EARTH MOUNDS IN NORTHERN AUSTRALIA:

A Review

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Abstract

Although earth mounds are a common archaeological feature of the northern Australian coastal plains, there has been little systematic investigation of them. This paper aims to redress the balance by reviewing and synthesising investigations into earth mounds in northern Australia. I examine several themes raised in the literature that are relevant to research on earth mounds in relation to a number of case studies from northern Australia. These include location, morphology, origins, chronology and the role of mounds in the wider context of settlement systems. I conclude that earth mounds in northern Australia can be divided into two distinct types, coastal/estuarine and freshwater. Both types proliferated in the late Holocene and represent seasonally occupied sites at the junction of a number of resource zones that may also have had social significance as territorial markers.

Introduction

In northern Australia, mounds, composed both of shell and/or earth, are a common feature in the archaeological landscape. Most previous studies have focused on shell mounds in relation to marine and estuarine resource exploitation (cf. Bailey 1977, 1994, 1999; Baker 1981; Beaton 1985; Bourke 2000; Burns 1994, 1999; Cribb 1986, 1996; Cribb *et al.* 1988; McCarthy and Setzler 1960; Meehan 1982; Mitchell 1993; Mowat 1995; Mulvaney 1975; O'Connor 1999; Roberts 1991, 1994; Sullivan and O'Connor 1993; Veitch 1996, 1999; Warner 1969). There is some overlap in definition between shell and earth mounds (cf. Roberts 1994:179-181). However, for the purposes of this paper, earth mounds are defined as those which are composed mostly of soil and sand. Depending on their location, they may also contain stone artefacts and faunal remains, including shell.

Investigations that feature earth mounds have been conducted in a number of locations, including Cape York Peninsula (Cribb 1986); Milingimbi, Arafura Swamp and the Blyth River in Arnhem Land (Meehan 1988, 1991; Peterson 1973; Roberts 1991, 1994); Kakadu (Allen 1996; Allen and Barton 1989; Brockwell 1989, 1996a; Kamminga and Allen 1973; Meehan *et al.* 1985; Woodroffe *et al.* 1988); the Mary and Adelaide Rivers (Baker 1981; Brockwell 1996b, 2001a, 2001b, 2005; Schrire 1968; Smith 1981); Darwin Harbour (Bourke 2000, 2005; Burns 1999); and Reynolds River (Guse 2006; Guse and Majar 2000) (Figure 1). Information recorded includes both archaeological data and observations on the ethnographic uses of earth mounds. However, apart from Brockwell (2001a, 2005) and Peterson (1973), these studies are usually concerned with wider investigations of settlement strategies, of which earth mounds are only one site type.

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A review of the literature has identified a number of themes in common between these studies of earth mounds across northern Australia (Brockwell 2001b). These themes include location, chronology, origins, morphology, function, and the role of mounds in the context of wider settlement systems, which include considerations of seasonal occupation, mobility and mounds as cultural markers. This review revealed that the earth mounds are situated on the recently formed coastal plains of northern Australia. These sites date from 4600 BP but proliferated post-2000 BP, reflecting the recent nature of this landscape. They are usually found at the junction of a number of resource zones and can be divided into two distinct types, according to location, morphology and composition; coastal/estuarine and freshwater. They were multifunctional sites that were seasonally occupied as part of a wider settlement system, which includes several other site types, and may have acted as markers of territorial boundaries in the past.

Cape York Peninsula

Cribb (1986) describes earth mound sites, or 'mounded middens' as he calls them, on the Love River in the Aurukun region of western Cape York (Figure 1). The area is coastal and shell middens are the dominant site type. The earth mounds are located at the junction of a number of resource zones on Pleistocene dunes, or on silt plains that contain extensive freshwater wetland systems bordering open woodland (Cribb 1986:150-151). Vegetation consists of dune scrub community and vine thicket, containing vegetable resources and fruit trees. Apart from swamps, creeks and lagoons, water is available from wells at the dune-savanna interface (Cribb 1986:139-140). Unlike nearby shell mounds, the earth mounds are composed mainly of earth with a low proportion of estuarine shell. Some also contain stone artefacts.

