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AN INTRODUCTION TO EARTHEN MOUND SITES IN SOUTH AUSTRALIA

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Abstract

Aboriginal earthen mound sites (mounds) have a patchy distribution across south-eastern and northern tropical Australia though in all regions are consistently associated with floodplains and seasonal wetlands. These sites appear to be the locations of repeat-use pit ovens developed primarily through the intensive exploitation of wetland resources for food and fibre. It has been suggested that improved resource yields gained through mound use may have supported increased levels of residency and population growth from the mid to late Holocene. Despite a long history of mound reporting in South Australia, local examples are yet to be incorporated into the national debate on any meaningful level. This paper seeks to address this through a review of mounds in two disparate regions of the state; the Northern Adelaide Plains and the Riverland region of the River Murray.

Introduction

Aboriginal earthen mound sites (mounds) are a widely researched site type in Indigenous archaeology and have been recorded throughout various parts of south-eastern and tropical northern Australia (Figure 1). While mound typology varies on both a local and regional scale, these sites are consistently associated with seasonal floodplains or wetland environments, and are often located on poorly draining soils (Williams 1988:213). This common association led Peterson (1973:190) to argue that their development within geographically distinct regions must have arisen independently, though as a consequence of “selection pressure on broadly similar economies in similar environmental situations.”
Over the past two decades, the authors have recorded large numbers of mounds in two regions of South Australia: the Northern Adelaide Plains and the ‘Riverland’ region of the River Murray. These sites appear analogous in terms of both typology and hydrological setting to earthen mounds found elsewhere in Australia. The Adelaide examples represent the western limit of the documented use of mounds in south-eastern Australia and extend this form of landscape modification into yet another distinct regional setting. Importantly, these two mound provinces are separated by the Mount Lofty Ranges, a significant geographic and cultural boundary (see Ellis 1976:115; Tindale 1974). It is clear that mounds represented a dominant feature of the social landscapes in both regions though the implications of mound development are yet to be integrated in any significant way in the discussion of pre-colonial economic and demographic systems.

Current interpretations of mound function, age and distribution in South Australia are constrained by a relatively small number of studies, a limited amount of excavation data and dating, and an often poor state of preservation. However, we suggest that there were distinct differences in the societal role played by mounds between the Riverland and Northern Adelaide Plains. In the Adelaide region, mound groupings appear to have developed around residential nodes located at freshwater wells and supported by high value habitats extending along the boundary between alluvial and estuarine habitats. The mound structures may have provided an engineered solution to a landscape prone to flooding and are likely to have developed through a range of activities including habitation and the processing of food and fibre in earth ovens. The symbolic significance of these artificial and highly visible features on the plain landscape resonates with the selective use of larger structures as cemeteries. In contrast, the Riverland mounds may have been related to a more routine use as processing sites that were distinct from formal occupation areas. Mounds were rarely used as burial locations in the Riverland region.
Figure 1 The locations of major earthen mound provinces reported in Australia (adapted from Balme and Beck 1996; Brockwell 2006; Klaver 1990).
Earthen Mounds in Australia

Earthen mounds are generally described as raised, circular accumulations of organic rich sediment between 5-30m in diameter, comprised principally of oven debris (heat retainer, charcoal and ash) and containing limited lithic and faunal assemblages. Beyond this norm, features of up to 200m in diameter and containing more extensive material assemblages have been reported. Mounds occasionally contain burials though their selective use as burial locations appears to be a region-specific trait (see for example Martin 2010:90). Mounds are particularly prevalent throughout the Riverine plains of the Murray-Darling Basin (Balme and Beck 1996; Berryman and Frankel 1984; Coutts et al. 1979; Klaver 1990; Martin 2006, 2010, 2011; Pardoe and Martin 2001) with additional mound provinces identified in the volcanic plains of south-western Victoria (Lourandos 1980, 1983, 1997; Williams 1988) and the coastal plains of tropical northern Australian (Brockwell 2006) (Figure 1).

Balme and Beck (1996:39) highlight that “variation in size, shape, content and stratigraphy...has led to a variety of explanations of function, construction and economic role” of mounds with archaeological interpretations describing mounds variously as discard from earth ovens, general camping locations, collapsed turf huts, raised habitation areas, burial places, vegetable gardens, territorial markers or some combination of these (see also Brockwell 2006:47, 53; Hiscock 2008:189; Williams 1988:212-213). Mound use is described in a range of ethno-historic accounts though the reliability of much of this material has been questioned by various writers as it often relates to interpretation rather than actual observation (see for example Balme and Beck 1996:44-45; Coutts et al. 1976; Edmonds and Long 1998:27-36; Frankel 1991:74; Williams 1988).

Of the themes developed interstate, two seem the most compelling. The first sees mounds as engineered structures that provided opportunity to occupy wetlands during the period when they were at their most productive though least accessible. Nicholas Peterson (1973), investigating mounds in the Glyde River region of Arnhem Land, for instance, saw mounds as providing access to staple aquatic vegetables and
meat during the summer wet season, when access to the wetlands was otherwise difficult (see also Brockwell 2006:53). In some instances, termite nests had been collapsed to form the initial mound base with subsequent fires and camp debris adding to the structure. Coutts et al. (1979) presented a similar scenario in respect to mound sites in the Nyah Forest region of the upper River Murray (in Victoria) where stratigraphic evidence suggested a progressive site use from an initial rake-out from oven pits through to an occupation phase on the raised structures of some of the mounds. Coutts et al. (1979:86) suggest that the mounds may have provided an efficient means of exploiting resource-rich, though periodically inaccessible, habitats.

