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ARTICLE



Earth oven cookery and cuisines in Aboriginal Australia: Ethnographic and ethnohistoric insights from Western Cape York Peninsula and the Southern Murray Darling Basin

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ABSTRACT

Earth oven cookery involves cooking food in pits using hot heating elements, typically over extended periods of time. This technique has been reported in Holocene and Late Pleistocene contexts in Australia, and is of ongoing importance to many Indigenous peoples today. Despite considerable previous work on earth ovens and related sites, few have explored earth oven cookery as a distinctive cultural phenomenon. Here, we investigate the foodways associated with earth ovens drawing on ethnohistoric and ethnographic sources from the southern Murray-Darling Basin and central Western Cape York Peninsula, Australia. While there are many commonalities in earth oven cookery, it was also a highly adaptable practice in terms of the range of foods cooked, oven construction practices, and cooking techniques. People widely used herbs and wrappings to flavour foods, added water to aid the cooking process, and made extensive use of other plant materials to impart flavour, prevent food from burning, while also keeping food free of debris. We show that earth ovens are strongly associated with culturally distinctive cuisines and foodways and an investigation of these cookery practices can enhance our understanding of past social organisation, identity, commensality and the scale of food production.

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Introduction

Pascoe's (2018) proposal that Australian Aboriginal and Torres Strait Islander societies were practicing forms of agriculture and aquaculture at the time of European conquest has sparked wide public interest. Various scholars have questioned Pascoe's work, noting problems with his treatment of empirical data, and use of social evolutionary frameworks (Keen 2021; Porr and Vivian-Williams 2021; Sutton and Walshe 2021). Yet, questions about Aboriginal cooking practices are rarely explored within this debate, reflecting a lack of research on this topic. For example, Pascoe (2018) makes frequent reference to a species of yam (*Dioscorea* spp.) and its high dietary importance, but does not explore the way this important food was prepared. Similarly, Sutton and Walshe (2021) make only passing reference to cooking practices in their detailed review of ethnohistoric and ethnographic sources, though do provide important detail on the wider economic, social, religious and ecological dimensions of

Aboriginal food production. In Australian archaeology, cooking practices are rarely the subject of direct investigation, though the discipline has a long tradition of investigating diet and subsistence, defined elsewhere as the types of foods eaten and the various means through which foods were produced (Graff 2020:341; Schulting 2013:2). Archaeological approaches to diet and subsistence have evolved since they were first popularised in the discipline in the 1960s–1970s. A number of researchers have challenged simplistic, reductive and at times environmentally deterministic interpretations, instead emphasising the evident complexity and diversity of Aboriginal food production systems in the past (e.g. Lourandos 1997; McNiven and Feldman 2003; McNiven et al. 2021; Morrison 2003, 2013; Wilson et al. 2022).

A focus on foodways can produce novel insights on past human behaviour (Graff 2018; Peres 2017; Schulting 2013). Foodways encompasses the 'activities, symbolism, and beliefs surrounding the acquisition, preparation, and serving of food'

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(Schulting 2013:2). Key themes explored include past social relationships and aspects of social organisation, cultural symbolism, cultural practices and worldviews, gender, age, food sharing, status and cosmology (Graff 2018; Peres 2017; Schulting 2013). This work stems from anthropological research that highlights food as being key to the establishment and maintenance of social relationships and networks, the construction and expression of identity and meaning, and in cultural symbolism (Appadurai 1981; Counihan 2018; Douglas 1984, Harris 1987; Graff 2018, 2020; Tierney and Ohnuki-Tierney 2012). Here, we add to such studies and argue that the exploration of foodways can generate a broader range of insights than studies of diet and subsistence alone, including a consideration of past cuisines: a term that is rarely applied to Aboriginal foods. While early research associated cuisines with 'high culture' (Goody 1982), others have subsequently emphasised that all societies have distinctive food cultures, or cuisines (Fischler 2011; Graff 2020; Mintz 1996; Pilcher 2012). These are reflected in the culturally and often context-specific choices people make about food and ingredients, desired textures and flavours, preparation and cooking techniques, attitudes, beliefs, and the cultural codes and precepts underpinning everyday practices that contribute to the construction of meaning and identity.

Here we set out to analyse the foodways, cuisines, technologies and cultural practices associated with earth oven cookery in the southern Murray-Darling Basin and western Cape York Peninsula, Australia (Figure 1). Earth oven cooking is documented across a wide range of recent historic and contemporary settings particularly amongst Indigenous and First Nations communities around the Pacific Rim such as Papua New Guinea, Aotearoa-New Zealand, North and South America, and on many Pacific Islands (Black and Thorns 2014; Campanelli et al. 2018; Carson 2002; Gott 1999; Isaacs 1989; Leach 1981; Salazar et al. 2012; Sopade 1997; Thoms 2008, 2015; Wandsnider 1997). While earth oven cooking varies, it commonly involves cooking food within a pit using heat-conducting elements – raw materials such as stone or clay nodules – rather than directly on an open fire. Food is typically wrapped or encased within layers of plant material, buried on or with heating elements and sediment, and cooked for an extended period. In Australia, earth oven technologies have been documented in archaeological sites around the country, including in Pleistocene and Holocene settings (e.g. Holdaway and Fanning 2014; Whitau et al. 2018). While the basic construction method is known from this and other work, the specific foodways and cuisines associated with these features have received scant attention to date.

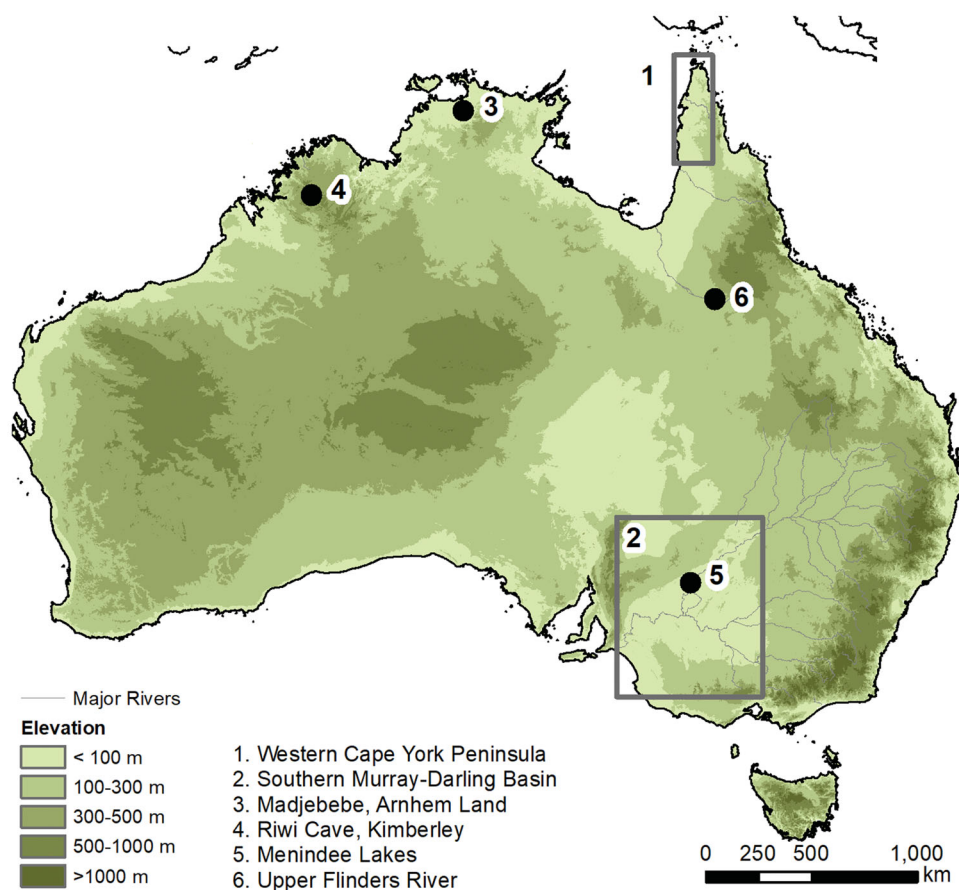


Figure 1. Location map.

Earth oven features are an excellent target for archaeological research into past foodways. Kuhn and Stiner (2019:319) describe hearths as ‘irresistible interaction bubbles’ that drew people together in the past, especially where cooking and food consumption took place. Others highlight the potential for investigations of hearths to cast light on aspects of past social organisation and interaction, food preparation, consumption, sharing, and in some cases, cultural symbolism, and the enculturation of past landscapes (e.g. Chazan 2017; Mithen 2019). Many archaeologists adopt a cautious approach when interpreting hearths, as these are often ambiguous features in archaeological contexts, and potentially used for a wide range of purposes in the past – including for light, warmth, signalling, material culture production and cooking. We show here that earth ovens, in contrast, were strongly, if not almost exclusively, associated with food preparation and as such, have the potential to provide more specific insights on aspects of past foodways and cuisines than hearths alone. That said, clearer diagnostic criteria are required to support the identification and analysis of these features. Here we draw on results of a review of ethnographic and ethnohistoric accounts of earth oven cooking in the southern Murray-Darling Basin and western Cape York Peninsula. The paper begins with a brief discussion of previous research on earth ovens and related features in Australia, before exploring earth oven cooking techniques and associated foodways for each of the case study areas. We conclude the paper by arguing that earth ovens reflect culturally distinctive foodways and cuisines with broad similarities across vast geographic areas, in addition to localised, culturally specific practices.

