bone Cave inhabitants selected eight different lithic materials, with the most common being quartzite (62%), followed by chert (19%) and quartz (11%). The quartzite was sourced locally from water-worn cobbles found in the Weld River that runs below the cave. The remaining lithic materials were brought in from sources located away from Bone Cave.

Tasmania is geologically complex, and locating Aboriginal stone sources is difficult. Sheppard (1997) examined chert, the second most important lithic material in Bone Cave, using thin-section petrography and neutron activation analysis. He distinguished ten chert types used by Aboriginal people and

concluded they were all sourced from extensive beds in the Ragged Range, approximately 10 kilometres to the north of the cave. Similar chert was used in smaller proportions at Warreen (1.6% of the lithic assemblage), some 15 kilometres from the source, and Pallawa Trounta (1.3% of the lithic assemblage), 45 kilometres from the source, suggesting that usage of chert decreased with distance from the source.

In Bone Cave, as at the other occupation sites, archaeologists have been intrigued by the presence of two items: a specialised tool termed a 'thumbnail' scraper and the presence of a rare material called Darwin Glass. Along with hand-stencil art (discussed below) and bone points, these artefacts seem to link the sites across the region. Thumbnail scrapers, so named for their shape and size, are small (less than 2.5 centimetres maximum dimension), disc-shaped tools, with a steep edge reminiscent of a wood-plane blade. They are unusual in being manufactured using the bipolar technique, where the core is rested on a stone or piece of wood that acts as an anvil, and then struck carefully and precisely with a hammer-stone (McNiven, 2000). The size of these thumbnail scrapers created using this technique is testament to the skill of Aboriginal knappers. Early studies based on small assemblages suggested that thumbnail scrapers appeared suddenly in the archaeological record and, therefore, could be used as a temporal marker of some major cultural or economic change in the region. For instance, Jones et al. (1988) noted that 80 were found at Kutikina Cave and concluded they were common in the upper (later) part of the deposit (Jones 1990). McNiven (1994) noted from a small sample of the Bone Cave assemblage that 95% of the scrapers were dated after 18,000 BP. However, Holdaway (2004) has shown that thumbnail scrapers are present in all levels of the Bone Cave deposits, albeit in lesser amounts pre-LGM (18,000 BP). A study of a larger sample of sites confirms that there was, overall, no sudden introduction of this technology after the LGM (Cosgrove, 1999). No evidence has been found that these tools were hafted. They appear to have been multifunctional, being used on wood, bone, skin, and plant material (Cosgrove, 1999).

Holdaway's (2004) comprehensive study of the Bone Cave assemblage concluded that there was a high degree of conservatism amongst the tool-makers represented there. While there were technological differences between tools made of different material which was probably due to the properties of the material and the use made of it, these separate technologies continued unchanged over the 20,000-year occupation. Similarly, there is no change in the types of tools found at the cave, although proportions vary at different times. The proportions of the different lithic materials also varied through time, as did the intensity at which they were worked. This led Holdaway to propose that, due to populations increasing in the region after the LGM, group mobility was reduced, resulting in sites becoming more intensively occupied.

The second signature item found in the sites is Darwin glass. Darwin glass is an 'impactite', a natural glass created by the heat generated during the collision

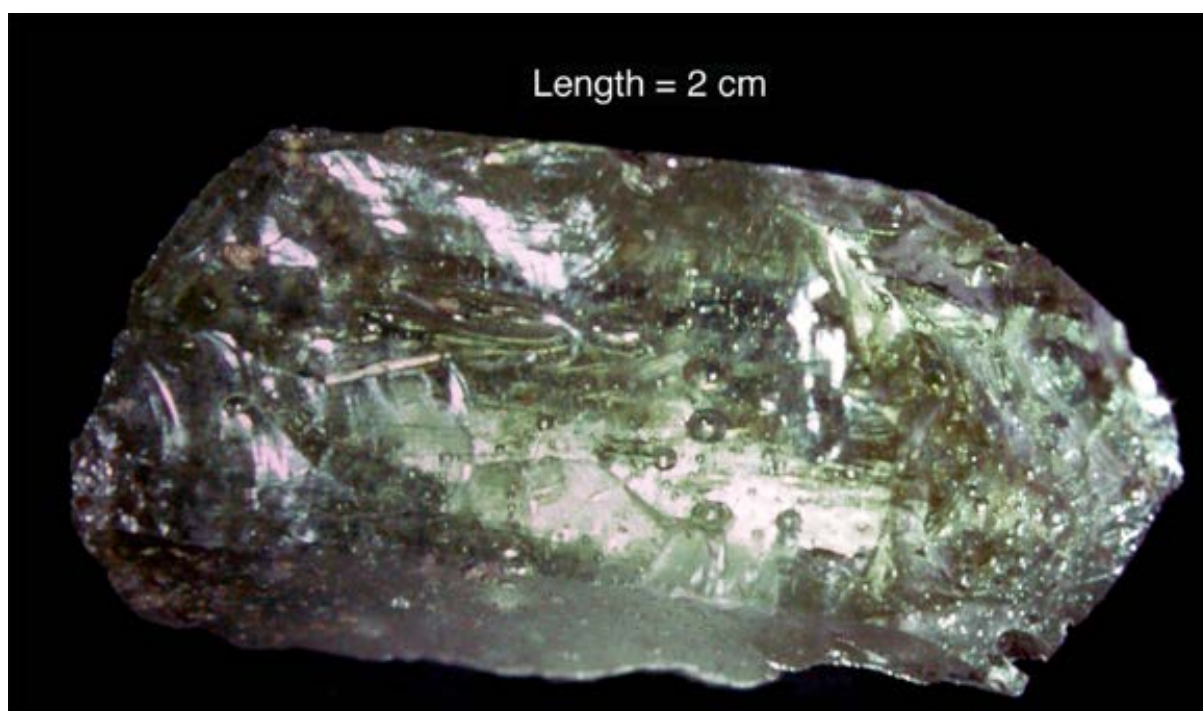


Figure 6. The favoured meteoritic impactite Darwin glass was transported over 100 kilometres (Photo: Richard Cosgrove, Southern Forests Archaeological Project).

of a meteorite with Earth. The Darwin Crater was formed 816,000 years ago by an impact that released about 20 megatons of energy. Just west of the Engineer Range and the Andrew River, within the TWWHA, the crater is a circular depression 1.2 kilometres in diameter. Now infilled with sediment, it was originally 220 metres deep (Howard & Haines, 2007). The impactite was ballistically ejected by the energy released during the collision, forming a strewn field greater than 400 square kilometres, including 22,500 tonnes of impactite landing within 50 square kilometres around the crater. Proportional to the crater size, this is the most abundant strewn field in the world. The colour of the impactite, Darwin Glass, ranges from white, to grey, light green, dark green, and black (Howard, 2009). During the Pleistocene, Aboriginal people preferentially selected the most common colour, dark green (53% of the impactite), and carried it throughout the TWWHA region for use at their living sites. No quarrying is needed, as the material can be picked up off the ground or from amongst the roots of fallen trees (Jones & Allen, 1984). Because of the small size of impactite fragments, the bipolar technique was used to manufacture tools from it. Darwin Glass is found in sites throughout the TWWHA as far away as Bone Cave 100 kilometres from the crater (Cosgrove, 1999) suggesting it was highly valued.