The second theme sees mounds developing through some economic activity related to a wetland resource, and specifically, the large scale processing of aquatic plant materials. Coutts et al. (1979:5-7) argue that mounds along the upper Murray may have developed primarily through the processing of bulrush [Typha orientalis], a significant food and material resource for Murray River peoples (see also Frankel 1991:74; Martin 2006, 2011:162-163). Similarly, Sarah Martin (1996, 2006:195) has proposed that mounds in the Hay Plains region of New South Wales resulted from an economy that relied heavily on plant materials for food and fibre and that required cooking in earth ovens.

Martin (2006) also provides compelling argument that the application of heat retainer technology (a common element in all mounds) be considered as a ‘single explanatory model’ for the development of mounds. Specifically, Martin views mounds as manifest of an intensified use of wetland habitats from the mid-late Holocene with pit ovens improving the nutrient returns, digestion, palatability, storage life and hygiene of reliable and predictable sources of carbohydrate-rich aquatic vegetation (Martin 1996, 2006:3, 46, 195-196, 254). Improved resource recovery may have supported higher levels of residency with mounds becoming important markers on the landscape, identifying ancestral lineages and tenure over high resource value habitats.

Dating evidence suggests that mounds first appeared in the archaeological landscape during the mid-Holocene and may have proliferated in the last 2000 years (see Balme and Beck
1996:Table 2; Brockwell 2006:47; Brockwell et al. 2009). It has been argued that mound development was intimately linked with a broad suite of socioeconomic changes occurring during this time, and specifically, that mounds illustrate a more sedentary mode of occupation supported through the intensive and systematic exploitation of resource-rich habitats from the mid-late Holocene (Lourandos 1983; Lourandos and Ross 1994; Martin 2006:195-196, 254; Williams 1988). The role that mounds may have played in these changes is subject to differing interpretations. Elizabeth Williams (1988), for instance, saw the introduction of mounds into the south-western districts of Victoria as an engineered solution that circumvented the poorly draining soils of the region, facilitating a more intensive late Holocene settlement that would ultimately manifest in the integrated encampments, or ‘villages’, depicted in historical accounts. Martin (2006) views the application of heat retainer technology used in mounds as the key driver of demographic change. The occupants of the ‘villages’ may well have exploited the elevated mound structures though ‘village’ life was sustained through the use of heat retainer cooking in maximising energy returns from plant foods.

The Northern Adelaide Plains

Landscape

The Northern Adelaide Plains comprise a region of urban, industrial and agricultural land stretching north of Adelaide between Gepps Cross and Two Wells (Figure 2). This is an alluvial landscape developed across the distal margin of a series of fans extending west from the Mount Lofty Ranges and centred on several intermittent streams. Prior to flood mitigation, outwash had terminated along the distal edge of the fans with seasonal wetlands maintained across the lower floodplains of Dry Creek, the Little Para, Gawler and Light Rivers (Hall 1999; McCarthy et al. 2006; Philpott et al. 1999:6; Zuflic and Wohling 2004:3-4). Dry Creek, for instance, would spread into a wide sheet of flowing water during flood, maintaining a ‘semi-permanent bog’ during winter across the low-lying outwash plain in the area of Parafield and Greenfields (Fenner 1927:243; Miles 1950). The immediate coastline is low energy and estuarine, with a configuration of subtidal seagrass meadows,
intertidal sand flats, mangrove woodlands and supratidal marshes extending around the Port River estuary and northern coast (Figure 2).

**Early References to Mounds**
References to mound sites in this region can be found in a variety of documentary sources including media articles, personal reminiscences and South Australian Museum (SAM) reports. The majority of sources relate to the unearthing of burials and invariably contain scant detail of the context of the burials or associated materials. Nonetheless, these reports provide compelling reading and suggest that the extant examples of mounds represent a small fraction of the number that may have existed pre-colonially. Indeed, mound numbers were such that their rich organic sediment was actively sought by local market gardeners as late as the 1970s as a ready source of ‘fertiliser’.

A survey party sent to investigate what would become the Milner Special Survey, describe in *The South Australian Gazette and Colonial Register* (28/2/1839:8) following a tidal creek (Strange’s Creek) from the Gawler River estuary to within 300 yards of red gum woodlands extending across the lower Gawler River floodplain. The party located a ‘native well’ close to where they landed and at the same spot a “burying place – a circular mound of earth.” In June 1895, the remains of a female child were unearthed from an ‘old Aboriginal mound’ near St Kilda by two men digging out rabbit burrows (*South Australian Register* 19/6/1895:6; *The Advertiser* 19/6/1895:5). An article published in *The Adelaide Advertiser* in 1908 describes the Little Para River as having been a favourite meeting place for the Kaurna prior to European settlement (c. 1836) and relates how:
Figure 2 The distribution of earthen mounds on the Northern Adelaide Plains (geological framework adapted from Belperio et al. 1986).
Evidence of the fact that the natives used to congregate there has been found on many occasions by the turning over of small hillocks on the slopes near the creek, which have been built up by generations in the process of baking the game and fish on which the blacks used to live. The remains of numerous Aboriginal ovens have been unearthed, and the soil, which was little else but decomposed vegetable matter and ashes, has been spread over many of the gardens as manure. One of the last of these mounds has only recently been reduced to the level of the surrounding land on Douglas Park, the farm of Mr W. J. McNicol, and the material carted away consisted of ashes and rotten vegetable substances, which had been piled up little by little probably for a century...Old residents of the district, who had had experience in the Darling district before going to Salisbury, and had watched the process of baking animals and birds in the improvised earthen ovens, say that the Salisbury creations of the natives were identical with those of the river blacks.