Background

Earth oven cooking is known to have many benefits, including increasing the energy density, palatability and digestibility of starch and inulin-rich plant parts (Wandsnider 1997). Earth oven cooking is reported to reduce the level of toxins in some foods, including, for example, the cyanogens in cassava (*Manihot esculenta*) (Sopade 2000) and toxic alkaloids in karaka fruit (*Cornycarpus laevigatus*) (Leach 1981). Meats also benefit from extended, moist cooking in earth ovens, as it promotes collagen and lipid hydrolysis, as well as fat rendering (Wandsnider 1997). The basic technique varies considerably in terms of oven size, the amount of food being prepared, and the number of people to be fed. This includes the simultaneous cooking of six adult pig carcasses in Polynesia (Leach 1981), up to half a ton

of rhizomes by Aboriginal people in southeastern Australia (Gott 1999), and up to a ton of mesquite tubers by Apache peoples in North America (Wandsnider 1997:23). Some have proposed earth ovens were key to large-scale cooperative collection and cooking of plant foods and helped to maximise calorific returns and minimise the possibility of spoilage of seasonally abundant foods, with associated social, health and political implications (Black and Thorns 2014; Martin 2006, 2011; Wandsnider 1997).

Earth oven cookery practices are thought to have emerged after 32–30 kya in Europe and Asia, 8 kya in North America, and 6–4 kya in Central and South America (Black and Thorns 2014; Salazar et al. 2012; Thoms 2015). Research in Australia raises questions about this chronology, with some indications that this practice has a deep antiquity and may have formed part of the cultural package of the first human populations moving into Sahul. ‘Pit hearths’ are reported in the earliest occupation layers at Madjedbebe (after ~59,300 BP) (Figure 1) and contain accumulations of macro-botanical remains, charcoal and ash (Clarkson et al. 2017; Florin et al. 2020). While the authors do not explicitly interpret these features as earth ovens, this is an interpretation worthy of consideration. At Riwi Cave (Figure 1), four pits rich in ash, charcoal and macro-botanical remains dated to after ~34 kya (Whitau et al. 2018) are interpreted as ground ovens. In addition, numerous instances of Pleistocene ‘hearth’ features reminiscent of earth ovens have been reported in southeastern Australia (e.g. Allen 1998; Bowler et al. 1970; Cupper and Duncan 2006; Veth et al. 1990), potentially providing further evidence that earth oven cooking techniques were widespread by the terminal Pleistocene. Again, these examples have not been interpreted as earth ovens, and are instead described as ‘hearth’.

Earth ovens are a major element of the Holocene archaeological record in northern and southeastern Australia. Within parts of the northern Murray-Darling Basin (MDB), earth oven remnants – generally referred to as ‘heat retainer hearths’ – are commonly found eroding along drainage lines (Holdaway and Fanning 2014; Holdaway et al. 2017), with one study reporting 979 such features along approximately 9 km of an inland seasonal catchment (Holdaway et al. 2017: figure 2). This work shows that ovens were constructed by placing heat retainers within a shallow depression and heated directly with a fire (Holdaway et al. 2002:353; Holdaway and Fanning 2014:111). Archaeological investigations within the upper Flinders River catchment in north Queensland (Figure 1) have identified similar



Figure 2. Two common components of earth ovens in western Cape York Peninsula. Left: ‘ant bed’ or termite mound at Waypandan. Right: ‘tea tree’ or paperbark (*Melaleuca* spp.) at Mbau Tjath that has been scarred through recent bark removal (Photographs: Michael Morrison).

archaeological features, and have produced comparable results in terms of exploring questions about broad construction methods and local chronologies (Wallis et al. 2004).

A range of other archaeological features related to cumulative oven use have been identified across Australia. These include ashy deposits several metres or more in diameter, laden with heating elements and reported in the southern MDB (Coutts 1977; Jones et al. 2017; Pardoe 2003; Pardoe and Martin 2001). Earth mound features with evidence of earth oven use are also reported in the southern MDB, Arnhem Land and western Cape York Peninsula (Brockwell 2006; Coutts et al. 1977; Jones et al. 2017; Martin 2011; Morrison et al. 2015; Ó Foghlú 2017; Shiner and Morrison 2009; Peterson 1973; Westell and Wood 2014; Williams 1988). Those in the southern MDB are generally classified as either oven mounds or residential mounds. Oven mounds are thought to form through repeated and cumulative earth oven cooking activities (Coutts et al. 1977, 1979; Westell and Wood 2014; Williams 1988). Some consider they were cooking features used for a variety of food types, often vegetable foods but also a range of animals (Coutts et al. 1979; Williams 1988). Others have proposed a more focused use of oven mounds, specifically for the intensive

processing of aquatic vegetation found near wetlands, such as bulrush (*Typha* spp.) rhizomes, a staple in many regions historically (Pardoe 2003; Martin 2006, 2011). Larger residential mounds are generally broader in surface area and between 0.5 and 2 m in height and some have suggested they were used as living platforms and hut foundations, and often containing oven features or heat retainers that are suggestive of their use (Coutts et al. 1979; Martin 2011). A much narrower range of research has investigated earth mounds in northern Australia, but here again, earth ovens are proposed as a key element of mound formation. In these instances termite mound fragments are used as a heating element, and mounds interpreted as residential bases, specific earth oven cooking features, and in some cases, as burial sites (Brockwell 2006; Morrison et al. 2015; Ó Foghlú 2017; Peterson 1973; Shiner and Morrison 2009; Sutton 1994). Further research efforts are warranted on these earth mound features.

Despite the array of previous studies and abundant archaeological evidence for this practice, there has been little consideration of earth oven cookery as a distinctive cultural phenomenon worthy of independent investigation. While ethnographic and ethnohistoric literature have been used to address a

range of research questions relating broadly to archaeological features associated with earth oven cookery, particularly earth mounds (Williams 1988; but see Balme and Beck 1996; Martin 2006, 2011), no syntheses of earth oven cooking have been produced to date. This stands in contrast to research in Pacific and North and South American contexts where analyses of ethnohistoric and ethnographic accounts have illustrated the socio-cultural, symbolic and economic dimensions of earth oven cookery practices, which have significantly aided archaeological investigations in these regions (e.g. Black and Thorns 2014; Carson 2002; Jones 2016; Leach 1981; Salazar et al. 2012; Wandsnider 1997). These studies highlight the benefits of considering the ethnographic and ethnohistoric literature when interpreting archaeological site function, though caution is required particularly where researchers uncritically draw uniformitarian assumptions from these sources, especially when interpreting dynamic and variable cultural practices over long time periods (Allen and Holdaway 2009). Others have noted the 'obvious danger of using the literature uncritically as a source of convenient ethnographic parallels, or to build unstable reconstructions on selected evidence' (McBryde 1979:140). Indeed, McBryde (1979:144) emphasised the need to address these issues by 'deriving the general from the particular' via the

comparative and critical analysis of source material, implicit recognition of key differences between ethnohistoric and ethnographic sources, and the identification and documentation of trends across diverse sources. This is the approach we adopt in this study.

Western Cape York Peninsula

The western Cape York Peninsula region (Figure 3) comprises the Countries of a large number of Aboriginal Custodians from a range of socio-linguistic groups. In both the recent past and certainly the present, the notion of Country has been key to Aboriginal peoples' lives, livelihoods and wellbeing in this region (Fletcher 2007; McConnel 1934, 1953; McNaughton et al. 2016; Sutton 1978; Thomson 1939; von Sturmer 1978). Countries comprise socially circumscribed assemblages of places and features and are socially and spiritually meaningful landscapes that are intimately known to clan members – typically members of extended family groups (Sutton 1978). During the early colonial period (ca. 1850–1900), family groups resided at and moved between a range of places across several Countries, based on both access and resource usage rights that were generally inherited through descent, but also mediated by kinship ties, marriage, adoption and other factors. Food

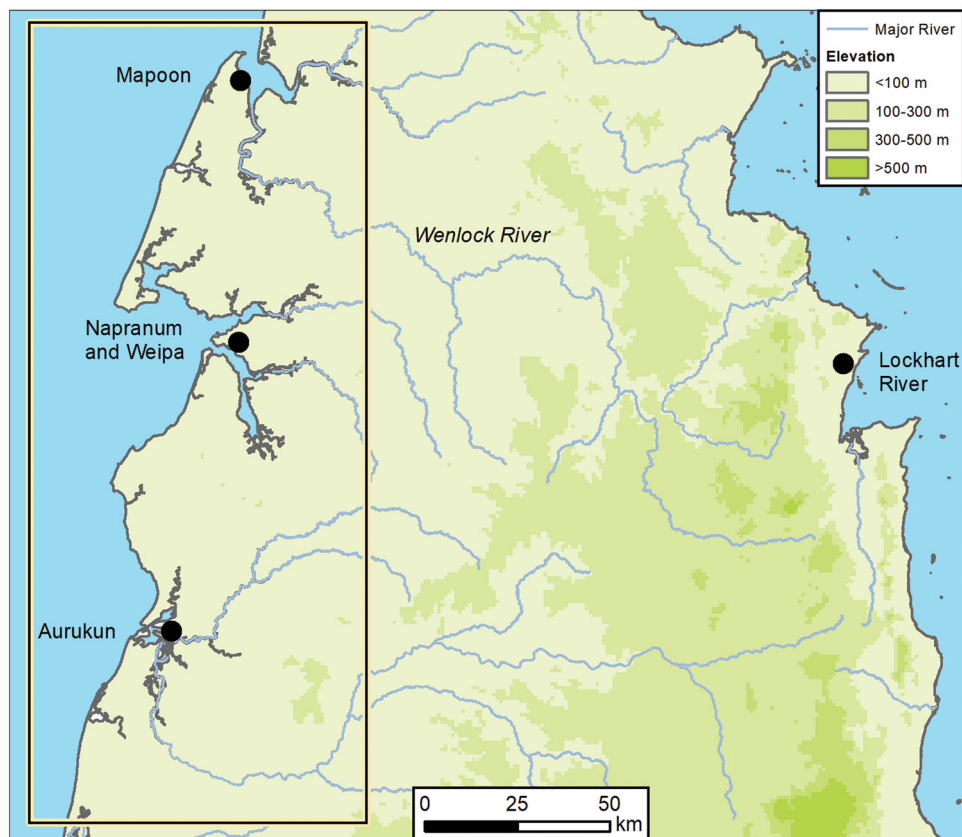


Figure 3. Location map, western Cape York Peninsula (highlighted).