Cribb (1996; Cribb *et al.* 1988) concludes that the earth mounds were used for what he refers to as 'domiculture'. Hynes and Chase (1982:38) have defined 'domiculture' as selective environmental knowledge and resource strategies applied at a specific time to a specific area. For example, in tropical Australia, taking only the yam tuber and replanting its top with the vine intact ensures continued growth (Hynes and Chase 1982:40). The domicultural focus can shift as people move between camp sites and ecological zones within their domain (Hynes and Chase 1982:38).

Cribb (1996:151-152) suggests that domiculture of various floral species on the Love River mounds implies custodianship or ownership of resources by a particular group or individual. Hynes and Chase (1982:40) address this notion and cite examples where yam patches, coconut trees and fig trees are 'owned' by various families. Ownership confers certain privileges, for example, rights to a campsite, with trees acting as boundary markers. Cribb (1986:145, 153, 1996:161) and Cribb *et al.* (1988:68-69) also note that the Love River mounds have taken on mythical

Figure 1 Location map of earth mounds in northern Australia.

status and represent sites where ancestral beings camped in the Dreaming (cf. Greer 1996, 1999).

Arnhem Land: Milingimbi

Roberts (1994:180) identifies earth mounds owned by the Yolngu people of Milingimbi as one of a range of mound types, including mudflat mounds, midden mounds, conical shell heaps, base site mounds and geomorphological or natural mounds of shell (Figure 1). He describes 15 earth mounds that are located in semi-deciduous vine thickets on dunes interspersed with grassland and paperbark swamps, bordering mangroves and mudflats (Roberts 1991:119, 122).

These earth mounds are elongated in shape and conical in cross-section, composed mainly of sand and forest humus and contain few cultural remains. They average 23m in length, 17.5m in width and 1.3m in height (thickness) above the ground surface (Table 1). There is some shell from the mangroves and upper mudflats, the dominant species being *Anadara granosa*, and remains that could be evidence of food preparation, namely hearths containing stones, ash and turtle carapace (Roberts 1991:118-119, 1994:182).

Roberts (1991:118-119, 122-123, 1994:186) concludes that the earth mounds are the remains of nests built by the scrub fowl (*Megapodius reinwardt*), based on their location in monsoon rainforest, the exclusive habitat of the megapode; current usage of the mounds by megapodes; and a lack of unequivocal cultural remains (but see below).

Roberts (1991:123) records people at Milingimbi using earth mounds sporadically as 'dinnertime camps' to cook turtle and shellfish and says that they are chosen as soft, sandy, comfortable

sites that afford shade and are convenient to shell beds. He was also told about one earth mound that was occupied in the late wet season and used as a 'dinnertime camp' from which to harvest waterlilies and corms of *Eleocharis* sp. (spike rush).

Roberts (1991:81-82) does not specifically discuss earth mounds in relation to religious beliefs, but says that Yolngu people view some shell mounds as being made by people in the past, and the more spectacular examples as being created during the Dreaming. Roberts (1994:183) goes on to state that the 'majority of [mounds] at Milingimbi represent resource harnessing in places on the island with respect to the territories of tribal groups that inhabited the island before the turn of the century'. Approximately 35 mounds and other sites are found within each of these territories.

Arnhem Land: Arafura Swamp

Peterson (1973) reports clusters of 2-20 or more earth mounds at the freshwater Arafura Swamp on the Glyde River, central Arnhem Land (Figure 1). They are found located in a sandy fan delta complex at the junction of a number of habitats, including freshwater stream and swamp, monsoon rainforest and tall open forest, close to ephemeral pools of water (Peterson 1973:173, 175, 181, 186).