(Adelaide Advertiser 5/1/1908)

An article appearing in The Register in 1926 refers to the rediscovery of Aboriginal remains at a sand quarry near Two Wells. A local resident was interviewed and describes several mounds in the vicinity of the township “measuring up to 25 ft in length and about 2 ft broad [thick], akin to the larger barrows found in England and other parts of Europe” (The Register 22/4/1926).

In February 1957, a SAM group including Norman Tindale and Paul Lawson recorded two mounds at a property at Bolivar. The mounds measured roughly 20x8m and were located near a reed-filled spring which had been used by pastoralists into the early 1900s (Tindale 1957:421). Several holes were excavated in the mounds, revealing ashy sediment to approximately 1m depth and containing oven stones and a few bones of wallaby, possum and rat. In later correspondence to the land owner, Tindale noted that similar material was being collected by glasshouse tomato growers for use as fertilizer, and:

It is the experience of those who gathered this material commercially that it is seldom that Aboriginal bones are found in it, and it is as a rule, the result of the occupation of the site by people and of the burning of many fires.

(Tindale 1957:417)
In 1940, skeletal material was exposed in a mound at Dry Creek, reported as measuring 1.2m in height and 30m in diameter, and being removed to fertilise “lawns and recreational areas” (Police Report 23/11/1940 in SAM collection records). We suggest that several additional burials unearthed in the same area may have originated from mounds including an example at Dry Creek where a number of burials (7) unearthed during the construction of a rail spur were found associated with charcoal, burnt limestone, artefacts, dingo bone and ‘food' shells (The Advertiser 3/11/1965). Workmen interviewed by SAM officials after the discovery of skeletal remains nearby at Cavan in 1973, claim to have had prior knowledge of the ‘tell tale' stratigraphy associated with Aboriginal habitation (Bockner 1973).

Mrs Quick, whose family were early landholders at Greenfields, makes mention of several ‘native wells' in this area, including a spring-fed well below (west of) Ryans Road with a “big black mound of earth around it” (Salisbury Library Local History Collection, PAG Bio 1:0007). This same area is described in a SAM report detailing the rediscovery of a burial in 1970. The report relates how:

The terrain in this area is low and flat except for occasional earth mounds...on only two of the several small mounds of earth have children been digging and both areas have revealed skeletal remains. On one as yet untouched hillock are numerous quartz chips and carbon pieces which would indicate a campsite.

(Choate 1970:2-4)

**Greenfields and Beyond**

Despite the long history of mound reporting, it was the rediscovery of a large burial mound in Greenfields in early 1992 that threw a spotlight on these features. The mound, possibly that described by Mrs Quick (above), was identified following the disturbance of human remains during earthworks at a factory. The south-western edge of the mound had been impacted with sediments removed to the garden beds at the front of the property. A mitigation program run by the then Aboriginal Heritage Branch, Department of Environment and Planning, and undertaken in collaboration with the Kaurna community sought to recover artefactual, faunal and skeletal materials from these displaced sediments, and undertake a
controlled excavation of the impacted portion of the mound. The work recovered a total of 13 individual burials and an extensive and diverse array of occupation materials (Draper 1992).

The mound had measured approximately 57m in diameter and 1.3m high prior to the disturbance and is likely to have contained an estimated 1200m$^3$ of accumulated material, comprised chiefly of baked clay fragments and other heat retainers (calcrete) contained within a fine silt matrix saturated with ash and charcoal. Grey, plastic clay, similar to a deposit identified immediately to the south of the mound had been used extensively as heat retainer throughout the mound. The burials were exposed during the initial disturbance and subsequent excavations with several lying directly on a basal hardpan surface. When burial numbers are extrapolated across the full extent of the mound, it is clear that this site had operated as a major ritual centre.

The preservation, extent and range of faunal material in the Greenfields mound provided a unique opportunity to describe in detail the suite of species and habitats that had been targeted by the Kaurna locally. These materials depicted a broad diet breadth and the exploitation of the full range of local habitat (terrestrial, alluvial and estuarine). A checklist of species included snapper, mulloway, bream, freshwater mussel, abalone, cockle, bird, emu eggshell, crab, lizard, kangaroo, wallaby, bettong, bandicoot, dingo and a number of other small mammals (Draper 1992). Stone artefacts included grindstones, hammerstones, anvils, cobble choppers, flakes, blades, adzes and masses ofdebitage (Draper 1992).


It is likely that early reporting of mounds in this region was biased toward burial mounds and that the locations of other mound types were under-reported. Inferences on the distribution and extent of mounds are therefore difficult though
might be gained from the historical summary presented above. The majority of these reports, together with the more recently recorded mounds, occur in a narrow arc of coastal plain stretching around the eastern margin of the Port River estuary and northern coastline, at elevations of approximately 5-8m AHD or lower (Figure 2). The mounds are positioned around and within the lower outwash plains of several major streams including the Gawler and Little Para Rivers, and Adams and Dry Creeks. These areas are typified by low surface gradients and poorly draining, heavy textured clay soils, and were prone to flooding. The majority of recently recorded mounds are also found in recognisable groupings which vary in spatial extent, number of mounds (2-7), range of mound form and associated site types.