The conservatism and homogeneity exhibited in the stone tool assemblage over a 20,000-year period offers a salutary foil to European studies (Holdaway, 2004). In Europe, such an unchanging record would be ascribed to Archaic *Homo* (Neanderthals), rather than to modern humans, as is the case in Tasmania. Given the assumptions in Europe that a change in lithic typology

and technology from simple to complex often distinguishes the change from Archaic to modern humans, the results from the TWWHA, and other select sites in Australia, are challenging. They question the Eurocentric view that stone tool evolution equates to the evolution of behaviour from ancient to modern humans (Cosgrove, Pike-Tay & Roebroeks 2014; Holdaway & Cosgrove, 1997). European experts may need to reassess whether changes in technology might instead be a simple response to change in local environmental conditions.

Pleistocene rock marking sites

Four caves containing red ochre hand stencils and other amorphous markings are known from the area covered by the TWWHA. Most of the markings are in locations with no natural light. This implies that the locations within caves that were regarded by Aboriginal people as suitable were accessed, and the markings executed, by torchlight. None of these marking sites contain occupation deposits, suggesting deliberate separation of domestic and ritual spheres. Due to the absence of occupation deposits, it has not been possible to date the markings conclusively. However, all are considered to be Pleistocene in age. This is on the basis of their close geographical relationship with occupation sites of that date, as well as their apparent 'fixing' behind thin, protective transparent calcite layers that flowed down the cave walls, the growth of which has been dated elsewhere in Tasmania to the LGM (Goede & Harmon 1983). Descriptions of these sites follow and their locations are shown on Map 4.

Ballawinne Cave (AH3790)

Located close to the Maxwell River, Ballawinne Cave was the first site containing hand stencils found in the TWWHA (Harris, Ranson & Brown, 1988). A narrow tunnel, marked by five ochre blazes at the entrance, leads from daylight into the cave where 23 hand stencils, of both left and right hands, were executed in the pitch dark. There are also 11 ochre patches (McGowan et al., 1990). The cave with its stencils was recorded photogrammetrically in 1989 (McGowan et al., 1990 and McGowan et al. 1993).

Wargata Mina (formerly Judds Cavern; AH3525)

Red ochre markings were recorded at Wargata Mina in 1987 (Cosgrove & Jones 1989). This is the southernmost Pleistocene marking site in Tasmania. The markings comprise 15 hand stencils, as well as large patches and small smears of ochre some several metres across. In addition, six hand and arm stencils down to the elbow were found a kilometre underground (Cosgrove, Pike-Tay, & Roebroeks, 2014).

For the first time in the world and from two small samples, mammal blood was identified as mixed with the ochre, possibly as a fixative (Jones et al., 1988). Human blood was later identified as mixed with the ochre and was dated to



Figure 7. An ancient ochre hand stencil sealed behind a transparent calcite layer (Photo: Aboriginal Heritage Tasmania).

10,730±810 BP (Loy et al., 1990). However, there is doubt over the date due to the methodological problems associated with dating microscopic organic samples (Langley & Taçon 2010; Nelson, 1993; Taçon & Langley, 2012). In 1988, for the first time in Australia, cave markings were recorded photogrammetrically at Wargata Mina (McGowan, Hughes & Shreeve, 1992).

Keyhole Cavern (AH3614)

In 1988, three hand stencils and four ochre smears were found in this cavern located two kilometres south of Bone Cave (Allen, Cosgrove, & Brown, 1988; Allen & Cosgrove, 1996b). The markings were found in darkness 50 metres from the entrance. They were photogrammetrically recorded in 1991 (McGowan, Hughes & Shreeve, 1992).

Riveaux (AH9189)

This is the most recent Pleistocene ochre hand stencil site to be discovered (in 2002). It has not been studied in any detail since, for conservation reasons, access is restricted to viewing the stencils from the threshold of the cave mouth (Ranson, 2004). From the entrance can be seen, on the cave wall across a stream passage, at least ten stencils, including one with a forearm. There are two very small hands, possibly children's, as well as partial stencils, some of

which are occluded by intervening stalactites. Another ten hand stencils are known in stream passages not visible from the entrance.

Possible abandoning of the TWWHA

Around 18-19,000 BP, the Earth began to warm and by 15,000 to 14,000 BP the glaciers had retreated from the highlands of Tasmania. Precipitation climbed to double the present levels. Between 14,000 and 10,000 BP, increasing rainfall and rising temperature caused the advance of the rainforest out of its lowland refugia and up the valleys, the rise of the tree line, and the concomitant retreat of alpine vegetation. By the mid-Holocene (6,000 BP) maximum forest development had occurred (Colhoun & Shimeld, 2012; Jackson, 1999). The change in vegetation, from open grassy patches to a closed rainforest, forced the game away. Without ready access to their major prey species, it became uneconomic for Aboriginal people to remain and they too were obliged to move. On current evidence it appears likely that people abandoned the caves around 12,000 BP and do not appear to have returned (Allen et al., 2016; Cosgrove, 1999; Kiernan et al., 1983).

Thomas (1993) posed an alternative scenario. In brief, he suggested that the dry, comfortable caves of the Pleistocene became damp in the early Holocene, driving Aboriginal people in the region to live in the open. He noted that the TWWHA region is not uniformly rainforest but is, instead, a mosaic of forest and moorland that is substantially fire-dependent, with some of it possibly created by Aboriginal firestick practices of deliberate burning. Moreover, Thomas observes that Aboriginal people were seen in the area in the early 19th century. Thomas is also critical of the lack of palynological research which, he claims, would support the existence of discrete grassy patches near caves, on which prey species would have survived during the Pleistocene. Additionally, Thomas is critical of Cosgrove and others' assessment of the behaviour of the main prey species (Bennett's wallaby) and its 'tethering' to small grassy patches close to the caves. He notes that the wallaby has been seen to consume buttongrass shoots, thereby allowing it to be much more widely dispersed and more widely available for hunting than acknowledged by Cosgrove (1991).

Cosgrove, Allen, and Marshall (1994b) responded by suggesting that the 13 deposits dated by 133 radiocarbon analyses, most from the TWWHA, demonstrate that the cave sites, and possibly the region, were abandoned around 12,000 BP. While acknowledging that occupation might have switched from cave sites to open sites, there is currently no dated evidence for this. The much-reduced occupation in Parmerpar Meethaner during the Holocene, when the cave would have been in wet sclerophyll forest, supports the

suggestion that this forest type was difficult to live in. Cosgrove et al. did not deny that wallabies are able to consume food other than grass, but offered strong evidence from zoological surveys that forest and sedgeland vegetation zones support very low levels of the animals in stark contrast to their superabundance in grasslands. They point out that the historical evidence available indicates that only small populations of Aboriginal people were present in the TWWHA at the beginning of the European invasion, and they are critical of Thomas's extrapolation from this to account for the whole of the Holocene.

Thomas (1995) responded to Cosgrove et al., who felt that no further reply was necessary (Cosgrove & Allen, 1996). Fletcher and Thomas (2007, 2010a, 2010b) later suggested that fire-promoted moorland in large parts of southwestern Tasmania dating to 10,500 BP could be anthropogenic, though no archaeological sites have been dated from these areas.

On balance, until further rock shelter and open sites are identified, described and dated, and palynological studies of wetlands close to Pleistocene caves become available, the evidence currently points strongly to the abandonment of the region around 12,000 BP due to game being driven away by the encroaching forests. Considerable time elapsed before Aboriginal people reoccupied the TWWHA region, moving up the valleys into the highlands and along the west coast.