Seventeen mounds were recorded in one cluster. They have average dimensions of 9m in diameter with an above ground height of 0.7m (Table 1). Faunal remains include those of blue tongue lizard (*Tiliqua scincoides*), freshwater fish, long-necked turtle (*Chelodina rugosa*), wallaby (*Macropus* sp.) and freshwater mussel (*Vesunio angasi*). Other remains include termite nest ovens with food debris; paperbark used in cooking; pestles

and mortars; edge-ground axes; and stone flakes (Peterson 1973:192). Peterson (1973:177) suggests that the Arafura Swamp earth mounds were deliberately constructed through the use of termite nest for ovens. He also proposes that mound location is linked to availability of seasonally abundant foods, located on ground that is flooded seasonally, with elevation that takes advantage of insect-dispersing breezes (Peterson 1973:175, 179, 190-191). He concludes that they represent a regular pattern of behaviour for at least 1400 years, on the basis of a date taken from a shell mound in Mililingimbi (Mulvaney 1975:248; Peterson 1973:189-190).

The mounds were still being used at the time of the study. Typically, one mound in a cluster was used for cooking and another contained a shelter (Peterson 1973:177). Peterson's (1973:187-188) ethnographic observations suggest that the mounds represent early-to-mid-dry season habitation. During the wet, people moved to tall open forest locales near a seasonal stream. When the rains ceased, they relocated to the sandy fan delta complex from early-to-mid-dry season. When the swamps retreated, they moved onto the dried-out floodplains to camp next to permanent water until forced away by the wet season rains. Today, the people of the Arafura Swamp do not recognise the mounds as being anthropogenic, but as part of the natural landscape (Peterson 1973:186).

Arnhem Land: Blyth River

Earth mounds are dotted around Balpilja, a large freshwater swamp owned by the An-barra people of the Blyth River in central Arnhem Land (Figure 1). These earth mounds average 20m in length, 10m in width and 2m in height above ground surface (Table 1). Cultural remains identified in these sites include bone, shellfish, eggshell and stone artefacts (Meehan 1988:2, 1991:205). The mounds are located at the juncture of a number of resource bases, between swamp and open woodland (Meehan 1988:2, 1991:205). One large earth mound on the edge of Balpilja swamp, Ji-bena, was excavated and described in detail. It returned a basal date of 1510±100 BP (Brockwell *et al.* 2005:86) (Table 2).

From ethnographic observation, Meehan (1988:12-13, 1991:205) concludes that the earth mounds were built up using termite nest as heat retainers in earth ovens to cook wallabies, geese, ducks and turtles. The An-barra can recall living on the mounds in the early dry season, when the swamps were full of water. They provided well-drained, breezy campsites that offered some relief from mosquitoes (Meehan 1988:6). From this base, they exploited *Eleocharis dulcis* corms and waterbird eggs. Later in the dry season, people camped at the edge of the retreating swamps (Meehan 1991:205). Meehan (1982:179) records 32 'dinnertime' camps and two home bases occupied in An-barra territory during the month of April 1973 (early dry season). The Blyth River mounds are of religious significance to the An-barra, who claim they were made and/or visited by Dreamtime ancestors (Meehan 1988:13). However, contemporary use is observed by Jones (1975:25) who notes that seeds were planted deliberately in shell mounds in anticipation of fruit trees, seeds, shade and other useful products being available in the future. This practice means that sometimes seasonality of occupation can be deduced from the species of fruit trees present.

Kakadu: Alligator Rivers Region

Kamminga and Allen (1973; see also Allen 1996:199; Allen and Barton 1989:106) report, but do not describe, a number of earth mounds located along the edge of the floodplains of Magela Creek, a tributary of the East Alligator River (Figure 1).

On the South Alligator River, 13 earth mounds located close to freshwater floodplains have been reported. Detailed investigations have been undertaken by Meehan *et al.* (1985) on the eastern side of the river at the site of Kina, located on a peninsula jutting into a freshwater billabong. This site consists of an extensive scatter of stone artefacts and several discrete mounds containing freshwater mussel shells in a dark clay matrix (Meehan *et al.* 1985:117). One of the mounds measured 50m by 40m (Table 1). It was excavated to a basal depth of 80cm where it rested on laterite. The assemblage consists of stone artefacts and shell, almost exclusively the freshwater mussel *Velesunio* sp., though there were two samples of mangrove shell

Table 1 Dimensions (m) of recorded earth mounds in northern Australia (CE = Coastal/Estuarine; FW = Freshwater; R = Range).