The mounds are invariably found in a poor state of preservation and it is tempting to speculate that at least some of the mounds have been subjected to the activities of market gardeners and simply represent 'quarried' remnants. Inferring the original size, height or structure of the mounds is difficult though it could be assumed that they have been dispersed to broader and lower features. Where dimensions have been recorded, maximum diameters range between 10-57m (mean 21.3m), median surface area is 227m² and heights range from 0.1-1.3m. Few have estimated volumes of over 100m³ (mean for non-burial mounds is 39.3m³) with the Greenfields mound a clear outlier at just over 1200m³. Most are roughly circular in shape though the two recorded at Bolivar by Tindale (BM1 and BM2), and subsequently reassessed by Wood (1996), are ovoid.

Based on form and content, it would appear that at least two distinct mound types exist in the Adelaide region. The majority are low, roughly circular features and comprise homogenous accumulations of baked clay pellets or some other form of heat retainer, contained in a silt matrix laden with disseminated ash and charcoal. These mounds contain small numbers of stone artefacts and faunal remains are generally absent or rare. The second recognised type is larger, contains more substantive and diverse material assemblages and is often, though not consistently, associated with burials. These larger mounds, which include the Greenfields and Gillman sites, are far less common.
The Gillman Burial Site was unearthed during quarrying of a broad dune on the southern margin of the Port River estuary in the 1970s (Hodges 1973; Littleton et al. 2013; Walshe et al. 2011). A salvage program conducted by the SAM recovered the remains of 22 individuals together with faunal and lithic assemblages essentially replicated in the Greenfields mound. These materials were contained within a dark ash and charcoal-rich matrix, described by Hodges (1973:27) as the “occupation layer” extending to an approximate depth of 0.9m. As with Greenfields, clay had been imported into the site for use as heat retainer (Hodges 1973:42). For all intents and purposes, the Gillman site is a mound, though in this case the mound had been perched on the pre-existing dune topography. In this respect, the Gillman site is unique amongst the documented mounds in this region.

**Association with Freshwater Springs and Wells**

A striking feature of mound distribution is their common association with freshwater wells. In at least nine instances, reported mounds and mound groupings are located in proximity to wells or springs, including examples at Buckland Park, Bolivar, Burton, Greenfields, Waterloo Corner (Curnow 2007:9) and Two Wells (Reddin 1985:79-80; *The Register* 22/4/1926). At least some of these wells appear to have developed as solution cavities in surface calcrete and in several reported instances supplies of freshwater were such that the wells were enlarged to water stock and bullock teams (Williams 1991:14, 20).

An alignment of reported wells (Figure 2) approximates the landward extent of the Glanville Formation, a permeable fossiliferous limestone which occurs in the shallow sub-surface and pinches out along a line approximating the modern alluvial-estuarine plain boundary. While this aquifer is highly saline toward the coast (see Belperio and Harbison 1992), we suspect that freshwater may be perched above the underlying Hindmarsh Clay along its landward edge. Surface water is largely ephemeral in this region, and the availability of freshwater wells to supplement seasonally ponded sources would have been significant, and indeed, we would argue supported the level of residency reflected in the mounds.
Other Locations

Whilst the majority of mound reporting in this region relates to the northern plains, additional references from other locations around Adelaide can be found. One of the earliest accounts was made by Dr Duncan, an early settler at Marion, who reported in his diary of 1839 of uncovering skeletons from a large mound on his property by the Sturt River (see Edwards 1964). The Torrens River, and in particular the section immediately east of Adelaide, features in several accounts (Tom Gara pers. comm.; see also Pardoe 2005:8). An Englishman, Jessop, who visited Adelaide in the early 1860s, also saw a large burial mound near the Torrens River:

It was a well-marked spot, in an angle of the river, on a high bank, and consisted of a huge spherical mound, which no doubt owed its size to the time it had existed.
(Jessop 1862:51-52)

Mound Chronology

The timing of mound development in the Adelaide region is poorly understood with dating limited to several bone samples recovered from the Greenfields and Gillman sites. There are currently no basal dates available for any mound structure and whilst the mounds may be spatially related, any assessment of temporal relationships remains purely speculative.

Dating of skeletal material from the Greenfields mound has returned ages of between 700 years BP (before present) to modern (Wood et al. in prep.) and it is apparent that mound use continued into the contact period with one of the individuals displaying dental attrition consistent with the habitual use of smoking a pipe (Wood et al. in prep.). A burial range spanning 300-500 years between 1120 to 760 years BP and occupation continuing from at least 2480 years BP to the recent past has been determined for the Gillman site (Littleton et al. 2013:40-41; Walshe 2011).