production activities varied in scale and level of cooperation, from those undertaken by individuals, family groups and sub-groups, through to larger-scale communal events, which drew together extended social groups and often focused on short-term abundances of foods within distinct ecosystem patches (Chase and Sutton 1981; Thomson 1939). This in part reflected the considerable seasonal changes that occur in the region, which is within the tropics and is subject to an annual monsoon with high temperatures, precipitation, vegetation growth during the summer months, and progressive drying of landscapes across the remainder of the year. Ecosystems throughout the region are predominantly homogeneous, tall, open sclerophyll woodland with the greatest ecological heterogeneity to be found near the numerous coastal streams, rivers, wetlands or on low-lying coastal landforms.

During fieldwork in the region in the late 1920s and early 1930s, anthropologist Donald Thomson recorded part of a journey he made across a coastal plain near Aurukun with a local family group:

On the banks of a salt water creek were the remains of a fire at which a large quantity of a Mud Shell (*Cyrehia jukesii* [*Geloina erosa*]) had been cooked by roasting on the coals of a fire. And again there was an ant bed 'oven' called pia by the Wik Monkan—which is employed by the people through Cape York Peninsula and over a large part of tropical Northern Australia, for the cooking of larger game, such as kangaroos, wallabies and emu, as well as for much of the vegetable food (Thomson 1939:220–221).

After describing the general process used in constructing *pia*, he concludes by noting that 'remains of such cooking places will long remain to mark the places where the Aborigines have hunted in Northern Australia' (Thomson 1939:221). Some 80 years on, local research indicates that earth mound sites found on some wetland margins are likely the result of cumulative earth oven cooking practices (Brockwell et al. 2017; Cribb 1986; Morrison et al. 2015; Ó Foghlú 2017; Shiner and Morrison 2009). Despite the availability of ethnographic research in the region, limited efforts have been made to integrate archaeological datasets with the insights generated through ethnographic work (Allen and Rowe 2014).

Cooking techniques

Two general means of cooking food were used historically in the western Peninsula: open fires and earth ovens. While there is some commentary on the use of open fire (e.g. McConnel 1930:103; Sutton 1994:35; Thomson 1932), there is much more detail available on earth oven cooking. The

earliest report of the technique is by Walter E. Roth, a Queensland Government official, who observed the preparation of a kangaroo for cooking in an oven while at the Mapoon Mission (Figure 3):

As an example of baking, take the case of a Kangaroo which, on being killed, is usually first of all robbed of its tail-tendons, and then has all the main joints of the upper and lower limbs dislocated, so as not to break the bones (of economic value for spears, needles, etc): the tongue is next drawn out, and skewered with a wooden splinter over the incisors to prevent them being damaged by the heat (these teeth being required for spoke-shaves); the belly is incised horizontally, the intestines removed, and filled up with heated stones. The limbs are next drawn up to the sides of the body, the whole tied round and round like a bundle, and put into the ashes and well piled over (Roth 1900:36–37).

He also reported that turtles and crocodiles were cooked in similar ways, albeit with little additional detail.

Three decades later, Ursula McConnel working near Aurukun (Figure 3), provided a description of what she called an 'ant-bed oven':

Ant-bed ovens for cooking meat and roots are made by lighting a fire in a hole in the ground and placing ant-bed thereon. When the ant-bed is sufficiently hot, the food is placed on it and covered over with tea-tree bark, or sometimes special leaves to make the meat tender and tasty, and finally all is covered with earth or sand and left to cook in a slow oven (McConnel 1930:103).

A range of other accounts throughout the 20th century describe the same general practice (Isaacs 1989:54–55; Sutton 1994:44; Thomson 1939:220–221; von Sturmer 1978). Two recurring aspects of earth oven cooking are evident across these examples: the use of 'ant bed' and 'tea tree'. Termite mound (i.e. 'ant bed') nodules are pieces of compact sediment collected from termite nests. These are very common throughout northern Australia and in the western Peninsula, and are formed by small insects collecting grains of sediment and organic material, which are then cemented together to form distinct mounds (Figure 2). Ethnographic sources for the Aurukun region indicate that termite mound nodules were preferred for earth oven use due to their superior heat retaining properties (von Sturmer 1978; Sutton 1994). 'Tea tree' refers to the use of the soft, layered and paper-like bark of several species of *Melaleuca* (also known as 'paperbark') (Figure 2), common near freshwater lagoons and streams. This highly adaptable material was and continues to be used for a variety of purposes including wrapping foods for storage, transport, cooking and eating, and much

more (McConnel 1930; Sutton 1994; Thomson 1939; von Sturmer 1978).

Although 'ant bed' and 'tea tree' are widely reported in accounts of earth oven cooking, other heating elements are sometimes noted. These include compacted shell-rich conglomerate found in some beach ridge and sand dune deposits, mud obtained from swamps, or stone, when available (Sutton 1994; von Sturmer 1978). John von Sturmer (1978:233–234) reported that termite mound and paperbark were most desired, but that when unavailable, the bark of a kind of wattle (*Acacia* spp.) was used as a heat retainer, while certain palm tree leaves could be used to cover foods prior to burial. This further demonstrates flexibility in raw material use in response to local context.

Oral histories also provide important insights. The late Elder, Mrs Ina Hall, recounted several earth oven cooking techniques. The first involved the excavation of a shallow depression in sand where a fire was lit without additional heating elements. When hot, still-burning wood was removed and used to 'make another fire, in case you need it' (Hall 1984a). Washed, still-wet grass was then placed over the coals, and 'then you put [in] your fish ... then cover it with paperbark, and then sand' (Hall 1984a). A second technique, used for kangaroos and other animals, required a large pit and firewood supply, as well as abundant termite mound nodules, 'because if you want [the] meat to be really cook[ed], you have to get the fire well and truly hot' (Hall 1984a). She then described the use of the thin, grass-like leaves of *ngganj*, or water chestnut (*Eleocharis dulcis* [Fletcher 2007:55]):

Well you get whole lot of it, and then wash it careful. Always wash it first and then put it over your kap murri [earth oven] and then put [in] your kangaroo or wallaby or whatever you want to cook: porcupine, hedgehog, bandicoot. And then get your big sheets of paperbark, put it over and then lots of sand, you know, to keep the heat down (Hall 1984b).

The gutted animal was placed on this moistened bed of *ngganj*, sometimes with vegetable foods including the tubers of *ngganj*, which were cooked together for an extended period of time.

Cuisines

There is strong evidence that specific culinary preferences were associated with earth oven cookery in the western Peninsula, reflecting both personal and local group preferences. Sutton (1994:43) noted differences in earth oven techniques between local groups and suggested that some of these were 'consciously maintained as an aspect of local group identity'. Various herbs were used to impart or

enhance the flavour of the item being cooked, and different foods received different herbs. For example, Ina Hall (1984a) recounted that as a child living in the dormitories at the first Weipa Mission, she observed adults returning from hunting trips with cooked foods such as kangaroo that had been prepared in an earth oven away from the Mission. She recalled that these often had a peppery taste, from a leaf or a sprout added to the earth oven (Hall 1984a). Other sources indicate that leaves of a species of *Casuarina* were placed into earth ovens 'to taste it like pepper and salt' (Mrs Joyce Hall in Isaacs 1989:56) along with a variety of other leaves that provided seasoning (McConnel 1930:103; Sutton 1994:45). Additional sources of flavour were obtained from the choice of grasses placed at the base of the oven (von Sturmer 1978:233–234) or by cooking together certain combinations of foods that would season each other (Sutton 1994). This is a practice used by people today, for example, the leaves of several plant species growing on a shell mound were noted by Elder Richard Barclay to be a herb 'like bay leaf' commonly used in 'kap murri' or earth ovens, especially when cooking *minyha* (a term used to describe 'big meats' locally) (Richard Barclay, pers. comm. 2006). Given the deep ecological knowledge of Aboriginal people in Cape York Peninsula, it is very likely that a diverse range of herbs were used that simply went undocumented or perhaps unnoticed by western researchers.

Earth oven cuisines were not restricted to a specific class of food. Vegetables, nuts and tubers, fish, stingrays, reptiles, shellfish, small mammals and *minyha* – such as kangaroo, dugong, and turtle are all documented as being prepared in earth ovens (Table 1). Some foods, such as stingray, were cooked in several stages, as they are today, starting with initial cooking on an open fire to allow for the soft white flesh to be removed from the skin. This flesh was then rinsed thoroughly, mixed with the finely chopped heart and liver for flavour, rolled into balls, and then wrapped and sealed in paperbark parcels which, in turn, were cooked in earth ovens (McConnel 1930). This resulted in a very soft textured meat with the paperbark imparting a distinctive flavour. McConnel (1953:7) suggested that in the 1920s, this was 'a delicacy reserved for older men'.