Reoccupation of the TWWHA region

With the warming of Earth at the end of the ice age, the melting of glaciers and sea-ice contributed to the rapid rise of the level of the sea. Sea levels rose 120 metres, sometimes as rapidly as 1 metre in 75 years, stabilising at their present level around 6,000 years ago. The consequences were gradual but substantial, with the flooding of thousands of square kilometres of hunting grounds on the Bassian Plain, the drowning of its large central lake, and the continuing and rapid movement of coastlines would have severely impacted on food resources. Material resources too, such as stone and ochre quarries, were flooded; camping places inundated; burials, rock marking sites and other sacred sites submerged forever. All this and, with the rising temperatures, the expansion of forests up the valleys would have created massive economic and social change, leading to a major reconfiguration of survival strategies. The flooding of the land bridge across the Bass Strait 14,000 years ago (Lambeck & Chappell, 2001) made an island of Tasmania, and brought about the longest isolation of any human group in history. The TWWHA offers interesting opportunities for conducting comparative studies in microcosm of conditions that were repeated across the globe at this time.

Reoccupation of the wet forests and valleys leading up into the highlands of what is now the TWWHA did not occur for some time. Evidence comes from Warragarra Rockshelter (AH74) in the Mersey River Valley, a fairly elevated site at around 610 metres a.s.l., and just metres outside the boundary of the TWWHA. A date of $10,910 \pm 110$ BP was obtained from the earliest levels of occupation at Warragarra. This occupation was sealed by a series of sterile layers indicating that the site was abandoned. Then further layers of occupation deposit showed that the rock-shelter was reoccupied from $3,480 \pm 90$ BP and that it continued to be visited up to 410 ± 60 BP (Allen & Porch 1996; cf. Lourandos, 1983). Thus, after a tentative foray shortly after the Mersey Valley became deglaciated, the valley was apparently not used for 7,500 years. In contrast, the TWWHA site of Parmerpar Meethaner in the Forth Valley, just 15 kilometres to the north of Warragarra, and lower in elevation by 200 metres, continued to be occupied throughout the Holocene, reaching a low point about 3,000 years ago before increasing again. Cosgrove (1995) suggests this downturn in occupation activity was due to a temporary expansion of forests in the local area associated with more humid conditions.

Compared to the detailed studies undertaken into the archaeology of the Pleistocene, the Holocene archaeology of the high country in the TWWHA region remains relatively unexplored. There have been three investigations that have touched upon the Central Highlands Plateau: a survey for sites around the Great Lake (Thomas, 1983); Cosgrove's (1990) work on Tasmanian forests which, in part, surveyed the edge of the Great Western Tiers; and a site survey along some of the rivers and lacustrine edges of the Central Highlands (Cosgrove, 1984).

This research suggests that the Highlands were not accessed until around 3,000 years ago. Billop Rockshelter (AH2564), a large, 40 metre wide shelter, is located at approximately 750 metres a.s.l. on the lip of the Great Western Tiers. The site has a date for initial occupation of $2,830 \pm 130$ BP (Cosgrove, 1990). Other shelter sites (AH 2629) dated to 2240 ± 70 BP and (AH2855) dated to $1,180 \pm 100$ BP on the Tiers to the west, point to a similar timing of occupation.

Occupation at Billop Rockshelter was fleeting at first but, on the basis of the quantity of stone and bone deposition, increased threefold from $1,380 \pm 60$ BP to 120 ± 60 BP. The majority of bone was from the ringtail possum (*P. peregrinus*), reflecting the forested environment that surrounded the cave throughout this period to the present. The stone artefact material comprised flakes, some retouched, flaked pieces and cores. The stone was mainly sourced from 'cherty-hornfels' (77% of the lithic assemblage), a metamorphosed mudstone that is found in nearby quarries in the Central Highlands at Great Lake, Arthurs Lake and Lake Sorell, as well as having various sources in the Midland Valley to the east. Of great interest, is the presence of three shells in the upper sequence of the excavation: a marine brooch shell (*Neotrigonia margaritacea*) and two freshwater mussels (*Velesunio moretonicus* and/or *Hydriddella narracanensis*). These shellfish remains, dated to between $1,380 \pm 60$ BP and 120 ± 60 BP, are the first found in an inland Tasmanian deposit that has been dated. The marine

shell must have been transported from the coast at least 80 kilometres away, while the freshwater mussel shells came from shellfish beds along the lower reaches of the northern river systems. The presence of shells points to the evolution of a complex communication system over relatively long distances, while the stone material illustrates a rich understanding of the resources available throughout the Central Highlands.

Regarding the wet forests in the southwest, there is little evidence of any reoccupation of the interior. The only site dated to this period is an open site (AH488), the first ever found in the southwest forests, with its discovery igniting the research that followed. The site is located on the top of an alluvial deposit and was revealed by a tree-fall at the mouth of the Denison River. Here a retouched core and waste flakes were dated to around 300 ± 150 BP (Kiernan et al., 1983; Jones, 1982). Since the artefacts were not directly associated with the dated carbon flecks in the sediment on which they rested, the date can be questioned. However, it is intriguing that the site was positioned at the apex of a tongue of land that had formerly been fired, as evidenced by a line of dead eucalyptus trees visible above the rainforest, leading over a nearby range and down to the river bank near the site ((Don Ranson 2016, pers. comm). If this relationship is sound, it suggests that Aboriginal people may have (at least occasionally) taken advantage of the 'green-pick' that grew in the wake of an occasional bush-fire and which would have attracted game. However, the Aboriginal people would have been unable to burn back the rainforests en masse to recreate their former hunting grounds.

As with the Highlands, there appears to have been a considerable lag before the TWWHA coastline was also occupied. While the coast would have stabilised around 6,300 to 5,800 years ago (Fletcher & Thomas 2010b), it took some millennia before it became permanently inhabited. The picture in the TWWHA is unclear because of the paucity of excavated sites, but comparisons with the southwest coast outside the TWWHA provides some clues as does the contiguous coastline to the north-west.

Tenuous at best, an early date is claimed for a midden in a tiny cave (AH4554) at Point Hibbs, outside of and to the north of the TWWHA, dated to 5380 ± 70 BP and $4,920 \pm 50$ BP (McNiven, 1996). However, although the dated deposit contains shell remains of warrener (*Turbo undulatus*), a marine species consumed by Aboriginal people, it has been reworked by natural forces, contains no stone tools, and incorporates bones of species that may or may not have been introduced by people. Tellingly, a nearby cave that is slightly larger and more comfortable contains *T. undulates* shells that exhibit damage that McNiven (1996) assigns to human agency. This site (AH4553) dates to only 1720 ± 100 BP and $1,690 \pm 70$ BP. This apparent lag in dates between the sea level stabilisation and human occupation has an analogue in the northwest coast, which has similar marine and terrestrial environments to that in the southwest. Here, the earliest date on a midden of 4050 ± 240 BP, is followed by a slow increase until 2000 years ago when a dramatic rise in the number of middens occurs (Stockton, 1983). This patterning can be glimpsed in the relatively



Figure 8. Hundreds of eroding shell middens are found along the coast of the TWWHA (Photo: Tim Jones).

unexplored archaeology of what is now the TWWHA coastline. The earliest date from what is most certainly an Aboriginal midden is $2,970 \pm 200$ BP at Louisa Bay (Vanderwal & Horton, 1984).

The remaining dates from the TWWHA coast range from 2000 years BP up to the very recent past. On present evidence, exploration of the TWWHA coast by Aboriginal people followed by permanent occupation appears not to have taken place until 3,000 years after the sea stabilised at its present level.

Little work has been carried out on the rich heritage to be found along the coast. Besides limited landings from a boat by Stockton (1976), there were two early site surveys along the coast: Sims' visits to previously reported rock art sites (Sims, 1977) and Zakharov's 1980 survey from the Mainwaring River to Port Davey (Zakharov, 1981). It was not until a series of major reconnaissance site surveys were undertaken in the late 1980s and early 1990s that the archaeological wealth of the coastline became apparent (Burke, 1991a; Prince, 1990a, 1990b, 1992a). These surveys noted rich and extensive middens and associated artefact scatters, and further discovered that many sites are actively being destroyed by wind and water erosion (Prince, 1992b). There has been just one comprehensive excavation campaign of Holocene sites along the TWWHA coast; this was carried out by Vanderwal in 1975 (Vanderwal, 1975,

1978; Vanderwal & Horton, 1984). Dunnett (1989, 1992) excavated a single rock shelter at Prion Beach, and Prince (1990c) excavated two small rockshelters in Port Davey. Burke (1991b) conducted very small 'salvage' or sampling excavations but these added little to the understanding of the archaeology of the area. Only one Holocene rock art site has been closely studied (Ranson, 2008), as discussed below.