In several instances mounds occur on or near to parcels of land dedicated as Aboriginal reserves in early government surveys, including examples near the Gawler River (Buckland Park) and Bolivar. This coincidence may present opportunity for further research with the inception and history of these reserves potentially providing insight into the use of local mounds.
The timing of initial mound development is crucial in providing a context for these sites and related subsistence strategies. The rapid evolution of the Port River estuary throughout the late Holocene (Belperio et al. 1983; Belperio and Rice 1989; Bowman and Harvey 1986), in particular, would have determined the species able to be targeted and the methods employed in procuring these resources. The closed mangrove (*Avicennia marina*) woodlands which characterise the modern Port River estuary and northern coast, for instance, have only flourished within the last 2000 years (Belperio and Harbison 1992) with their development likely to have influenced the accessibility of a range of coastal habitats. We have previously speculated (Wood and Westell 2002:26) that the netting of tidal waterways, potentially accessed through the use of bark canoes, may have become an increasingly dominant strategy at the expense of foraging for shellfish over intertidal sand flats.

The temporal relationship between the mounds and formation of the coastal freshwater wetlands is another critical factor to consider. These wetlands were established during the early-mid Holocene as drainage became impeded behind the transgressing shoreline (Burton 1984:104). The local high-stand was reached by 6900 years BP (Belperio and Rice 1989). If we accept that the current dates are indicative of the mound set as a whole, it is apparent that the mounds post-date the formation of these wetlands. At some point in time, mounds were accommodated into a new or modified socio-economic system centred on these wetlands.

**The Riverland**

*Landscape*

The River Murray in South Australia flows through three recognisable sections; a broad Valley section continuing from the border to Overland Corner, a narrow, deep Trench confined by high cliffs between Overland Corner and Wellington, and a series of terminal freshwater lakes (the Lower Lakes) continuing downstream to the mouth of the river. The transition between the valley and gorge is abrupt and sees a change from a broad, complex floodplain of distributary channels, lagoons, oxbows, flood-outs, scroll plains, and a highly sinuous river, to a narrower floodplain containing a more regular series of lagoons
either side of a simpler river course characterised by long straight reaches. The Valley incorporates several major anabranch systems, including Chowilla Creek, Pike River and Katarapko Creek, which have been the focus of key studies (Wood et al. 2005; Wood and Westell 2009a).

**Mound Reporting**

Mounds are the most frequently reported site type across various parts of the Murray – Darling Basin, including the Riverine Plain extending through the central eastern and southeastern parts of the Basin. Martin (2006, 2010:101-106) provides an exhaustive account of ethno-historical sources detailing the use of heat retainer ovens and mounds in this region. These were evidently used in the preparation of, among other things, cress (Lepidium spp.), bulrush (Typha spp.) rhizome and bellila root (Bolboschoenus spp.), all of which were local food staples. Typha use was particularly extensive with harvesting on a scale “akin to that of an agricultural crop” (Wrangham et al. 2009:7). Mitchell (1839:80-81) describes “lofty mounds” that had resulted from the cooking of this material.

We are aware of a total of 147 documented mounds along the River Murray in South Australia between Wellington and the New South Wales border (Figure 3). The majority of these have been recorded in the past 10 years during studies conducted within the Chowilla (Harris 2004a, 2004b, 2007; Wood et al. 2005; Wood and Westell 2004, 2007, 2009b), Pike (Wood and Westell 2012a, 2013a, 2014a) and Katarapko (Wood 2003, 2008, 2009, 2010; Wood and Westell 2009a, 2010a) anabranch systems together with additional small scale surveys undertaken elsewhere (Wood 2005a, 2005b; Wood and Westell 2008a, 2008b, 2010a, 2010b, 2010c, 2012b, 2013b, 2013c).

Earthen mounds are a particular feature of the Valley section of the river, representing close to a third of the total number of documented sites within the Katarapko floodplain alone (Wood and Westell 2009). The frequency of reported mounds declines rapidly downstream of Katarapko and again below Barmera where only three reported examples occur along 143km of river to Blanchetown. We are unaware of any mound being reported along the lower reaches of the river between Blanchetown and Wellington, a further 185km of river frontage. Large numbers of mounded features have been identified.
around the Lower Lakes though the majority of these appear to be essentially midden heaps that contain cooking evidence and occasional burials (Wiltshire 2006:69-74). These shell mounds are considered a distinct site type from the earthen mounds of the Riverland. Worsnop (1897:63) refers to large mounds of earth along the shore of Lake Alexandrina near the coast, one of which contained “scores of human skeletons arranged in rows”, though it is apparent that these are not common features.

Whilst the decline in the frequency of mounds is no doubt a function of survey coverage, it is important to recognise that a number of archaeological surveys have been undertaken below Loxton, including an extended survey by Wood (1993) of publicly accessible land within the floodplain between Mannum and Wellington. Additional regional studies include work by Paton (1983) and Luebbers (1986-1987).

**Mound Form and Distribution**

The mounds recorded in this region display a consistent form. They are roughly circular in plan and are comprised of a homogenous accumulation of baked clay peds, disseminated ash and charcoal contained in a fine silt matrix. They range in diameter from 3m to 50m (median 14.0m), and in height from 0.2m to 0.7m, with a small number exceeding 1m. Freshwater mussel shell has been identified on 44% and 50% of the Chowilla and Katarapko mounds, respectively, and in these and all other areas this material is invariably fragmented and diffuse. Additional faunal elements identified on a small number of mounds include fragmented burnt emu egg shell, fish bone, yabbie and small mammal bone (see Wood et al. 2005:63). Stone artefacts are found in association with approximately half of the mounds. No burials have been identified in any of the Riverland set though remains were found in a mound within the New South Wales portion of the Chowilla floodplain (Wood et al. 2005).
Figure 3 Mound locations in the Riverland region of the River Murray.
The mounds occur in a relatively limited number of landform elements when compared to other site types, occurring predominantly across the lower and more regularly inundated (under natural flood regimes) parts of the floodplain. All but four examples recorded at Chowilla and over 72% of mounds at Katarapko are located within the low dissected relict meander plain. Mounds are a particularly common feature of the major distributary channels and lagoon margins and tend to occur in linear distributions along these features rather than within clearly recognisable groupings. This distribution is coincident with the occurrence of large emergent macrophyte vegetation such as *Typha* spp. which requires shallow water or a permanently saturated root zone (Gehrig and Nicol 2010:19; Roberts and Ludwig 1990; Roberts and Marsten 2011:115). Few examples of mounds are recorded along the bank of the River Murray itself.