Location	No.	Length or Diameter (m)	Height (m)	Reference
Milingimbi (CE)	15	23 (R=11-36)	1.3 (R=0.5-2.1)	Roberts (1991)
Arafura Swamp (FW)	17	9 (R=5-14)	0.7 (R=0.5-1.1)	Peterson (1973)
Blyth River Ji-bena (CE)	1	20	2.0	Meehan (1988, 1991)
South Alligator River (FW)	12	10-25	0.5-1.0	Brockwell (1989)
Kina (FW)	1	50	0.8	Meehan <i>et al.</i> (1985)
South Alligator River (CE)	4	15-20	0.5	Woodroffe <i>et al.</i> (1988)
Mary River (CE)	12	25-40	0.1-0.8	Baker (1981)
Adelaide River (FW)	11	30-80	0.25-1.4	Brockwell (2001a); Schrire (1968)
Hope Inlet (CE)	18	18 (R=12-50)	1.1 (R=0.4-2.0)	Bourke (2000)
Reynolds River (CE/FW)	46	25-30 (R=9.3-11.3)	0.3-0.8	Guse (2006)

Table 2 Chronology of earth mounds in northern Australia (uncorrected and uncalibrated) (CE = Coastal/Estuarine; FW = Freshwater; R = River).

Site Name	Location	Spit No.	Depth (cm)	Lab. No.	Material	Date
Ji-bena 1 (CE)	Blyth R.	5	48-55	ANU-3415	<i>Dosinia juvenilis</i>	970±80
Ji-bena 1 (CE)	Blyth R.	8	86-100	ANU-3416	<i>Dosinia juvenilis</i>	1260±70
Ji-bena 1 (CE)	Blyth R.	auger	91-122	ANU-3414	<i>Dosinia juvenilis</i>	1250±80
Ji-bena 1 (CE)	Blyth R.	13	148-60	ANU-3417	<i>Dosinia juvenilis</i>	1360±70
Ji-bena 1 (CE)	Blyth R.	14	160-165	ANU-2817	<i>Dosinia juvenilis</i>	1510±100
Kina (FW)	South Alligator R.		45-60	ANU-3212	charcoal	280±40
G (CE)	South Alligator R.		surface	ANU-3994	shell	2080±70
H (CE)	South Alligator R.		surface	ANU-3992	shell	4600±80
H (CE)	South Alligator R.		surface	ANU-3991	shell	4170±100
J (CE)	South Alligator R.		surface	ANU-4047	shell	1950±100
N (CE)	South Alligator R.		surface	ANU-4045	shell	3050±70
38 (CE)	Mary R.		0-5	ANU-2887	shell	modern
40 (CE)	Mary R.		surface	ANU-2888	shell	920±90
HD1 (FW)	Adelaide R.	3	10-19	Wk-6373	turtle carapace	2027±77
HD1 (FW)	Adelaide R.	9	49-56	Wk-5957	<i>Polymesoda erosa</i>	3880±60
HD1 (FW)	Adelaide R.	11	62-69	Wk-5796	<i>Polymesoda erosa</i>	4060±60
MP2 (FW)	Adelaide R.	5	22-26	Wk-5581	charcoal	350±70
MP2 (FW)	Adelaide R.	7	31-35	Wk-8452	charcoal	460±130
MP2 (FW)	Adelaide R.	10	42-47	Wk-6235	charcoal	360±190
MP2 (FW)	Adelaide R.	10	42-47	Wk-6374	turtle carapace	2040±260
MP2 (FW)	Adelaide R.	13	53-59	Wk-5582	charcoal	1880±210
MP5 (FW)	Adelaide R.	11	36-41	Wk-7400	charcoal	630±60
MP6 (FW)	Adelaide R.	5	10-15	Wk-6668	bone	434±56
MP6 (FW)	Adelaide R.	11	43-45	Wk-6669	bone	1432±56
HI97 (CE)	Hope Inlet		46	Wk-6526	<i>Anadara</i> sp.	1830±100
Werat 1 (CE)	Reynolds R.	14		Wk-7432	<i>Anadara</i> sp.	4330±60
Werat 14 (CE)	Reynolds R.		surface	Wk-7170	<i>Anadara</i> sp.	3480±50
Pandyal 2 (FW)	Reynolds R.	6		Wk-7262	charcoal	626±77
Djingurr 1 (FW)	Reynolds R.	8		Wk-7171	charcoal	400±60
Djingurr 1 (FW)	Reynolds R.	8		Wk-7431	charcoal	197±57