The oral histories of female Elders are particularly important in terms of understanding plant food preparation, as this was rarely documented. Sutton (1994:37) for example, reported only one tuber (*Cayratia* spp.) that was 'sometimes' cooked in earth ovens and makes no mention of other local flours derived from plants (see also Thomson 1939; von Sturmer 1978). Mrs Ina Hall's recollections add significantly to the picture as she recounted how

Table 1. Foods prepared with earth ovens in Western Cape York Peninsula.

Food	Technique	Source
Atakani, or the water lilly (<i>Nymphaea violacea</i>)	Flowers and stems eaten raw, while roots and seedpods cooked on an open fire or earth oven.	McConnel 1930:102
Bandicoot	Earth oven technique.	Hall 1984a
Breads (Mission, >1898)	Earth oven technique.	Hall 1984b
Bush or wild grape (<i>Cayratia trifolia</i>)	Tubers cooked in earth oven.	Sutton 1994:37, 43
Dugong (<i>Dugong dugon</i>)	Animal cut up into smaller pieces and cooked in earth oven. Bones grilled on open fire.	Fruit 1984; Hall 1984a; John and Andoran 1984
Echidna	Earth oven technique.	Hall 1984a
Emu	Earth oven technique.	Fruit 1984; Thomson 1939
Fish (various)	Cooked on open fires or in ground ovens when a larger quantity needed to be prepared, or in line with personal preference, without heat retainers when cooked in sand.	Hall 1984b; von Sturmer 1978:216
Fruit bats	Earth oven technique.	McConnel 1936:362; Sutton 1994:43
Ndhay or Hairy yam (<i>Dioscorea bulbifera</i>)	Baked for 2–3 hours in earth oven, crushed into meal, then soaked in freshwater until no longer bitter.	Hall 1984a (see also Fletcher 2007)
Marsupial mice (likely <i>Antechinus</i> spp.)	Earth oven technique.	Sutton 1994:43
Mbau-nu or wild grape (<i>Ampelocissus acetose</i>)	Root is cooked in an earth oven (possibly similar to <i>Cayratia trifolia</i> , above)	Wharton 2005:58
Nhomb propagules, the large-leaved orange mangrove (<i>Bruguiera gymnorhiza</i>)	Baked for 2–3 hours in earth oven, crushed into a meal, then soaked in freshwater until no longer bitter.	Hall 1984a (see also Fletcher 2007)
Ngaanj (<i>Eleocharis dulcis</i>)	Tubers cooked in earth oven or roasted on coals. Stems used as a 'grass' in earth oven cookery.	Hall 1984a
Pig	Earth oven technique.	Fruit 1984; Sutton 1994
Saltwater crocodile	Earth oven technique.	Roth 1900:36–37
Sea Turtle	Animal cut up into smaller pieces and cooked together in earth oven.	Fruit 1984; John and Andoran 1984;
Stingray	Cooked on open fire, flesh removed and wrapped in paperbark parcels, then baked in earth oven.	McConnel 1953:7
Wallaby and kangaroo	Gutted, cooked for extended time in earth oven, skin side down, sometimes with vegetables or herbs.	Fruit 1984; Hall 1984a; Sutton 1994

earth ovens were used to prepare *nhomb*, the propagules of a species of mangrove (possibly *Bruguiera gymnorhiza* [Fletcher 2007:99]), and *ndhay*, the 'hairy' or 'cheeky yam' (*Dioscorea bulbifera* [Fletcher 2007:89]) (Hall 1984a). These were placed in an earth oven for 2–3 hours before being crushed and then soaked in water inside a string basket to remove the bitterness. Once removed, the flesh was dried, or pounded into flour that could be used immediately, or stored or transported, and used to create unleavened breads that were cooked on the coals of open fires.

A wide range of animals of varying sizes were cooked in earth ovens and cooking methods were equally varied (Table 1). Smaller animals were grouped together and placed inside an oven, though larger animals were cooked by placing hot heating elements inside the gut cavity, once the intestines had been removed. These required longer cooking times to produce a moist, tender meat. According to the late Elder Mr Eddie John, the bones of larger animals were often roasted on an open fire as a smaller meal, while the larger meat cuts were cooking in a nearby oven (John and Andoran 1984). This represents a different mode of cooking to that reported by Roth at Mapoon in 1900, where whole trussed wallabies were cooked in an oven, again highlighting local variability in this practice.

One final aspect of earth oven cookery that is of note is highlighted by another late Napranum Elder, Mrs Eva Fruit. She recounted that cooking large

animals in an oven would produce a large amount of meat, and that this was easily transported:

When we shift camp, our parents shift camp, they carry them meats, our foods, inside dilly bag. ah different bag. Yams in another one. Them hairy thing [possibly hairy yam, ndhay] in another basket. ... that meat can keep like how today you, you keep your ... your roasted meat (Fruit 1984).

von Sturmer (1978:218) also suggests that earth oven cooking and the presence of smoke improved preservation, with fish or other meats frequently being left in the oven overnight and that this meat '... tends to last several days'. Thus, earth oven cookery may provide the additional benefit of helping to preserve foods, at least for a short period, and facilitating its transport to other locations if required.

Southern Murray-Darling Basin

The southern MDB region comprises a series of rivers and tributaries that drain a vast portion of southeastern Australia (Figure 1). This region encompasses a large number of distinctive communities with lifelong knowledge and experience of living and growing up on or near the River. Communities today are dispersed across regional towns along the River, as well as in more distant larger towns and cities. The contemporary importance of the River to community members reflects deep-time relationships with freshwater riverine and

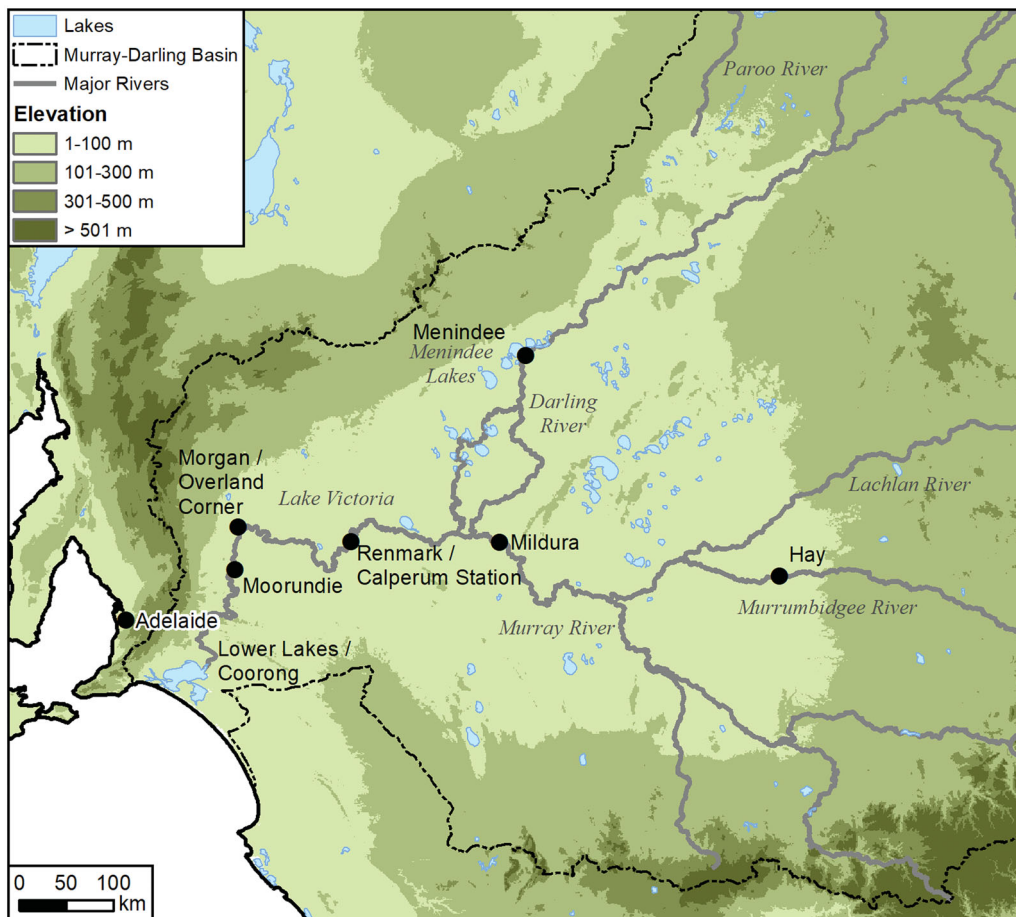


Figure 4. Southern Murray Darling Basin.

lacustrine environments in a wider regional setting of limited surface water availability and extended periods of aridity. Between Mildura and Swan Hill, several major river systems, such as the Murrumbidgee and Darling (Figure 4), converge on the Murray River creating a complex system of floodplains and sinuous river channels, oxbow billabongs, anabranch creeks and ephemeral lagoons and lakes (Hollingsworth et al. 1990; Prendergast and Cupper 2009). These landscapes comprise diverse and rich ecosystems including woodlands of river red gum and black box, extensive lignum and chenopod shrublands together with a variety of aquatic reeds and rushes, molluscs, fish, mammals and avifauna. Downstream of Morgan, the Murray River flows through a narrow gorge and simpler floodplain, before emptying into the lower lakes (Figure 4).