Vanderwal excavated three middens and two cave sites at Louisa Bay, a midden at Anchorage Cove, and a midden on Maatsuyker Island (Vanderwal & Horton, 1984). Because radiocarbon dating was limited to the lowest deposits, variation through time cannot be discerned at a high resolution. The oldest date for a coastal site, 2970 ± 200 BP, came from a midden fringing the Louisa River. The base of the deposit at Louisa River Cave 2 some 1.5 kilometres away, was 870 ± 90 BP, while the midden at Anchorage Cove was dated to 250 ± 80 BP. The earliest date of the midden on Maatsuyker Island, approximately 14 kilometres offshore from Louisa Bay, is 570 ± 100 BP.

The Aboriginal economy, as revealed in these sites, fully exploited the range of marine and terrestrial zones offered along the coastline. Mammals preyed upon included Australian fur seal (*Arctocephalus pusillus*) and southern elephant seal (*Mirounga leonina*) taken from the coast. Hunted inland among the lightly wooded country were Bennett's wallaby (*M. rufogriseus*), pademelon (*T. billardieri*), and ring-tailed possum (*P. peregrinus*). Also abundant in the sites were bird bones, particularly of mutton birds (short-tailed shearwater, *Puffinus tenuirostris*) but also of shy albatross (*Thalassarche cauta cauta*) and fairy prions (*Pachyptila turtur*). Common invertebrates were mussels (*Mytilus planulatus* and *Brachidontes rostratus*), warrener (*T. undulates*), abalone (*Notohalotis ruber*), and spiny crayfish (*Jasus lalandii*). The stone artefact industry was simple and relatively uniform, with 96% of the assemblage comprising poor quality local quartz and the remaining 4% was brought in from elsewhere.

Comparing the chronology with the seasonal evidence provided by faunal analysis, Vanderwal and Horton (1984) suggested that Aboriginal visits to the TWWHA coast was tentative and seasonal to begin with. The first visitors to arrive on the coast 3,000 years ago lived there in summer only. By 1,000 years ago, Aboriginal people had become permanent dwellers year round. They did not begin to access the offshore islands, such as Maatsuyker Island, until 500 years ago, and then they visited only in summer for the rich seal and mutton bird resources.

The small number of subsequent excavations along the coast have done little to modify Vanderwal & Horton's initial conclusions. In 1989, Dunnett (1989, 1992) excavated a large shelter at the north-western end of Prion Beach and obtained a basal date of $2,017 \pm 70$ BP. Prion Beach Rockshelter is situated on a rich boundary of a number of environmental zones, including sandy and rocky coastlines, woodlands, and coastal scrub, as well as a large body of fresh water and the sea. Here, Dunnett (1992) found a similar suite of terrestrial and marine

mammals to that found by Vanderwal at Louisa Bay. He identified, however, many more species of birds brought back to this site by the Aboriginal people.

A total of 197 individual birds were identified at the Prion Beach site from the excavation of approximately 0.4 cubic metres. These included terrestrial birds: Tasmanian raven (*Corvus tasmanicus*), currawong (*Strepera* sp.) and a small parrot. Waterbirds were represented by swan (*Cygnus atratus*), a teal described as *Anas gibberifrons* an Indonesian species, pied cormorant (*Phalacrocorax varius*), little black cormorant (*P. sulcirostris*) and a rail. By far the most predominant were sea birds, especially fairy prions (*Pachyptila turtur*), short-tailed shearwater (*Puffinus tenuirostris*) and the common diving petrel (*Pelecanoides urinatrix*); many were chicks or juveniles, suggesting that nesting sites were raided. Minor species were represented by Antarctic prion (*Pachyptila desolata*), shy albatross (*Thalassarche cauta cauta*), fairy penguin (*Eudyptula minor*) and, intriguingly, an extinct penguin (*Tasidyptes hunterii*). Dunnett (1992) suggests that this site represents a specialised summer sea-bird procurement site that sometimes involved a high risk procurement strategy of accessing off-shore islands, the nearest being the Ile du Golfe some 5 kilometres offshore across open water.

Few other excavations have been carried out on the TWHHA coast. Zakharov (1981) recovered a column sample from the centre of a hut depression which was dated to 740±100 BP. Such hut depressions, circular hollows approximately 5 metres in diameter and surrounded by shells, are the remains of the Tasmanian's beehive-shaped huts. Each hut was described by Robinson as a family dwelling (Plomley, 2008). The hut depressions are often found near the coastline, close to fresh water but on elevated ground. They are commonly grouped in 'villages' of five to ten huts which probably reflect residences of Aboriginal bands. The huts are restricted to the West Coast and are likely a response to the high rainfall in the area. As the representatives of the last phase of traditional Aboriginal lifeways in the area, their presence in the landscape is very significant.

Prince (1990c) excavated a deposit below rock markings (see below) at Bond Bay (AH 3511) that showed that the site was occupied between 820±60 and 320±50. Besides the typical suite of birds and mammals, occupants of this site consumed blue mussels (*M. edulis*) and southern mud oysters (*Ostrea angasi*), the latter reflecting the use of shallow, sheltered waters close by. Prince also excavated Ninene, a small cave (AH 114) on the western side of Port Davey. At the base of a 1.6 metres deposit he recovered a date of 2020±60, while the top shell layer was dated to 80±30. In the top of this layer was a fragment of bottle glass suggesting contact with Europeans. Intriguingly, there was a change in shellfish consumption through time. In the lower levels, limpets and mussels predominated in the deposit, while in the upper levels there was a preponderance of warrener (*T. undulates*) and abalone (*Haliotis* sp.). Prince suggests that a change in strategy from the consumption of littoral zone to the sub-littoral zone occurred during this time that required improved swimming and diving skills. Dunnett (1993) supports this contention, noting that while

abalone and crayfish were present in deposits in small quantities 3,500 years ago, it was not until approximately 1,000 years ago that these species dominated occupation deposits along the coast.

Holocene rock marking sites

Early reviews of Tasmanian-wide rock marking sites covered only a few of the sites that are now known from the TWWHA (Brown, 1991; Sims, 1977). There has been no systematic survey for, or detailed study of, rock marking sites in the TWWHA and little has been published on those found since the early reviews. Based on the limited number of occupation sites both within and outside of the TWWHA in which dating could be undertaken, rock marking sites along the TWWHA coast are likely to be Holocene and there are likely to be many more sites awaiting discovery. Most are on rocks or inside shelters, immediately adjacent to the high water mark and were probably executed after the sea reached its present level around 6,000 years ago. Three areas in the TWWHA are particularly significant for rock marking sites.

Bond Bay

There are five small marking sites recorded from Bond Bay within Port Davey that consist mainly of small cupules and grooves. These are designated Bond Bay 1-5. Bond Bay 1 (AH3511) is in a small overhang in a schist cliff and is the largest and most complex in the area, with 94 separate markings. It was first recorded by Reid (1954) and re-recorded by Sims (1977). There are 94 motifs in total: 91 cupules, most of which are so narrow and deep that they were most likely created by the drill-and-abrasion technique, as well as three grooves abraded along natural cracks (Don Ranson 2016, pers. comm). This is a very rare marking site in a Tasmanian context, as there is an associated, intact occupation deposit. Prince (1990c) undertook an excavation into the deposits below the markings dated to between 820 ± 60 and 320 ± 50 (see description above).