**Mounds to Middens**

The rapid decline in mound frequency downstream of Katarapko poses a number of questions. Does this decline reflect an abrupt change in subsistence, settlement or processing methods, for instance? While these factors cannot be ruled out, it seems unlikely that distinct economies would have operated between these contiguous areas that shared strong cultural links and networks of exchange, both intellectual and material. Instead, we consider the decline in mound numbers to be reflective of changes in the configuration of the river floodplain and its influence on the organisation of subsistence related activities.

Martin (2006:10-11) notes that mounds grade into other types of sites, and we suggest that this may be the case across the lower Murray where the mound-midden distinction may be obscured. We propose a scenario whereby mounds were established in areas where intensive industries developed around the processing of aquatic vegetation and where there was an opportunity to separate the collection and processing of these materials from habitation and other activity areas. This would be the case in the valley section, where individual site types tend to occupy a specific range of landform settings that are not necessarily coincident with other site types. The distribution of mounds, for instance, is very different to artefact scatters and burials, illustrating a separation of site-specific
activities (Wood et al. 2005). The distribution of the resource, availability of clay for use as heat retainer together with fuel wood and water (for steaming) must have been considerations in mound placement. The materials processed in the mounds may have been relocated to domestic sites for consumption or further processing though evidence of cooking within the shell middens and artefact scatters of the valley is most often limited to occasional hearths. Deeply developed, charcoal-rich middens are rarely observed.

Downstream within the gorge section, occupation evidence is commonly in the form of accumulations of deep midden developed along extended lengths of the valley margins and across levees and terraces encroaching onto the floodplain. Angas (1847 1:58) commented that:

In this district the natives were very numerous, their encampments being scattered along the narrow strip of ground between the limestone cliffs and the water's edge: there they find plenty of food from the fish, mussels, crayfish, bulrush-root and other products of this large river.

(Angas 1847 1:58)

Whilst evidence of intensive cooking in the valley is represented predominantly by mounds, similar evidence in the gorge is often incorporated into these midden deposits which often include dark, charcoal-rich sediment, and a component of oven rock (Wood 1993:15). It may be the case that the processing of the same foodstuffs using similar techniques as those represented in mounds may have occurred within the gorge section, though unlike the valley, this activity was undertaken within the confines of occupation sites established largely around the fringes of the floodplain.
Comparison Between Regions

All mounds recorded in South Australia contain evidence of intensive burning with mound structures being comprised principally of oven debris, including intact and decomposed heat retainers, charcoal and ash. In the majority of cases, all other elements, including faunal and lithic materials, are minor components of the mound structure. Based on this evidence, and consistent with the majority of historical interpretations, we view the construction and re-use of in-ground ovens as both a common origin and primary factor in mound construction.

The mounds in both regions are found in association with a range of other site types including scarred trees, open artefact scatters, hearths and burials. However, the distribution of mounds is highly restricted when compared to the broader site set with all examples situated within or adjacent to areas of seasonally ponded or permanent freshwater. The Riverland mounds are found predominantly across the lower parts of the floodplain adjacent to seasonally inundated watercourses and water bodies while the Adelaide examples are aligned around the margins of outwash plains. Consistent with interstate examples, the mounds tend to be perched on locally elevated topography in areas which were seasonally dry rather than regularly waterlogged (Balme and Beck 1996:39-40; Klaver 1990:8). Flooding is, however, likely to have impacted mounds in both regions. On the northern Adelaide Plains, the placement of mounds was also closely tied to a series of wells, some of which may have been constructed or at least modified.

The processing of aquatic plant materials in pit ovens seems consistent with the location and form of mounds in both regions. As Martin (2006:239) suggests “mounds, cooking *Typha*, high population density and reed beds are synonymous.” Mounds simply develop where high population densities exploit staple resources that required a particular form of processing. Aquatic plants proliferated in the seasonal wetlands of the Northern Adelaide Plains with a number of species known to have been targeted by the Kaurna for food and in the manufacture of nets, including the Common Reed (*Phragmites australis*), *Typha* spp. and Sea Rush (*Juncus kraussii*) (Angus 1847, 1:55, 58; Cawthorne 1844; Clarke 2007; Gara 1988; Ross 1984:5; Stephens 1889:491). A similarly intensive use of aquatic vegetation occurred...

Table 1 provides a summary of mound dimensions where these are known or able to be approximated, including 38 of the Adelaide mounds and 144 Murray mounds. Estimated volumes are presented in Figure 4 and expressed as percentages of each subset: Murray mounds, Adelaide non-burial mounds, and Adelaide burial mounds. As seen in Table 1, the Adelaide mounds (both the burial and non-burial sets) tend to be on average broader and more voluminous structures than the Murray mounds. The minimum and median diameters for the Adelaide mounds are also slightly elevated in comparison. The Adelaide burial mounds are clear outliers, in particular the Greenfields mound.