Earth ovens are a common element of the archaeology of floodplains in this region, including discrete heat retainer hearths, ashy deposits, oven mounds and distinct residential mounds. In recent, intensive studies on Calperum Station (Figure 4), discrete oven mounds are sometimes located adjacent to, or a short distance from more discrete 'heat retainer' type features (Figures 5 and 6) (Jones et al.

2017; Ross et al. 2019). Heating elements here are commonly clay (Figure 7), though field research elsewhere in the region indicates the use of calcrete nodules (Westell, unpublished data; see also Westell and Wood 2014).

Cooking techniques

Some of the earliest accounts of earth oven use in the MDB derive from the accounts of early explorers and colonial officials. During an expedition west of Sydney in the 1830s, Sir Thomas Mitchell (1838) highlighted the common use of this technique. Further downstream, at Moorundie (Figure 4), John Eyre (1845:289–291) noted that cooking methods comprised '... broiling on the hot coals, baking in hot ashes, and roasting, or steaming in ovens'. He goes on to describe the use of earth ovens as follows:

The native oven is made by digging a circular hole in the ground, of a size corresponding to the quantity of food to be cooked. It is then lined with stones in the bottom, and a strong fire made over them, so as to heat them thoroughly, and dry the hole. As soon as the stones are judged to be sufficiently hot, the fire is removed, and a few of the stones taken, and put inside the animal to be



Figure 5. Heat retainer hearth with clay nodules, Calperum Station, South Australia (Photographs: Michael Morrison).

roasted if it be a large one. A few leaves, or a handful of grass, are then sprinkled over the stones in the bottom of the oven, on which the animal is deposited generally whole, with hot stones, which had been kept for that purpose, laid on top of it. It is covered with grass, or leaves, and then thickly coated over with earth, which effectively prevents the heat from escaping. Bark is sometimes used to cover the meat, instead of grass or leaves, and is in some respects better adapted for that purpose, being less liable to let dirt into the oven (Eyre 1845:Chapter 3).

Significant here is the link between oven size and the quantity of food to be cooked, as well as variations in practices to suit particular foods and contexts. While this example refers to cooking animals, he notes that a similar technique was used for vegetables and some fruits, but with additional moisture introduced:

The vegetables tied up in small bundles are piled over this in the central part of the oven, wet grass being placed above them again, dry grass or weeds above the wet, and earth over all. In putting the earth over the heap, the natives commence around the base, gradually filling it upwards. When about two-thirds covered up all round, they force a strong sharp-pointed stick in three or four different places through the whole mass of grass weeds and vegetables, to the bottom of the oven. Upon withdrawing the stick, water is poured through the holes thus made upon the hissing stones below, the top grass is hastily closed over the apertures and the whole pile as rapidly covered up as possible to keep in the steam (Eyre 1845:Chapter 3).

According to Eyre (1845:289–291), a single oven used for cooking vegetables could produce enough food for three or four families. He suggested that individual women would place parcels of vegetables in an oven and then retrieve these once cooked – indicating a communal practice in both oven construction and use. He further suggested that the

preparation of food for earth ovens was generally undertaken by women, but that ‘larger and more valuable animals’ such as emu or kangaroo were prepared by men (Eyre 1845:289–291). While this may reflect his gender bias or that of the men to whom he spoke, it is suggestive of distinct gender roles around cooking with earth ovens.

In 1844, Charles Sturt led an expedition into central Australia that traversed a portion of the Murray River from Overland Corner east to the lower Darling River, which the party then followed north (Sturt 1849) (Figure 4). While Sturt himself made no reference to earth ovens, Daniel Brock, employed on the expedition as an armourer and collector, observed one in use on the lower Darling River:

The oven is a hole dug into which are placed stones; a fire is then made and when the stones are become sufficiently hot, whatever fibrous things they eat, or animal, is put into this oven and covered over and a fire made over it, where it soon gets cooked (Peake-Jones 1988:25).

Beveridge (1865:18) notes the widespread use and highly adaptable nature of earth oven cooking in an area he terms the ‘Lower Murray’ (a portion of the River upstream of Mildura) (Figure 4), noting that it ‘is a very perfect method, and can be made large enough to roast an ox, or small enough to cook an opossum’. The late Albert Karloan, a Ngarrindjeri man who grew up around the Lower Lakes and Coorong region (Figure 4), described the *maramin* (or steaming) method of cooking (cited in Berndt and Berndt 1993:573), which also conforms to the general approach used further up-river, whereby stones are also used as heating elements.

There are good indications of regional variation in techniques for earth oven cookery. Etheridge (1893), for example, noted that earth ovens included two common types, one specifically for the



Figure 6. Oven mounds sites at Calperum Station, South Australia. Top: a low mound with dark soil and frequent heat retainers on a floodplain (scale 2 m). Bottom: a concentrated deposit of heating elements on a residual sediment pedestal, possibly a heavily deflated earth oven feature (scale 2 m) (Photographs: Michael Morrison).

processing of Murnong, or the yam daisy (*Microceris lanceolata*), and a second, larger type, composed of ash, charcoal and oven rock. According to Etheridge (1893:21–22), these mounds

were distributed throughout central and western Victoria to the east, and as far north as the Lachlan River (see also Mitchell 1838). Similarly, in the gorge of the River Murray south of Morgan (Figure 4),



Figure 7. Traditional Owner Jennifer Grace holding fragmented clay heat retainers, which are common on Calperum Station in the South Australian Riverland (Photograph: Amy Roberts).

Angas (1847:58) noted that ‘we frequently came upon their ovens or cooking fires, resembling kilns, beneath which the roots of the bulrush were being steamed between heated stones’. Further east on the lower Murrumbidgee (Figure 4), Morey (n.d.: 46) described a technique not documented elsewhere but conforming to the general approach:

The native oven was a round shallow hole made in the ground, a fire was kindled in it and flat round stone laid on it, and when sufficiently heated through, a thin layer of young gum branches were placed on the stone and the cleaned fish carefully laid on them, and on top of all a thick layer of gum branches (Morey n.d.:46).

There are fewer accounts of earth oven cookery in the southern MBD during the 20th century, though some accounts of their use exist (see Pardoe and Martin 2001). Gordon Kirby, for example, described the use of an earth oven in the 1920s–30s near Hay (Figure 4) (Taylor and Undy 1994). This involved establishing a hot fire within a pit and, once the wood had burnt down, the coals were raked out and meats such as kangaroo, emu, goanna, possum and echidna were placed inside, covered with leaves, coals and sediment, and cooked for several hours. He also noted that hot stones were placed in the gut cavity of larger animals such as kangaroo or emu to speed up the cooking. Margaret Tucker recalled seeing wild pigs, swans, emus and kangaroos cooked in ‘a large hole in the ground’ and ‘all specially prepared and wrapped in leaves, with hot rocks or mussel shells around it, to make it cook quickly’ (Tucker 1977:41).

Cuisines

A wide variety of plant and animal foods were prepared in earth ovens throughout the southern MDB (Table 1). Most examples of cooking animals

involved placing the prepared animal (with entrails removed) onto a layer of hot heat retainers and wet ‘grass’, and covering them with additional vegetable material, hot stones, coals, ash or sediment. The types of grass used are rarely noted, though Albert Karloan (cited in Berndt and Berndt 1993) provides important details about the types of grasses used in *maramin*:

Cut kinyera and pilbala grass was strewn over the stones to keep the meat clean and unburnt. Either portions of meat or the whole trussed up would be put on the grass bed. If trussed up, the kangaroo was placed on its chest with the head and tail alongside it. The oven was then covered with yalkura or other grass, followed by skins and finally sand so that the heat of the oven would be retained. Shortly after cooking, a pointed stick would be thrust through the sand, between the skins, so that it reached the bottom stone base, and was then withdrawn; water was poured into the hole to increase the intensity of the steam (Berndt and Berndt 1993:573).

The use of a similar technique involving the use of grasses, stone and introduced water are widespread, and occur from the Paroo River (Smyth 1878:187) to the Lower Murray Lakes in South Australia (Figure 4) (Angas 1847:89–90; Eyre 1845:289–291).

Despite prolific birdlife throughout the southern MDB, commentary on the cooking of birds in earth ovens is limited to examples of the use of Australian bustard, ducks, swans and emu (Table 1). Smyth (1878:194) reported that in the Paroo River district birds were cooked in ‘an oven formed of a number of heated stones on which wet grass was strewn. The birds were placed on the grass, and covered with it; more heated stones were laid on, and the whole was covered with earth’. Albert Karloan (cited in Berndt and Berndt 1993) also noted that:

When cooking an emu the legs would be broken, doubled up and placed on the hot stones, or a bed of grass could be placed between the emu and the stones. Grass could be strewn over the bird and more stones placed on this, then covered up as for the kangaroo. The emu head was left sticking out of the coverings, and when steam was seen coming out of the beak the bird was regarded as cooked (Berndt and Berndt 1993:104).

A wide range of vegetable foods were also prepared in earth ovens. Many of these were sourced from wetlands where seasonal pulses of vegetation growth occurred following flood events. For example, Eyre (1845) described the ‘belillah’ plant which:

...is another important bulbous root, which also grows on lands subject to floods. It is about the size of a walnut, of a hard and oily nature, and is prepared by being roasted and pounded into a thin

cake between two stones. Immense tracts of country are covered with this plant on the flats of the Murray, which in the distance look like the most beautiful and luxuriant meadows. After the floods have retired I have seen several hundreds of acres, with the stems of the plant six or seven feet high, and growing so closely together as to render it very difficult to penetrate far amongst them (Eyre 1845:270).