Bond Bay 2 (AH7093) is a very small sea cave with 47 small cupules, possibly formed by drilling and/or abrasion. In Bond Bay 3 (AH9906), another small sea-cave, Sims (1977) noted 23 cupules, 5 at the entrance and 18 cupules in three rows further back along the wall. Sims also noted two other sites (Bond Bay 4 and 5) but these have not been relocated in recent times.

Louisa Bay

In a former sea cave, previously excavated by Vanderwal (Vanderwal & Horton, 1984) around 20 handprints in yellow ochre were recently noted on the walls. These are positive prints not negative stencils and are presently the only known site of this type in Tasmania.

Deadmans Bay

Located along the shore of Deadmans Bay is a cluster of five marking sites containing pecked motifs in the form of human feet (Ranson, 2008; 2010). The most outstanding site is South Coast Cave (AH9450; Ranson, 2008). On the walls of this small sea cave, over 680 motifs have been executed, including 86 human footprints, some exhibiting polydactyly, as well as eight macropod tracks, nine anthropomorphic lizard-like motifs where the lizard's feet and heads are formed from human footprints, and at least 556 additional 'toe prints'. Linear, curvilinear, and other geometric designs have also been recorded. The markings lower down the main wall of the cave are heavily eroded by storm surge and are likely to date between sea level stabilisation and the current understanding of when Aboriginal people began visiting the coast (approximately 3,000 years ago).



Figure 9. A 3D laser scan of Aboriginal art at South Coast Cave (Photo: Aboriginal Heritage Tasmania).

Other marks have been created more recently using a metal tool, perhaps a 25 mm chisel, and thus post-date European exploration. These characteristics are indicative of a long tradition of marking at this site. The markings are in the Panaramitee Style, a style that is found across most of Australia except for the far northwest and in which animal and human tracks are a major component. The presence of the Panaramitee Style at this site suggests that a Pleistocene mental template was carried across the land bridge at least 14,000 years ago and was employed up until recent times. South Coast Cave has been recorded in three dimensions by laser scanning and structured light projection to sub-millimetric resolution (Ranson, 2010), a very early use of this technique in

Australia. Two other sites with human footprint motifs have been reported in the general area; however these are yet to be rediscovered. The distribution of the human foot motif appears to form a small sub-region within Tasmania, centred on the TWWHA except for two sites that are on the southwest coast at Mainwaring River. At all sites, nearly all of the human tracks seem purposefully oriented so as to appear to be exiting from the sea.

Finally, there are also other, smaller marking sites in the TWWHA, including ochre and charcoal 'tally' marks on a sandstone cliff at South Cape Rivulet (AH4169; Don Ranson 2016, pers. comm). There are fingerprints, most likely Aboriginal, in white pipe-clay on a cliff at the western end of Turua Beach (Ranson, 2010). Four cupules were noted on a low overhang at Anchorage Cove (AH11213; Don Ranson 2016, pers. comm). Burke (1991a) recorded ochre lines at Contact Cove 1 (AH5464) and Contact Cove 3 (AH5483) and ochre marks at Contact Cove 2 (AH5465). There are unconfirmed reports of ochre marks at South East Bight Cave in Port Davey (AH 7092) and possible cupules or a hand stencil at Alfild Bight (personal communication from J. Marsden-Smedley). An inland site at Mary Tarn (AH 7375) has reputed pecked markings (Anonymous, 1999; Bednarik 1999; Leaman, 2001: 316, Plates 176 & 177; Leaman, 2002: 168, Plate 63) but, after close examination, this is considered by the Ranson (2016, pers. comm) to be a natural phenomenon (see also Bednarik, 2001, Fig 5).

The recent past

The execution of rock markings with a metal tool, the presence of European bottle glass in a cave deposit, and the observation of hut depressions surrounded by middens, are timely reminders that archaeological surveys and excavations directly link to the occupation of the region by Aboriginal people within the very recent past. The early nineteenth century British forays into the region are summarised in Binks (1980). The ethnography of the Aboriginal people living in the TWWHA garnered from these early accounts is concisely described by Jones (1974). Unfortunately, these records are mere glimpses of a traditional Aboriginal society that was being destroyed by British incursions at the same time as they were being recognised and described. A summary of British expansion into Aboriginal lands can be found in Ryan (1996, 2012).

Tasmanian Aboriginal society was based on bands of approximately 30-40 people (Jones 1974). These bands are thought to be loosely associated in larger groups of 200 to 400 individuals. These larger groups have been called 'tribes', the Aboriginal names for which have not come down to us. The British recognised three 'tribes', (now referred to as nations by contemporary Tasmanian Aboriginal people) in the TWWHA region: the North, the Big River and the South West. During their annual round, the nations moved over large ranges that incorporated areas outside what is now the TWWHA.

Little is known of the North nation as many members had been killed and the group's social cohesion destroyed by the late 1820s, by pastoralists expanding out along the coastal plain from Launceston, interactions with European sealers and through European disease. It is thought that the North nation moved seasonally into the Highlands, as evidenced by still-existing open plains that were most likely created by Aboriginal firesticks.

The Big River nation, many of its members also killed by the 1820s, moved from the East Coast where it had wintered up into the highlands along the major access route, the River Ouse or 'Big River'. They ventured into the highlands in spring to access, amongst other resources, the sweet sap of the cider gum (*Eucalyptus gunnii*) that flows in November (Plomley, 2008). Many members of the Big River Nation were also killed in the 1820s.

The South West nation is the best known from the TWWHA region. Many details have been collected through observations and conversations with Aboriginal people by the government representative George Augustus Robinson who walked the southwest coastline in 1830 (Plomley, 2008). The South West nation appears to have had the largest seasonal movement of all Tasmanian nations, having reciprocal visiting rights to the northwest coast as far as Cape Grim and the southeast coast as far as Bruny Island. There is evidence that they also raided colonists in the interior behind New Norfolk in 1829 (Plomley, 2008).

In 1815, James Kelly, merchant explorer, was the first to describe a (peaceful) encounter with the inhabitants of Louisa Bay. Kelly claimed to have discovered Port Davey and, soon afterwards Huon pine (*Lagarostrobos franklinii*) was being logged there (Binks, 1980). However, it was the establishment, in 1822, of a penal station at Sarah Island in Macquarie Harbour that most likely disrupted the traditional lifeways of the Aboriginal people in the South West nation. The penal institution and its outlying pilot station and signal station at Macquarie Heads lay across the migration route of the South West Nation in their travels to their northern hunting grounds. Over 1,100 convicts were incarcerated there during the eleven years of its operation and over 100 escaped, many pursued by military guards (Maxwell-Stewart, 2008). It is likely that these desperate escapees, their pursuers, and the armed guards stationed at the Heads and elsewhere, sowed the final destruction of the tribe through violence and disease.

Throughout his travels in the South West nation's territory in the 1830s, Robinson remarked on the many empty huts he observed and puzzled as to where the inhabitants could be. It is likely that this was the end result of introduced British diseases as well as unrecorded murder perpetuated over the previous fifteen years.

By 1834, the last of the southwest coast Aboriginal people were rounded up for incarceration on Flinders Island (Plomley, 2008). However, a small family escaped notice. In 1840, the explorer James Calder was crossing the Painters Plains, in the high country near the northern boundary of the TWWHA, when he

noticed a recently built Aboriginal hut, the interior surface covered with art. Calder recounted:

I left these rude specimens of the arts to the mercy of the elements, which I afterwards found had respected them less than I had done, for on a visit some months after, I found the rude wig-wam of these last aborigines of Tasmania were blown down, and their sketches obliterated (Calder, 1849:419).