Polymesoda crosa (formerly *Geloina coaxans*) in the lower layers. Other faunal remains consist mainly of freshwater long-necked turtle (*Chelodina rugosa*) and estuarine fish that can also live in freshwater, barramundi (*Lates calcarifer*) and catfish (*Arius* sp.) (Meehan *et al.* 1985:148-152). Although there is goanna disturbance and no marked stratigraphy, the analysis reveals a two-fold sequence of occupation. There is a change in the proportions of lithic raw materials between the lower and upper levels and density of freshwater mussel shell increases over time (Meehan *et al.* 1985:148-150).

A charcoal sample taken from above the basal level of the site dates the Kina mound to 280 ± 140 BP (Meehan *et al.* 1985:147, 152) (Table 2). Jones (1985:292) and Meehan *et al.* (1985:152) link the establishment of Kina and nearby surface scatters to the development of freshwater conditions on the neighbouring floodplain from 1400 BP (Hope *et al.* 1985:233-236). They suggest that Kina has a basal age more like 500-1000 BP. The presence of mangrove shell in the lower levels of the site also hints at an older date, when the floodplains were estuarine.

North of Kina, two clusters of earth mounds are located in open woodland some 200m from the floodplains adjacent to a relict river channel. One group consists of three mounds, while a group of six mounds lies 500m northwards. The mounds have dimensions of 10-25m in diameter and 0.5-1m in height and are littered with stone artefacts (Brockwell 1983, 1989:158-162, 1996a).

On the western side of the South Alligator River at Malakanbalk, three earth mounds cluster in monsoon rainforest situated on a headland into the floodplains, adjacent to the main river channel (Meehan *et al.* 1985:126-127). These mounds range in size between 30-40m in diameter and 0.5-1m in height. They are composed of dark grey silt and littered with stone artefacts made from a wide variety of raw materials. Meehan *et al.* (1985:126) speculate that the Malakanbalk mounds may have been scrub fowl mounds originally, because of their location within monsoon rainforest and the presence of active mounds nearby. Ethnographic testimony provides no information about these mounds. On the basis of location and nearby wet season resources, however, Brockwell (1989:212, 1996a) suggests that they were occupied in the wet season.

Woodroffe *et al.* (1988) report four earth mounds, or 'surface mounds', on the floodplains of the South Alligator River, 6-20km north of Malakanbalk. They range in size between 15-20m in diameter and are 0.5m in height above the plains. They are composed of shelly silt or clay, with rock and bone fragments. They contain mangrove shellfish species, *Meretrix meretrix* and *Cerithidea* sp., as well as chipped stone artefacts, grindstones, mortars and pestles. One mound also contained human remains. Several dates were obtained from these estuarine mounds; 4600 ± 80 BP, 4170 ± 100 BP, 3050 ± 70 BP, 2080 ± 70 BP, 1950 ± 100 BP (Woodroffe *et al.* 1988:96-97) (Table 2). Woodroffe *et al.* (1988:99) conclude that the shellfish were collected from mangroves adjacent to the river and consumed at the sites, and that the stone artefact types present indicate that the mounds were used for a variety of functions.

Mary River

On the Mary River, Baker (1981) reports 12 earth mounds in two different locations, on the black soil floodplains and coastal

beach ridges (Figure 1). They are located conveniently close to the resources of sandy mudflats, mangroves, monsoon forest, pandanus fringe, and fresh and saltwater creeks. Regionally, there is a range of other sites that includes artefact scatters, shell mounds, sites with pounding hollows and contact sites (Baker 1981:74-75, 80-81).