Eyre's 'belillah' has been identified as *Bolboschoenus medianus* (Gott 1982:62), while Martin (2006:81) suggested that Sturt's (1849:135) 'barilla root', used by Aboriginal people near Menindee (Figure 4), is either the same plant and/or the similar *Bolboschoenus caldwellii* and reportedly cooked in earth ovens at times. Eyre also described the use of what he referred to as 'cress':

The tops, leaves and stalks of a kind of cress, gathered at the proper season of the year, tied up in

bunches, and afterwards steamed in an oven, furnish a favourite, and inexhaustible supply of food for an unlimited number of natives. When prepared, this food has a savoury and an agreeable smell, and in taste is not unlike a boiled cabbage. In some of its varieties it is in season for a great length of time, and is procured in the flats of rivers, on the borders of lagoons, at the Murray, and in many other parts of New Holland (Eyre 1845:254).

According to Martin (2006:73), Eyre's 'cress' is likely *Lepidium* spp. Frederic Bonney noted this was cooked in earth ovens on the lower Darling River (Bonney n.d.).

Other plant foods reported to be cooked in ovens included Murnong (yam daisy), stinging nettle as well as various other kinds of 'yam' (Table 2). One of the most widely reported foods cooked in ovens is *Typha* spp. (for food and fibre), which comprises two common but difficult to distinguish species

Table 2. Foods prepared in earth ovens in the central and lower Murray-Darling Basin.

Food	Technique	Location	Source
Bandicoot	In-ground covered (eaten raw or steamed).	Murray Districts	Smyth 1878:214
Birds	Earth oven (<i>Maramin</i>).	Lower Murray	Berndt and Berndt 1993
Cress (likely <i>Lepidium</i> spp.)	Earth oven (<i>Maramin</i>).	Lower Murray River	Berndt and Berndt 1993
	Earth oven.	Central MDB	Bonney n.d.
	Earth oven.	Central MDB	Eyre 1845:254
Cress (' <i>Nguni</i> ' and ' <i>takeruki</i> , flat-growing cress')	Earth oven (<i>Maramin</i>).	Lower Murray River	Berndt and Berndt 1993
Desert quandong (<i>Santalum acuminatum</i>)	Baked in an oven to take away the bitter taste.	Central MDB	Eyre 1845:270–271
Emu	Earth oven.	Central Murray	Tucker 1977:41
	Earth oven (<i>Maramin</i>), legs broken, doubled over and placed on hot stones (sometimes with wet grass) and covered with the head protruding.	Lower Murray	Berndt and Berndt 1993
	Cooked on wet grass in a 'heap of limestones' and covered with sand.	Lower Murray	Angas 1847:89–90
Fish (species not specified)	Earth oven (<i>Maramin</i>)	Lower Murray River	Berndt and Berndt 1993
	Cooked between layers of gum on a heated flat stone in a shallow hole.	Central MDB	Morey n.d.:46
Kangaroo	Earth oven.	Central Murray	Tucker 1977:41
	Cooked on wet grass in a 'heap of limestones' and covered with sand	Lower Murray	Angas 1847:89–90
	Earth oven with stones and wet grass.	Paroo district	Smyth 1878:187
Macropods	Earth oven (<i>Maramin</i>).	Lower Murray	Berndt and Berndt 1993
	Earth oven involving heated stones and wet grass, covered with a mound of sand.	Lower Murray	Angas 1847:89
<i>Main-nguni</i> or <i>manguni</i> (stinging nettle, possibly <i>Urtica incisa</i>)	Earth oven (<i>Maramin</i>).	Lower Murray River	Berndt and Berndt 1993
Mussels (likely <i>Velesunio</i> spp. or <i>Alathyria</i> spp.)	Earth oven (<i>Maramin</i>).	Lower Murray River	Berndt and Berndt 1993
	Earth oven (<i>Maramin</i>).	Lower Murray	Berndt and Berndt 1993
Native dog	Earth oven.	Central Murray	Eyre 1845:289–291
Other vegetable foods including <i>Kantjeri</i> (spring yam) and <i>Wiloki</i> (winter yam)	Earth oven (<i>Maramin</i>).	Lower Murray River	Berndt and Berndt 1993
Swans	Earth oven.	Central Murray	Tucker 1977:41
Turkey (Likely Australian Bustard, <i>Ardeotis australis</i>)	Earth oven.	Central Murray (western Victoria)	Smyth 1878:192
<i>Typha</i> spp. (Bulrush, Cumbungi, Coopers Reed)	Earth oven.	Lower Murray - Moorundie	Angas 1847:89
	Earth oven.	Murray Districts	Smyth 1878:214
	Earth oven between layers of stones or calcined clay.	Central Murray	Mitchell May 16, 1838
Wild pigs	Earth oven	Central Murray	Tucker 1977:41
Wombat	Cooked on wet grass in a 'heap of limestones' and covered with sand.	Lower Murray	Angas 1847:89–90
Yam daisy, Murnong (<i>Microseris lanceolata</i>)	Earth oven.	Lower Murray	Angas 1847:55, 58

(*T. domingensis* and *T. orientalis*), a major staple in south eastern Australia (Gott 1982, 1999). One of the earliest accounts of the use of *Typha* spp. rhizomes as food was provided by Angas (1847), based on his observations in the Lower Murray region:

It is cooked upon a heap of limestones, with wood laid over the top; fire is then applied; the roots are placed on the stones; another layer of heated stones is put over them; wet grass is used to create steam, and a mound of sand is then formed over the oven (Angas 1847:89–90).

Further upstream, in the vicinity of the confluence of the Lachlan and Murrumbidgee Rivers (Figure 4), Mitchell (1838) observed the preparation of ‘... ‘Balyan’, or bulrush-root’ which was ‘prepared in those kilns, when a family or tribe are together’ referring to accumulated oven features he had observed in the region. *Typha* spp. preparation in earth ovens is also reported by Berndt and Berndt (1993) for the Lower Murray lakes, along with numerous other plants foods (Table 2, Figure 4). Eyre (1845) noted the importance of *Typha* spp. in this region, indicating variability in how this was prepared as well as the likelihood of cultural preferences linked to when it was considered best to eat:

This is used more or less at all seasons of the year, but is best after the floods have retired and the tops have become decayed and been burnt off. The root is roasted in hot ashes, and chewed, when it affords a nutritious and pleasant farinaceous food.

Few non-wetland plants are described as being cooked in ovens, though this may reflect a bias in the early records, with early observers travelling along major rivers rather than further inland. In one exception, Eyre (1845:270–271) noted the use of ‘... a kind of fruit called in the Moorunde dialect “ketango”, and that people ‘prepare it by baking it in an oven, which takes the bitter taste away’. It is likely that *ketango* refers to the Desert Quandong (*Santalum acuminatum*).

Evidence of the use of herbs and specific culinary preferences around oven use are also available for the southern MDB. Gordon Kirby recalled the use of ‘tips of gum leaves or sandalwood’ in earth ovens used for cooking meat, in order to ‘give it a flavour’ (Taylor and Undy 1994). Morey’s account points to the use of gum leaves for cooking fish, presumably also imparting a desirable flavour, as well as the use of the leaves of ‘pig-face’ (likely *Carpobrotus* spp.) as a relish with fish prepared in ovens. He comments that ‘I can testify to the toothsome-ness of fish cooked in a native oven and eaten with young pig-face’ and that the ‘fish came out beautifully cooked’ (Morey n.d.:46). This is also highlighted by Eyre (1845:270) who noted that its leaves were ‘in general use in all parts of Australia ... and is eaten as a sort

of relish with almost every other kind of food’. This highlights both shared and regionally distinctive food and flavour preferences and, as such, cuisines.

Discussion

Assessing the evidence

In working with ethnohistoric and ethnographic literature, it is important to critically assess the reliability of sources. Many of those used here originate in the period following considerable colonial violence and attempts to remove Aboriginal people from Country. For the southern MDB, this occurred from the 1840s (Burke et al. 2016) and in western Cape York Peninsula the period between 1880 and 1895 involved the most overt violence (Morrison et al. 2019). Sources for this period of violence are relatively rare, and in fact it was the early phase of colonial administration in both regions that saw greater commentary on the lives and livelihoods of Aboriginal peoples. More formal anthropological research is of obvious value, as such accounts are often comprehensive, well contextualised, and involved extended work with people who used earth ovens or saw others do so.

A range of distinct biases are also evident across this body of material, particularly ethnohistoric sources, which are influenced by Eurocentric ideas of cleanliness and what was considered to be acceptable foods. For example, Smyth (1878:37) surmised that in regard to cooking practices, Aboriginal people were not ‘as careful as they might have been, nor as clean’ and that they were ‘to speak the truth, dirty in their habits’. He further contended that Aboriginal people were not ‘good cooks’, and suggested that as a result, ‘any advance in civilisation was nearly impossible’ (Smyth 1878). While we do not wish to give further voice to such negative framings, these views help to illustrate why there is often an absence of detail on the finer aspects of Aboriginal cooking practices and cuisines. In many instances, European observers appear to have had little interest in cooking, and indeed it is only when more formal ethnological and anthropological research was conducted that more in-depth accounts emerge. Yet, even in these accounts, food and cooking practices are often neglected, though other aspects of past foodways such as ecological knowledge, subsistence practices and in recent times, ritual basis of food production are given considerable emphasis (e.g. Sutton and Walshe 2021). Mintz (1996) suggests that food, cooking and cuisines are often neglected themes in anthropological research because of the dominance of male researchers disinterested in this topic, though this has shifted in recent years (Tierney and Ohnuki-Tierney 2012).