Conclusion

Archeological research in the past thirty-five years has provided a wealth of information on the lives of Tasmanian Aboriginal people in the TWWHA during the last 35,000 years. This research highlights the long and important relationship, management and interaction with the landscape by Tasmanian Aboriginal people, which is made all the more remarkable by the adaptation that was required to live within the environment that was subject to extreme climatic change. Research has shown that for at least 20,000 years Tasmanian Aboriginal people were geographically the southernmost people on earth and practiced complex cultural beliefs. This cultural practice and the unique adaptation and resourcefulness required for their ongoing occupation of the area is evidenced by the archaeological record. This reveals hunting and butchering strategies, use and transportation of available raw material, modification of the landscape through targeted firing regimes, glimpses into their spiritual life through artistic representations within rock shelters and utilisation of seasonal and coastal resources

In terms of its scientific value, the archaeological sites and assemblages in the TWWHA are an invaluable and rare resource that has contributed to our understanding of the ongoing cultural tradition and lifeways of Tasmanian Aboriginal people. Further investigation and research of this resource will provide the possibility to answer research questions that increase our understanding about people, places and cultural practices within the TWWHA. Research questions could include a focus on coastal and inland sites to determine the nature of human occupation in the TWWHA, the identification and recording of Holocene rock art sites to strengthen our knowledge of aspects such as cultural practices, further investigation on coastal sites such as middens to better understand coastal occupation and resource use and comparison with other archaeological regions including those in the northern hemisphere, which could fill current knowledge gaps in relation to our understanding of the activities, land use and broader occupation of the area through time.

The scientific value of the archaeological sites and assemblages contribute to the cultural significance of the TWWHA and are a fundamental part of the

TWWHA meeting three criteria used to assess the Outstanding Universal Value (OUV) of a place for inclusion on the World Heritage List. These criteria are:

Criterion (iii) to bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;

Criterion (iv) to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history; and,

Criterion (vi) to be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance.

Importantly, the scientific values complement rather than compete with other values, and are a testimony to the importance and significance of the TWWHA as a World Heritage property.

The most important contribution of the archaeological research in the TWWHA has been the wealth of information it has provided to the Tasmanian Aboriginal community. This information, when combined with cultural knowledge, provides the opportunity for current and future generations of Tasmanian Aboriginal people to engage and connect with rich traditions and cultural practices of their ancestral past both now and into the future. Future cooperation and collaboration between the Tasmanian Aboriginal community and researchers on current projects such as the Retrospective Statement of Outstanding Universal Value (RSOUV) project, the Comprehensive Cultural Values Assessment (including development of future survey plans for the TWWHA) and Cultural Values Assessment of the 2013 TWWHA extension area provide the potential to extend the knowledge and understanding of this unique World Heritage place and further highlight its value to the world.

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Further reading

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The list below is of academic works and reports stemming from or referencing the Aboriginal archaeology of the TWWHA, and which were not used in this review. It does not include preliminary reports on surveys and excavations when later publications on the subjects are available. Entries of unpublished theses is not exhaustive.

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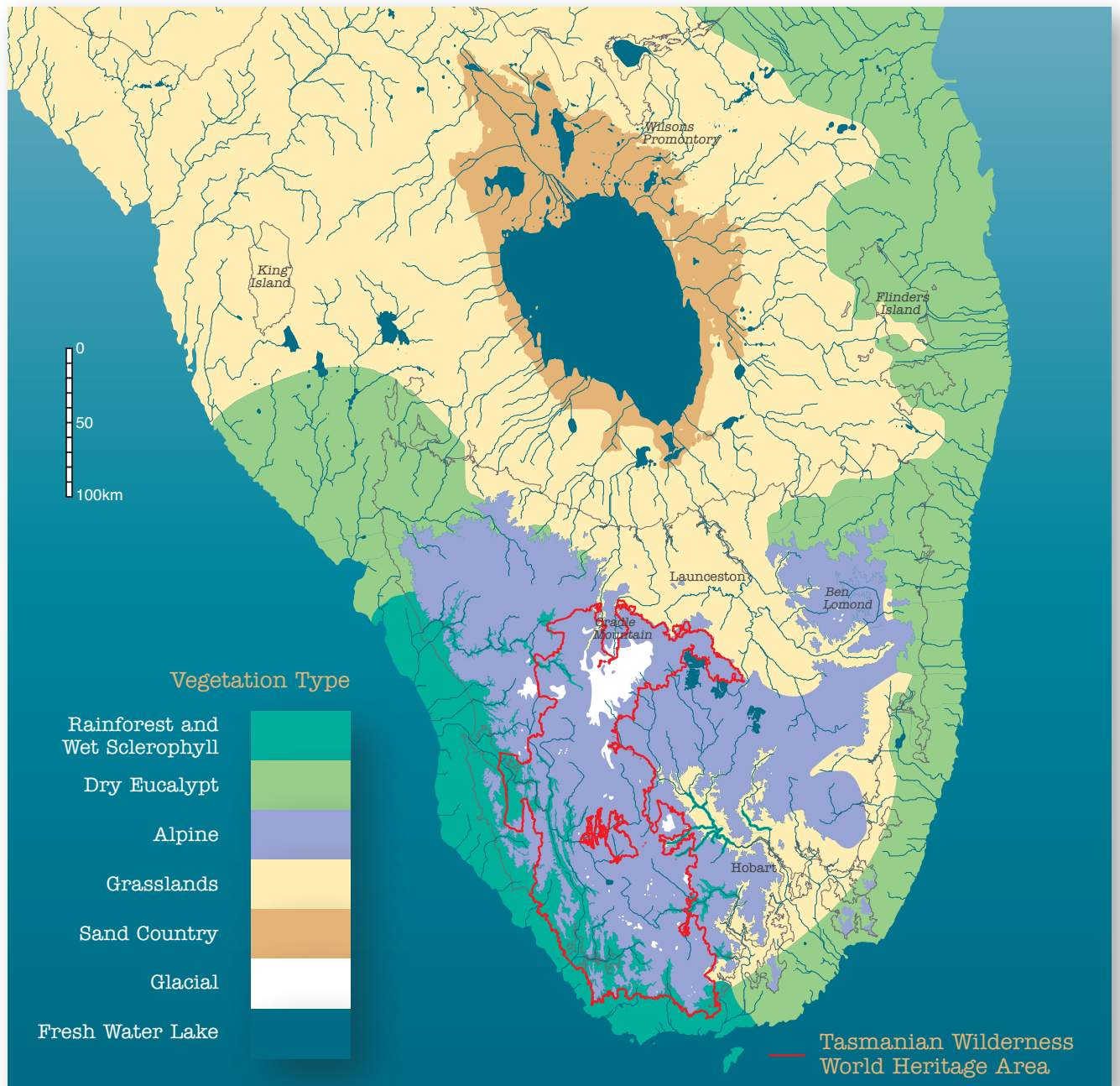
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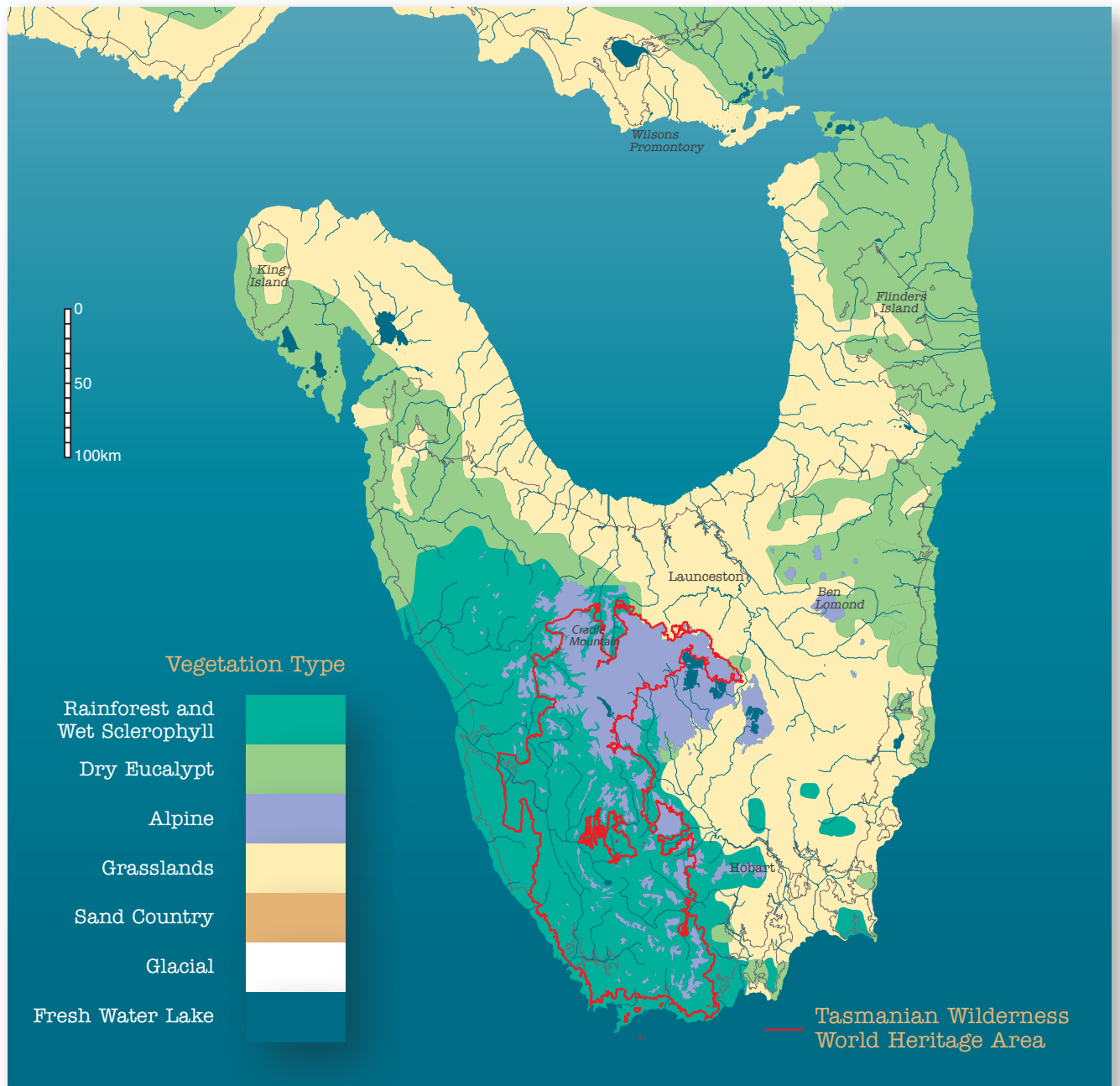
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Appendix A - Maps