Significant numbers of non-burial mounds develop from an initial form of approximately 6-8m diameter in the Murray and 8-10m in the Northern Adelaide Plains sets, as seen in Figure 5. We suggest that this minimum diameter is related to some functional parameter, e.g., the size of the cooking pit and volume of material being processed in mounds at any one time. In this respect, the diameter result illustrates a clear differentiation in the scale and method of cooking between mounds and hearths (also a commonly recorded feature on the floodplains). The burial mounds located in Adelaide have average diameters in excess of 30m (Figure 5), and while the form of these mounds at the time of burial remains unclear, it could be assumed that there was a selective use of larger mounds for the purposes of burial.

When interpreting these results it is important to consider that the Murray set includes mounds recorded during regional studies in areas that are relatively unmodified whereas the Adelaide set have been recorded during small scale studies and are invariably found in a degraded state. The Murray set, therefore, might be considered a more representative regional sample. Despite these caveats, we are confident that mound form does in fact differ between the two regions.
Table 1 Summary of mound dimensions.

<table>
<thead>
<tr>
<th></th>
<th>Murray (n=144)</th>
<th>NAP - non-burial (n=33)</th>
<th>NAP - burial (n=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diam (m)</td>
<td>3.0</td>
<td>10.0</td>
<td>30.0</td>
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<td>Tck (m)</td>
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<td>0.1</td>
<td>1.0</td>
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<tr>
<td>Surf Area (m²)</td>
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<td>64.1</td>
<td>25.0</td>
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<tr>
<td>Vol (m³)</td>
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<td>3.5</td>
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<td>0.3</td>
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<tr>
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<tr>
<td>Vol (m³)</td>
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<td>45.8</td>
<td>1.2</td>
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<td>Tck (m)</td>
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<td>34.19</td>
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<tr>
<td>Vol (m³)</td>
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<td>454.5</td>
<td>493.0</td>
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</table>

Figure 4 Volume distribution of mounds as a percentage of each subset.

Figure 5 The averaged diameters of mounds.
A generalised summary of lithic and faunal material also highlights some differences. Stone artefacts are found on 57.3% of the Murray mounds compared to 82.9% of the combined Adelaide mounds. In both regions artefact numbers on mounds are most commonly low though there is some suggestion that higher artefact counts occur in the Adelaide set (note that we have not assessed this against mound surface area). The Greenfields and Gillman assemblages are, again, standouts. While no detailed account of the assemblage is provided here, our observation is that the Murray assemblages are almost exclusively comprised of unmodified flakes though several instances of grindstones and retouched flakes, together with a single edge-ground axe, have also been identified. The Adelaide assemblages are also dominated by unmodified flakes though the Greenfields and Gillman assemblages are extremely diverse and extensive, and include a range of flaked and ground material.

In terms of faunal content 57.2% of all Murray mounds contain some material, though this is almost exclusively freshwater mussel (*Velesunio ambiguus* or *Alathyria jacksoni*) and invariably occurs in extremely low volumes within individual mounds as highly fragmented and disseminated material. Identifiable lenses of shell are rarely noted. Turtle, emu eggshell, fish and yabbie have been identified in minor amounts on several mounds. The Adelaide set includes only eight instances (26.7%) where faunal material has been identified though this includes the remarkable assemblages of the Greenfields and Gillman mounds. None of the Murray mounds contain an assemblage resembling these two Adelaide examples, in terms of extent or diversity.

The faunal assemblages represented in the Murray mounds can also be related to the same locations in which the mounds are situated, whereas the Greenfields, Gillman and at least one of the Bolivar mounds, include faunal elements relating to non-local species. Resources were evidently being collected beyond the immediate area of at least some of the Adelaide mounds.
**Spatial Organisation**

Figure 6 provides a breakdown of the minimum distances between mounds in the two regions (distances between mounds and other site types in the Murray anabranch systems are also shown). In respect to the Murray set, the trends (as expressed as cumulative percentages) observed between mounds and other site types are essentially replicated when compared to distances between all site types, illustrating a uniform spread of all site types in relation to each other to approximately 500m. In comparison, almost 75% of the Adelaide examples occur within 100m of another mound, suggesting a clustering of mounds in this region.

**Figure 6** Minimum distances between mound sites in the Northern Adelaide Plains and Riverland (distances between mounds and other site types in the Riverland are also shown).
Burials
Perhaps the most significant divergence between mounds in the two regions is the development of large-scale mounds and dedication of these as burial places in Adelaide. This aspect is not replicated in the Riverland set, though interestingly, seems to be a feature of the Hay Plains and other regions of the Riverine plain (Littleton 2006:1015-17; Martin 2006; Vanessa Edmonds pers. comm.). Within the Riverland, burials and cemeteries were most commonly established within dunal landforms and the sandy valley slopes.

A total of 67 burial locations on the Northern Adelaide Plains have been identified through a review of various documentary sources including the SAM data, media articles and archaeological reporting (see also Pardoe 2005:Table 4). Of these, 16 instances can be ascribed to mounds with some certainty, including examples of individual and multiple burials. While none of the Riverland mounds have been used for burial purposes, skeletal material was found associated with, and possibly excavated into, one of a series of four heavily eroded mounds on the Chowilla floodplain immediately upstream of the border (Wood et al. 2005).