The earth mounds range between 25-40m in diameter and 0.1-0.8m in height (Table 1). Those on the black soil plains contain mangrove shell, stone artefacts and pounders. The beach ridge earth mounds lack a dense scatter or wide range of stone artefacts and contain very little shell despite the proximity of the coast and nearby shell mounds (Baker 1981:74-75). The beach ridges have been dated variously from 3000 to 870 BP (Clarke *et al.* 1979; Lees 1987; Woodroffe and Mulrennan 1993:63; Woodroffe *et al.* 1993:269). Surface shell from two of the beach ridge earth mounds have also been dated; one to 920 ± 90 BP, the other as modern (Baker 1981:62-63, 80) (Table 2).

Baker (1981:75) points out that the elevation of the mounds on the black soil plains is insufficient for them to be above flood levels at the height of the wet season. On this basis, he speculates that they were occupied during either the early or late wet season. He goes on to speculate that if the beach ridge earth mounds and nearby shell mounds are contemporaneous, it may be that people built huts in the shelter of the beach ridges, but processed shellfish closer to the shell beds. Baker (1981:80-81) concludes that the beach ridge earth mounds probably represent wet season occupation that did not require a wide range of stone tools, as processing seasonal resources of fish, shellfish, and wet season vegetables and fruits required only an ephemeral material culture.

Adelaide River

On the Adelaide River, 30 earth mounds were recorded in the pandanus fringe on the western margins of the freshwater floodplains, some 50km inland (Figure 1). They are concentrated on two headlands jutting into the floodplains close to lagoons, and appear to be situated on low-level rises. They are all located within easy distance of other resource bases, including open woodland, monsoon rainforest, creeks and waterholes. They are the most common site type in the area, but are also associated with artefact scatters, pounding hollows and quarried rock outcrops (Brockwell 1996b, 1996c, 2001a:70-76, 2005:10-11; Smith 1981).

Eleven earth mounds were recorded in detail and five were excavated. They range in size between 30-80m in diameter and between 0.25-1.4m in height (Table 1). Apart from two isolated examples, they all occur in clusters. The excavations yielded numerous stone artefacts, large quantities of well-preserved faunal remains, including species of both the floodplains (fish and turtles) and the open savanna (wallabies and possums) (Brockwell 1996c, 2001a:141-172; Schrire 1968; Smith 1981).

Smith (1981) remarks that there are a number of edible plant species associated with the mounds that are out of natural context, including several species of yams and fruiting trees that normally grow in monsoon rainforest. There is anecdotal evidence that the area used to be covered in rainforest rather than the pandanus and open woodland of today, which suggests environmental change rather than domiculture (Brockwell 2001a:183). The location of earth mounds within former rainforest may indicate

that the mounds were originally megapode nests. However, as they contain stratified cultural material and the dates from the excavations are in sequence chronologically, it seems likely that the cultural component of the mounds is human rather than megapode in origin (Brockwell 2001a:200).

Radiocarbon dating reveals that the Adelaide River earth mounds were occupied from 4000 BP until recently. During this time the coast was prograding and the floodplains evolved from estuarine to freshwater. Only one site has been dated to the estuarine phase c.4000 BP, while the majority belong to the freshwater phase from c.2000 BP to present (Brockwell 2001a:80-84) (Table 2).

The assemblages indicate that the mounds are the remains of seasonal base camps. Schrire (1968) interprets the evidence as indicating wet season habitation (land-based indicators – savanna animals, stone points) with some early or late wet season occupation when freshwater floodplain resources were also exploited. The presence of the late dry season fruiting tree *Planchonia careya* (green plum), an extract from the bark of which can also be used to stun fish, and *Pandanus spiralis* (late dry season nuts) on many of the mounds may suggest late dry season occupation. However, on the basis of site location and the faunal analysis, I (Brockwell 2001a:200-201, 2005:16) conclude that the mound sites were inhabited early in the dry season, serving as bases for the exploitation of nearby transitory lagoons while the surrounding ground was still damp.

There is no direct evidence that these mounds operated as cultural markers. However, ethnohistorical sources suggest that at contact the Adelaide River formed some kind of boundary. Considerable numbers of people lived in the region at the time and there was conflict between neighbouring groups (Brockwell 2001a:181, 193). Additionally, the number of sites (36 earth mounds, artefact scatters and a quarried rock outcrop) recorded on the western floodplain margins is comparable with figures, cited by Meehan and Roberts above, that represent a territory inhabited by one group. In the light of this information, it is interesting to speculate whether the Adelaide River mounds, especially the larger ones, did indeed act as cultural markers of boundary.