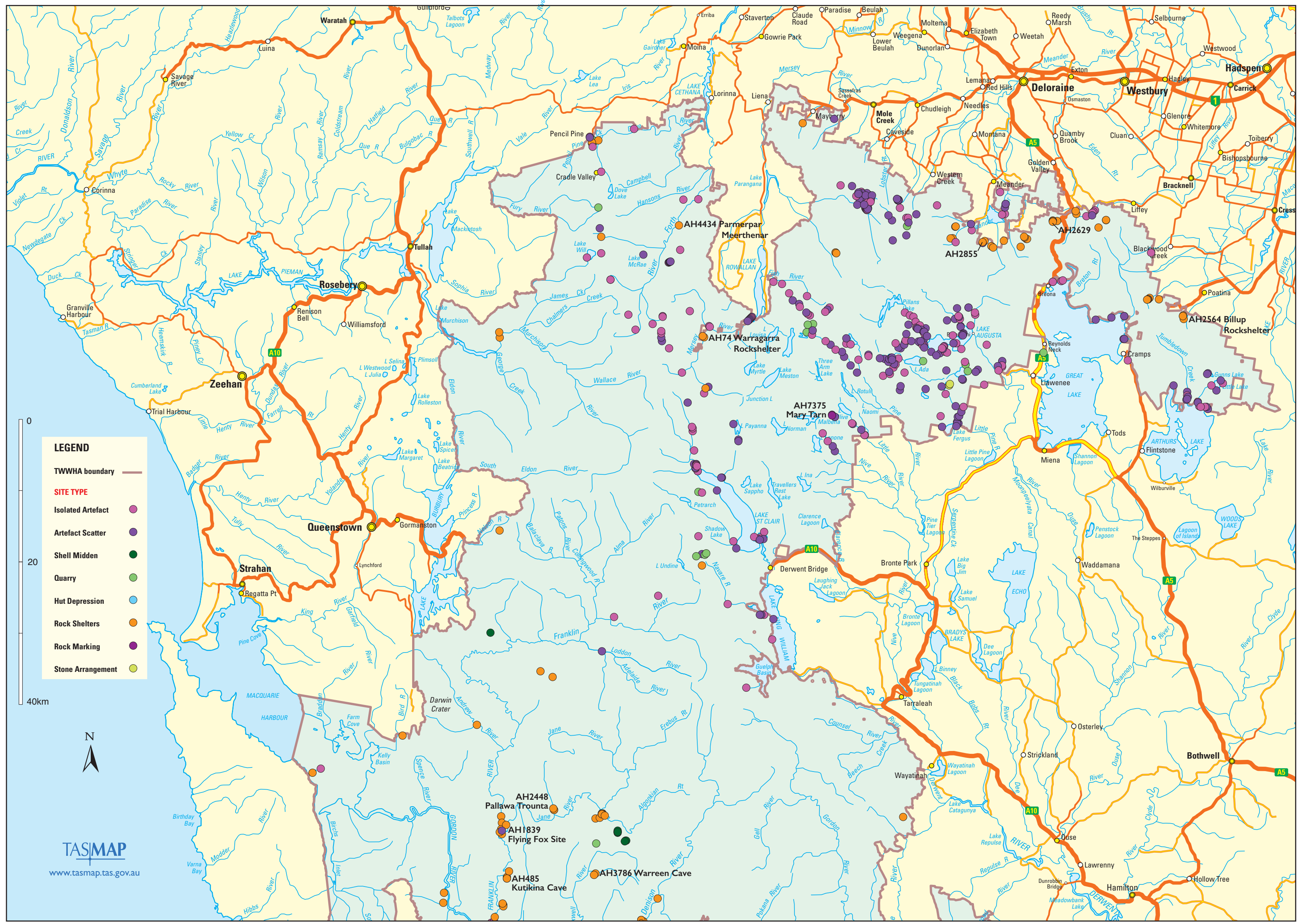
- Map 1.** The Tasmanian Wilderness World Heritage Area showing the rivers, lakes, coastal and upland features mentioned in the text.
- Map 2.** The land mass of Tasmania at the height of the ice age, c. 18,000 years ago. The red bounded area shows the position of the Tasmanian Wilderness World Heritage Area today.
- Map 3.** The land mass of Tasmania at the point of separation when the land bridge was flooded, c. 14,000 years ago. The red bounded area shows the position of the Tasmanian Wilderness World Heritage Area today.
- Map 4.** (North) and (South) Distribution of recorded Aboriginal sites in the Tasmanian Wilderness World Heritage Area. (Those mentioned in the text are labelled).