In Adelaide, the burial mounds are generally dedicated amongst a group of closely located mounds. It is apparent that burial was not necessarily the ultimate use of a mound with occupation, for instance, continuing subsequent to burials at the Gillman site (Littleton et al. 2013; c.f. Littleton 2006:1017; Walshe 2011). Similarly, burials at Greenfields included several which rested directly on the underlying hardpan surface and were most certainly overlain by occupation layers. Importantly, burials appear not to have been gender or age specific. Age estimates of approximately 10 to 47 years (clustering around 25-30 years) were returned on the remains of both male and female individuals at Greenfields (Wood et al. in prep.) with an equally broad spread reported for the Gillman site (Littleton et al. 2013:47). These sites were clearly inclusive and communal.

Interestingly, Wood et al. (in prep.) suggest that osteoarchaeological evidence from the Greenfields sample, such as a lack of evidence of infectious disease, may be indicative of a “low population density.” This assessment is consistent with Valerie Campbell’s (1988:218-224) synthesis of ethno-historical material relating to the Adelaide region. On the face of it, these
two lines of evidence seem counter to the impression of high levels of residency gained from the mounds, though perhaps reflect more upon organisation within and between locally based groups. Clearly there is further debate to be had, though we suggest that a more critical analysis of the ethnographic material is also required to understand the mounds.

Conclusions

It is curious that despite a long history of mound reporting in South Australia, earthen mound sites have not featured in the discussion of pre-colonial settlement. In Adelaide, in particular, the investment in these large spatially related structures, together with the dedication of cemeteries within the mound complexes, has demanded a significant reappraisal of settlement systems. Earthen mounds provide an impression of an integrated economic and domestic system, relating to resident populations exploiting high resource value habitats through the intensive use of ovens. We would argue, however, that observable differences in the form, spatial organisation and utility of mounds highlight different societal roles between the Riverland and Northern Adelaide Plains. On the basis of current data, we propose the following scenario.

Mounds are likely to have developed initially as processing sites relating principally to aquatic vegetation. In the Adelaide region, a subset of mounds also appear to have functioned as habitation sites located within residential nodes centred on a series of freshwater wells on the fringes of highly biologically productive seasonal wetlands. A small number of these mounds contain evidence of broad diet breadth and central place foraging into nearby terrestrial, alluvial and estuarine habitats. The mounds may have also offered a convenient solution to an environment that was flood-prone and formed on heavy clay textured soils, with the availability of dry, freely draining platforms exploited once a proto-mound had developed to a size sufficient to accommodate huts and other domestic structures and activities. A similar benefit was redundant along the Murray given the availability of elevated terrain in general proximity to the mounds and where occupation areas were typically established. The Riverland
mounds continued to function as pit ovens situated at accessible and reliable stands of aquatic vegetation.

Once established as a domestic site, mound structures in Adelaide would be expected to develop further through the accumulation of artefacts, faunal remains and oven debris, together with structural materials, e.g., collapsed huts and bedding. The Kaurna are thought to have constructed various types of shelter, including substantial structures erected during autumn and winter made from a frame of branches covered with bark, grass, seaweed and earth (Ellis 1976:117; Ross 1984:5). These structures would have added a considerable volume of material to a domestic site. Frankel (1991:85) cites the collapse of similar structures as a possible contributing factor in the formation of mounds in Victoria.

This interpretation of a progressive development of the Adelaide mounds is essentially similar to that proposed by Coutts et al. (1979:5-7), with the recognised mound types diverging at some point in their development. In this scenario, the Adelaide mounds would have operated within a feed-back system. By facilitating more permanent access to high resource value habitats, the construction and use of mounds provided opportunity for increasing residency which drove more intensive processing needs and further mound development. Ultimately, large, highly visible mounds on the Northern Adelaide Plains were selectively used for burial purposes, representing poignant markers of ownership over territory and resources (c.f. Bonhomme 1990:82-84; Brockwell 2006:47, 54; Martin 1996, 2006; Pardoe 1988; Williams 1988:215). This role is not replicated in the Riverland mounds.

Establishing a timeline for mound development in these regions will underpin ongoing discussion. What are the temporal relationships between mounds both within and between individual mound groups; can we necessarily rely on a contemporaneous use; and when, how rapidly and how widespread was the initial development of mounds? These are fundamental questions that need to be resolved. How the local mounds relate temporally to interstate examples would of course develop its own debate. At some point in time a transformation in land use, specialisation and the scale of resource exploitation, manifested in the development of mounds. Whether technological, social or economic, the question remains
as to whether the development of earthen mounds was an inevitable consequence or necessary precursor to a cultural trajectory which emerged during the last several millennia.

Acknowledgments

This paper is a summary of fieldwork the authors have conducted over the past two decades with the Kaurna, Mid Murray and Riverland Aboriginal communities. We would like to thank the various members of these communities who contributed to this work. In particular we acknowledge Gladys Sumner, Jeffrey Newchurch and the Mannum Aboriginal Community Association Inc. for reading and approving this article for publication. Tom Gara has also provided significant contributions to our work over the years. Phil Fitzpatrick, Rhonda Harris, Vanessa Edmonds and Sarah Martin have kindly provided various reference materials. Vanessa, together with Rachel Mapson and Ingereth Macfarlane offered comments on various drafts of the paper.

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