Despite such accounts, Aboriginal foodways, cuisines and earth oven cookery practices did at times impress some early commentators. For example, Eyre (1845:289–291) stated that meat cooked in an oven ‘looked as clean and nicely roasted as any I ever saw from the best managed kitchen’. Beveridge (1869:188) and Morey (n.d.:46) expressed similar sentiments. This highlights the importance of adopting a wider regional and comparative stance when working with often disparate and variable ethnohistoric and ethnographic source material, as it enables us to reduce selection bias and to develop more robust interpretations of the evidence (see also Allen and Holdaway 2009; McBryde 1979). It also enables researchers to move past local gaps and erasures in the data, and to eschew particularistic accounts in favour of more generalised syntheses that are more representative over large areas. While particularistic studies are important, they are heavily dependent on having sufficient detailed source material to highlight distinctive elements of local foodways, cuisines and cultural practices.

The oral accounts, histories and recollections of Aboriginal peoples are of immense value in terms of developing a deeper appreciation of locally distinctive cuisines and foodways. They provide a clear means of linking contemporary knowledge and practices with those documented historically and help to breach voids and biases in the literature. Eliciting deeper understandings of Aboriginal foodways is only possible if researchers can learn from Aboriginal people. This not only involves collaboration with contemporary communities, now virtually standard practice in Australian archaeology, but also a deep reading of research materials of earlier researchers and other relevant source material. The value of such sources are clear from the western Peninsula study area, where oral histories of Elders such as Mrs Ina Hall, Mrs Eva Fruit and Mr Eddie John, recorded in the 1980s, provide a deeper appreciation of cultural practices, preferences and cuisines, while also countering many of the implicit prejudices and assumptions inherent in Western accounts. There is significant need for much more collaborative research in this area, and in the western Peninsula context, comprises a key focus of our ongoing research with community members as part of our (MM, DM) ongoing research.

Characterising earth oven cooking techniques

This is the first Australian study to investigate earth oven cookery as a distinct cultural practice. We have shown that there are considerable similarities in earth oven cookery across two culturally and

geographically distinctive study areas situated in very different ecological contexts. Despite broad similarities in the technique, we have also found there is a greater degree of variability in the practice than previous research has indicated. Earth ovens were often created in soft sediment and a range of heating element types were used, including stone and calcrete, nodules of termite mound, clay and shell conglomerate, and even hot-burning hardwoods such as wattle. It is also important to note that additional heating elements were not essential to some forms of earth oven cooking, particularly where the properties of the substrate itself provided sufficient capacity to retain heat – as in Mrs Ina Hall’s example of cooking fish on a bed of hot sand.

The use of shell as a heat retainer is documented in one source in the southern MDB (Tucker 1977) and nodules of shell conglomerate have been reportedly used for similar purposes in the western Peninsula (Sutton 1994). While shellfish were likely consumed after collection, one question worthy of further research is whether the remains of shellfish were used as heating elements in earth oven cookery. In field surveys at Calperum Station (Figure 4), we have found that shells are often associated with earth ovens and mounds (Jones et al. 2017). In the Weipa region, shell mounds are common features and earth mounds less frequent, but there are examples of earth mound features containing discrete lenses of shells or that grade into a shell-rich matrix (Morrison 2010). We hypothesise that the intentional placement of shell to be used as a heat retainer for earth oven cookery may be implicated in the establishment and development of shell mound sites that are common near Weipa and elsewhere in northern Australia. However, addressing this question requires reanalysis of existing collections and data, as well as new field investigations.

A wide range of accounts from both study areas illustrate the addition of moisture to ovens to aid with cooking and the production of steam within the oven. This includes the addition of wet bundles of selected grasses or other vegetation beneath and sometimes over the food being cooked, with additional vegetation and sediment then used to seal the oven. A second technique, noted only in the southern MDB, involved the direct application of water into a sealed oven via one or more holes. This practice is not documented in the Peninsula, highlighting a further example of what seem to be regionally distinctive practices. In both areas though, water is a critical part of earth oven cooking which helps food to cook quickly, consistently, and aids the distribution of flavours. Moreover, cooking with steam contributes to lipid hydrolysis in meats

(Wandsnider 1997), producing more tender and, we suspect, tasty meals. Certainly, the mouth-watering and sumptuous qualities of foods cooked in earth ovens are renowned among community members in western Cape York Peninsula today.

This study also highlights the wide range of non-food plants and non-edible components of food plants used in earth oven cookery in both regions. These plant materials were used to seal ovens and as a bed on which foods were cooked, helping to retain heat and moisture, keeping foods free of debris, while at times adding desired flavours. In contrast to some early European accounts, people were also very concerned about cleanliness in the preparation of earth oven foods. As Mrs Hall (1984b) recounted for the Weipa region, great care was taken and people were 'very particular about cleanliness' when lining and covering food in the oven, and also when raking away the covering and removing the food. These plant components clearly had an integral role in earth oven cookery and cuisines. This is an important point in terms of interpreting macro- and micro-botanical evidence associated with ovens.

Identification and diagnostic criteria

One of the clear insights to emerge from this study is that earth ovens potentially yield detailed evidence relating to past foodways. Such work is dependent upon obtaining and analysing discrete samples from oven features with high stratigraphic integrity, as well as clear diagnostic criteria for assessing whether a feature is potentially an oven, rather than a generic hearth or open fireplace. Here we set out what we see as key diagnostic criteria for archaeological oven identification.

The clearest indication of earth oven cookery is the presence of a pit feature associated with evidence of combustion, indicated by the presence of wood charcoal, ash, heat affected sediment and heating elements. Careful stratigraphic excavation is key to identification of these features which are potentially subtle pits or lenses ranging in size from small discrete features to those several metres in diameter. Site morphology and local context are important factors in their preservation. In the case of rockshelters, the intensive reuse of a shelter floor likely contributes to the erasure of discrete pit features, as seems to be the case at Riwi Cave (Whitau et al. 2018). In open settings, remnant ovens are of course widely reported but these often represent the final stages of feature deflation due to erosional processes (Holdaway and Fanning 2014; Holdaway et al. 2017). As such, efforts to identify buried oven features may enable direct sampling of in situ ovens, prior to their deflation and exposure. Geophysical

investigations such as magnetometry have been shown to be a useful tool in such studies, at least in the southern MDB (Ross et al. 2019). For many oven-mound sites, discrete pit features are rarely reported and instead these features have quite homogenous stratigraphy because of repeated pit construction and rake-out activities (Coutts et al. 1979). It is generally only work on larger mounds where discrete pit features are reported, presumably because subsequent occupation events either re-use existing oven features or lead to the burial of earlier ovens as new features were constructed (see also Martin 2011).

Archaeologists often use the presence or absence of heating elements such as nodules of clay, termite mound, or stone, as being indicative of hearths or cooking activities (e.g. Holdaway and Fanning 2014). In this review we found no evidence of the use of heating elements in other contexts and thus we suggest that their presence is highly diagnostic of earth oven cookery. Of course, care needs to be taken in distinguishing heating elements from manuports or local naturally occurring materials not used for cooking with earth ovens. Physical signs that these materials are heat affected are useful, though magnetic susceptibility studies are perhaps a more reliable indicator of anthropogenic burning (e.g. Leierer et al. 2020). Importantly, the absence of heat retainers is not necessarily indicative of an absence of earth oven cookery practices. Durable heating elements such as stone may well have been reused for other purposes and moved off site or to other parts of a site (see also Whitau et al. 2018). Heating elements derived from sediment such as nodules of clay or termite mound all potentially degrade with use and over time, especially in tropical environments. Furthermore, our review indicates that shell and sand, soft conglomerate or even certain hardwoods had sufficient heat retention properties to cook some foods with earth ovens. Thus, while the presence of heating elements is certainly very instructive, their absence is not necessarily evidence of a lack of earth oven cookery.

The third key criterion for identifying earth ovens is the presence of food remains, though this is highly ambiguous and better viewed as a secondary criterion. Earth oven cookery was clearly used to cook all manner of foods, and it is speculative at best to assert that this cooking practice was used predominantly for any particular class of food (c.f. Martin 2011; Westell and Wood 2014). Plant foods are widely documented as being cooked in ovens, but this is perhaps the most challenging aspect of earth oven use to investigate. Careful sampling of discrete pit features coupled with analysis of plant macro-fossils (e.g. Florin et al. 2020) does provide

important insights on earth oven cookery. That said, researchers need to consider that these materials may be introduced as non-food items, not only as wood, but as a means of keeping food free of sediment, for introducing flavour and retaining moisture or for fibre preparation. Indeed, we suggest that the use of bark, leaves, bundles of grass and so on, is near universal across both study areas investigated here. Research on plant materials associated with pits and depressions with evidence of burning may not necessarily be a direct indication of foods eaten, but of the cooking process more generally or for the purpose of producing fibres.