Map 2. The land mass of Tasmania at the height of the ice age, c. 18,000 years ago. The red bounded area shows the position of the Tasmanian Wilderness World Heritage Area today.



Map 3. The land mass of Tasmania at the point of separation when the land bridge was flooded, c. 14,000 years ago. The red bounded area shows the position of the Tasmanian Wilderness World Heritage Area today.

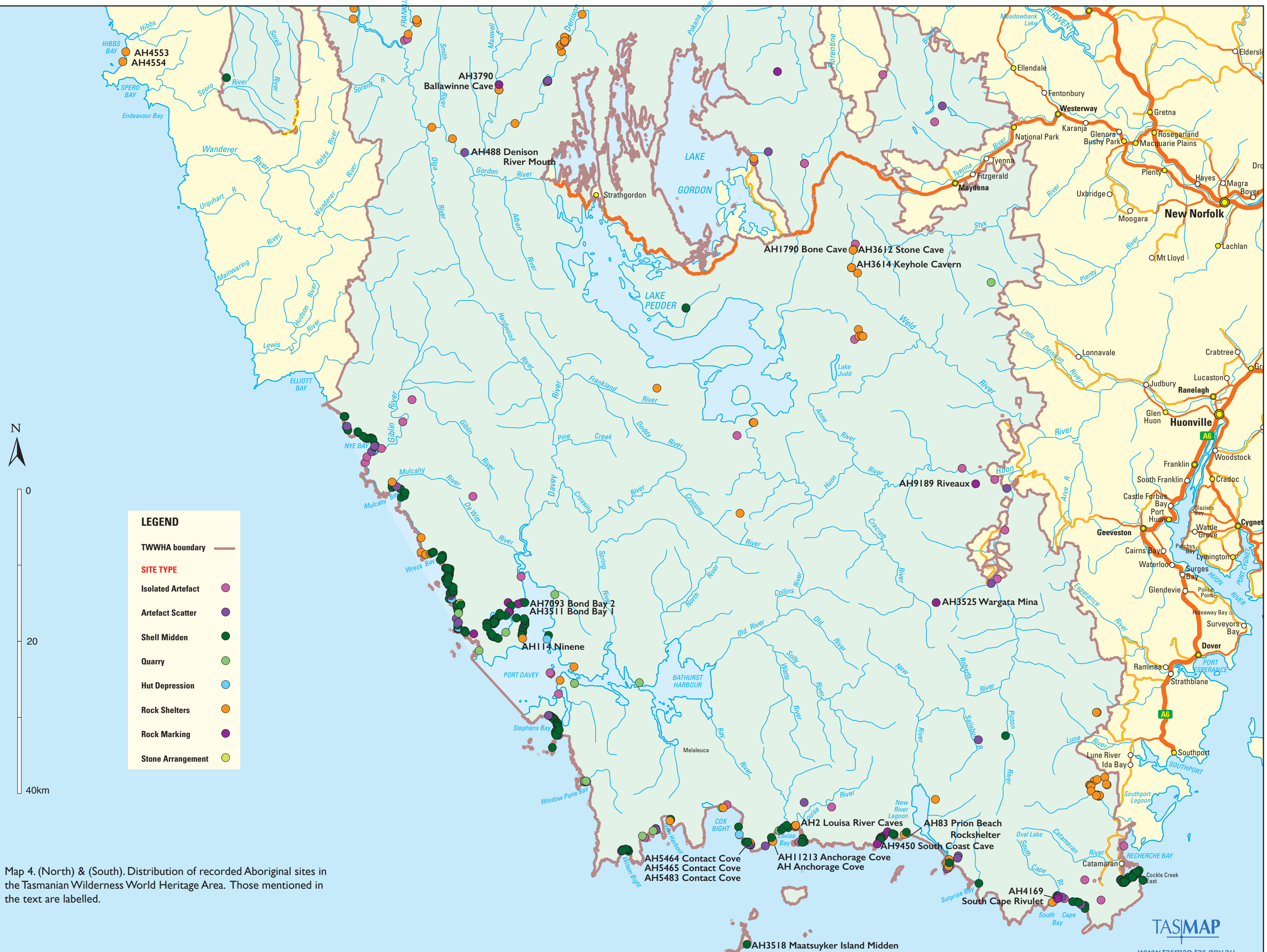


LEGEND

TWWHA boundary

SITE TYPE

- Isolated Artefact
- Artefact Scatter
- Shell Midden
- Quarry
- Hut Depression
- Rock Shelters
- Rock Marking
- Stone Arrangement



Map 4. (North) & (South). Distribution of recorded Aboriginal sites in the Tasmanian Wilderness World Heritage Area. Those mentioned in the text are labelled.

Appendix B – Glossary

AH. An abbreviation for Aboriginal Heritage. Preceding numerals used in designating sites, eg. AH1234.

Anthropogenic. Caused by humans.

Anthropomorphic. Exhibiting human characteristics.

Assemblage. A collection of different artefacts found in association with each other.

Bacterial osteomyelitis. Infection and inflammation of bone caused by bacteria, sometimes seen as a changed shapes and deformities in the bone as new bone is created to combat the disease.

Blaze. A mark placed on an object such as a rock or tree.

BP. Before Present. Used in radiocarbon dating, where 'present' is fixed at a standard reference sample dated to 1950 AD. The abbreviations are capitalised to signify estimated 'radiocarbon' years before the present. Radiocarbon years differ slightly from calendar years because they are derived from organic material that has interacted with differing concentrations of atmospheric carbon in the past.

Chert. A fine grained, silica rich metamorphic rock that often contains small fossils. It is excellent for making stone tools.

Confound. A factor, known or unknown, that has not been recognised or measured but that may influence the outcome of a study in unknown ways.

Crepuscular. An animal that is active during twilight at dawn or dusk.

Cupules. A cup-shaped hollow made in rocks by humans.

Ethnography. The study of a people, their behaviour and their culture at first hand.

Hafting. Attaching a tool to a haft or handle to achieve a better leverage.

Holocene. The geological period that began after the Pleistocene around 11,700 years ago and that continues up to the present. It is an interglacial stage, a warm period between ice ages.

Knapper. A person who shapes stone to make a tool.

Last Glacial Maximum or LGM. The last cold period in the Earth's climate history when glaciers were present in Tasmania. The coldest point was about 22,000 years ago.

Metamorphosed mudstone. A rock, first laid down as a sediment, and then subjected to high temperatures and pressures to form a fine grained material that can be knapped into tools.

Neutron Activation Analysis. Bombarding material with neutrons to create radioactive isotopes of the elements present. These can then be identified and their concentration measured.

Osteoarthritis. A disease of the joints caused by breakdown of bone and cartilage that results in pain and stiffness.

Palaeopathology. The study of ancient diseases in humans and other animals.

Paleoecology. The study of past ecosystems using plant and animal fossils.

Palynology. The reconstruction of past environments by studying plant pollen trapped in wetlands.

Petrography. The study of the composition of rocks.

Photogrammetry. Using photographs to take measurements in order to aid survey and mapping.

Pleistocene. The geological period before the present, which lasted between 2.6 million years ago to around 11,700 years ago. It is characterised by a series of ice ages. In this report it specifically means from approximately 40,000 years to 11,700 years ago.

Quartz. One of the commonest rocks, made of crystals. It is easily fractured when struck.

Quartzite. Sandstone changed by geological heat to form a hard material, a metamorphic rock.

Scat. Animal droppings; faeces.

Stratigraphy. Layers of rock and sediment, including layers of debris arising from human occupation.

Thin-section. A very thin piece of material prepared for viewing under a microscope.

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