Size and scale

Earth ovens evidently were used in varying ways and purposes, and consequently ranged considerably in size. They are commonly reported as small features used to prepare a meal from a single animal such as a wombat or kangaroo, or a varied meal of fish, small game, fruits or vegetables. Thomson's (1939:220–221) description of earth oven use on the open coastal plains near Aurukun highlights this type of use well; a single family using an earth oven to cook and share a meal. In contrast, larger ovens are often described as being used to cook larger quantities of foods, and prepared at a scale suited to the number of people present or expected. Accounts from the southern MDB point to numerous instances of communal cooking in ovens, where individual parcels of food were placed into large ovens and later retrieved (e.g. Eyre 1845:289–291). This indicates that at times earth ovens comprised shared infrastructure used in communal food production, and that these places were repeatedly used over decades and, in some cases, centuries (Martin 2011). These insights are helpful for interpreting oven features, and we propose that small, discrete ovens are likely to be associated with small-scale food production, such as by a single family or other small social unit. In contrast, large ovens and oven mounds are indicative of more intensive food production, intensive in terms of the total amount of food that could be prepared and eaten at any one time.

A range of previous authors have argued that large ovens and oven mounds represent functionally specific installations for communal food preparation and consumption (Coutts et al. 1979; Martin 2011; Williams 1988; Westell and Wood 2014). Our review supports this proposition, but we caution against interpretations of associations between earth ovens or oven mounds, and processing of specific foods, such as *Typha* spp. Ovens are clearly used in dynamic ways, both in terms of the types of food prepared, methods of food preparation and cooking,

and the number of people involved. There is clear evidence of intensive processing of certain food-types in some contexts, but key is identifying archaeological evidence of such intensive processing rather than extrapolating isolated examples from the ethnohistoric literature to account for a range of archaeological sites.

A key challenge for archaeological interpretation is reconciling temporal scales represented in ethnohistoric and ethnographic sources on the one hand, and archaeological datasets on the other. Accounts of earth oven use in the former tend to reflect short-term, often singular observations made on a specific day or cumulative observations over longer periods of time – weeks or months, for example. In contrast, archaeological evidence of earth ovens use tends to reflect longer-term occupation histories, at times over hundreds if not thousands of years (e.g. Holdaway and Fanning 2014; Martin 2011). Despite the seemingly inconsistent temporal scales involved, we nevertheless suggest that behavioural inferences can be drawn from integrated analysis of both types of empirical data. We propose a clinal model here to account for diversity in the archaeological evidence for earth oven use. Small discrete earth ovens reflect singular or very short-term events, and as other suggest, comprise the basic unit of formation of larger sites such as mounds. Much larger oven features can be argued to represent communal infrastructure that developed and were likely used over longer time periods, over hundreds of years or more (e.g. Martin 2011). While making such assessments in the field is a challenging prospect, careful assessment of the chronological and stratigraphic evidence is likely to yield important insights not only on specific aspects of past foodways, but also, the scale of food production, social interaction and organisation, and the role of specific places in wider occupation histories.

Foodways and cuisines associated with earth oven cookery

The central assertion of this paper is that earth oven features provide insights into culturally and regionally distinctive foodways and cuisines of Aboriginal people in the past. The term 'cuisines' is a designation that is rarely – if ever – extended to encompass Aboriginal foods and cooking practices in the Australian archaeological or anthropological literature, where terms such as 'diet' or 'subsistence' are more common. This is perhaps an example of the legacy of colonial or ethnocentric assumptions influencing the ways in which Aboriginal foods, knowledges, practices, and cultures are imagined and represented. We do not wish to discount the value

of research on diet or subsistence, but instead call for a wider perspective on Aboriginal foodways where possible.

Earth ovens are associated with distinctive cuisines encompassing specific cooking practices and taste preferences. There is evidence for regional and specific group preferences and practices around preferred herbs and flavours when cooking in earth ovens, as well as widely enjoyed flavours such as that associated with *Melaleuca* spp. in the Peninsula, or *Caprobrotus* spp. in the southeast. At present, we have at best glimpses of the cultural distinctions evident at varying scales, and it is likely that many more exist that remain undocumented. The use of herbs to season foods in earth ovens is also evident elsewhere in Australia (e.g. Harney 2009), but this requires more concerted research, and especially collaborative research with Aboriginal people to elicit a wider appreciation and understanding of locally distinctive practices and cuisines.

Earth ovens were an adaptable and widely used means of cooking in both study areas, with large and small ovens used for preparing vegetable and animal foods. Earth oven cookery was concerned with cleanliness, with enhancing the palatability and taste of foods cooked, and at times, with the bulk preparation of those foods that were locally abundant for short periods. The technique also seems to have been employed in processing toxic foods, such as *Dioscorea bulbifera*, but accounts of this in the literature are rare. Archaeologists do often note that toxic plant components from species such as *Macrozamia* were 'roasted' (e.g. Asmussen 2011), but this is not necessarily indicative of earth oven cookery. Beaton (1982) experimented on the role of earth ovens in detoxifying 'loaves' made from *Macrozamia* spp., but in doing so did not construct an oven that resembled any of those described here, and neither did he use leaching in the preparation process. This highlights several points. First, greater specificity is warranted in addressing questions about Aboriginal processing and cooking techniques, moving beyond the notion of cooking on 'the hearth' or 'roasting' and instead looking to finer grained aspects of past foodways. Second, it highlights a fruitful avenue for further research regarding the role of earth oven cookery in the detoxification of a range of plant foods, such as *Macrozamia*, and the antiquity of this and related plant food detoxification practices in Australia.

A further aspect of earth oven use that requires consideration is what they potentially reveal regarding commensality. This is one of the most notable features of human sociality and refers to the common tendency for people to share food and to eat

together in groups, at a table or other central location – including around hearths (Fischler 2011). Eating together establishes or affirms social bonds, expresses aspects of social organisation, and presents an opportunity for the performance of identity. The kinds of foods eaten, preparation methods used and the contexts in which meals were shared provide important insights into foodways and aspects of daily life that are often inaccessible to archaeologists. We suggest that the existence of an earth oven is not only potentially indicative of the scale of food production, but also, the degree of commensality in the consumption of cooked food. Indeed, the act of sealing uncooked foods within an oven, to be gradually transformed into a sumptuous, subtly flavoured meal to be eaten with others, is a highly symbolic act that illustrates the existence of close kinship ties and potentially other kinds of social and cultural relationships. Thus, earth oven features are indicative of much more than diet and subsistence practices alone and are illustrative of the existence of close or emerging social relationships between those present. In essence, they are a proxy measure for addressing questions about aggregation size, social dynamics and regional settlement patterns in the past.

Conclusions

Comparative analysis of earth oven cookery practices provides important insights on foodways and cuisines of Aboriginal peoples in the past. We have identified broad similarities in earth oven cooking techniques across both study areas, and these cultural practices broadly align with examples throughout the Pacific and in some North American contexts (e.g. Leach 1981; Wandsnider 1997). Yet, we have also identified highly distinctive practices in terms of cooking techniques and cuisines, extending to the combinations of foods cooked, and the tastes, textures, and flavours of foods being prepared. Earth ovens in archaeological contexts are potentially indicative not only of diet or subsistence practices, but of culturally distinctive foodways and cuisines of Aboriginal peoples in the past. The physical size and morphology of these features also potentially provide proxy data on occupation intensity and scale of associated food production: from small, expedient features used to prepare single meals, through to larger-scale ovens and oven mounds used both repeatedly and communally.

Our study has also clarified diagnostic criteria for the identification of these features in archaeological contexts. Pits with evidence of combustion together with heat retainers are relatively clear indicators of

earth oven cookery, especially if associated with macro-botanical or faunal remains. Where discrete pit features are absent, the presence of heating elements may indicate the localised use of earth ovens that have not been preserved. Efforts to identify and sample in situ earth ovens in open contexts will prove to be a valuable line of research for exploration of Aboriginal foodways and cuisines. In seeking evidence of earth oven cookery, researchers should be cautious in interpreting the absence of obvious heating elements. This may reflect use of materials that have decomposed, have been reused elsewhere, or that are perhaps not immediately obvious. Magnetic susceptibility assays and fine-grained sedimentological and micromorphological research is clearly a very fruitful line of investigation, as others have shown (e.g. Leierer et al. 2020; Whitau 2018), together with focused palaeobotanical and zooarchaeological research exploring specific questions about the range of foods and non-food items used in earth oven cookery. Finally, we call for further consideration of whether generic ‘hearths’ often reported in archaeological contexts are in fact earth ovens. The interpretive possibilities of such a distinction are considerable.

There are constraints on this study, notably the lack of descriptive detail in many of the accounts regarding the way people used earth ovens in daily life. There is an acute need for more focused research in this regard (see also Whitau et al. 2018), particularly research with Aboriginal people regarding local foodways and cuisines associated with earth ovens, including preferred herbs and flavourings, techniques and methods for preparing specific foods, the culinary qualities of food such as the aromas, flavours, textures and other cultural aspects such as symbolism and cultural precepts in oven use or in the foods being cooked. As influential interlocutors in the production of narratives regarding Australia’s Aboriginal history (Byrne 2011), archaeologists have an important responsibility in terms of the questions we pursue and how we frame our work. We suggest that there is value in moving beyond notions of ‘diet’ and ‘subsistence’ in archaeology, and instead embracing research on past foodways and cuisines of Aboriginal peoples. The examination of earth oven cookery practices present an excellent opportunity for such work; as Jones (2016:66) notes for the Pacific, these features represent a ‘locus of social identity’ and so the presence of an earth oven feature in an archaeological context potentially points to the existence of a wider constellation of social relationships, cultural practices and values, and aspects of commensality indicated in the sharing of a meal.

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Ethical approval

The research was undertaken under ethics approvals granted by the Flinders University Social and Behavioural Research Ethics Committee (approvals 6618 and 8295) and the University of New England Human Research Ethics Committee (HE20-219).

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