Darwin Region: Hope Inlet

Bourke (2000:97, 2004; Burns 1999:64-67, 430-434) records 18 earth mounds at Hope Inlet (Figure 1). They are clustered together with shell mounds 50-100m apart and are generally circular, but occasionally elongated in shape. Average dimensions are 18m in length, 14m in width and 1.1m in height above the ground (Table 1). On the surface, there are a few weathered shells and stone artefacts. Bourke (2000:97) likens these earth mounds to those described by Baker (1981) on the Mary River.

Bourke (2000:225) excavated one coastal/estuarine type of earth mound (HI97) located in open woodland, next to a seasonal paperbark swamp, and close to a freshwater creek (Bourke 2000:225). The quantity of shell recovered is only one-third of that from nearby shell mounds and, although the number of stone artefacts is relatively low, the density is the highest for excavated deposits at Hope Inlet (Bourke 2000:233). Faunal remains include macropod, snake, rodent, crab and a small quantity of fish (Bourke 2000:229). HI97 returned a basal date of 1830±100 BP (Bourke 2000:228; Burns 1999:66)

(Table 2). As the mound is stratified and contains both stone artefacts and faunal remains, Bourke (2000:233-234) concludes that it is anthropogenic rather than megapode in origin. Based on evidence of hearth-like features, burnt shells and fragmentation, Bourke (2000:233-236) suggests that this mound functioned as an earth oven that may have been built up with termite nest material.

Burns (1999:67; Bourke 2005:44) concludes that shell and earth mounds in the Darwin Harbour and Hope Inlet areas were occupied in the wet season, and provided refuge from low-lying seasonally inundated areas at the juncture of a number of resource zones. On the basis of ethnographic evidence, she further suggests that clusters of mounds represent the remains of semi-permanent camps for large groups of people, possibly involved in ceremonial gatherings. Although there is no direct evidence, she speculates that the large shell mounds (up to 7m high) at Hope Inlet served not only as territorial markers, but also as totems related to ensuring reproduction of species (Bourke 2005:43-44; Burns 1999:67).

Reynolds River

Guse (2006:110-111; Guse and Majar 2000) reports 46 earth mounds on the plains and plains/lowland junction of the Reynolds River, three of which were excavated (Figure 1). They are associated with other site types, including shell middens, artefact scatters, grinding hollows and quarries. The earth mounds can be divided into two types, according to location and contents. Those located on relict chenier beach ridges have a base of chenier shell, overlain with midden shell of edible species in a dark humic matrix, capped with an earth layer. The other type, located at the junction of the lowlands and freshwater floodplains of the river, within 500m of large freshwater billabongs, is composed mainly of earth with little or no shell present. In reporting their dimensions, Guse does not distinguish between the two types but has included them as one sample. They range between 25-30m in median diameter with a standard deviation of 9.3-11.3m, and 0.3-0.8m in height (Table 1).

These mounds associated with wetlands are located on small natural rises in the landscape, usually at the juncture of a number of resource zones that provide a focus for repeated occupation which, Guse (2006:116) surmises, is how they were built up. The mounds contain many grindstone artefacts that Guse (2006:116) associates with the processing of swamp plants. Economically useful plants, such as nut trees, fruit trees and tubers grow on the earth mounds. Guse (2006:117) describes them as rich and diverse micro-environments that would have encouraged repeated occupation. Several of the mounds also contain burials (Guse 2006:113-114, 117; Guse and Majar 2000:35).

Samples of *Anadara*, taken from the midden layers of two chenier earth mounds, returned dates of 4330±60 BP and 3480±50 BP. Three freshwater earth mounds returned dates of 626±77 BP, 400±60 BP and 197±57 BP respectively (Guse 2006:112; Guse and Majar 2000:34, 36-37) (Table 2).

Ethnographic evidence indicates that, because stone was lacking, the Werat used termite mound fragments, which act as heat retainers, to build their hearths. There is also oral evidence that paperbark shelters were used on the wetlands in the first half of the twentieth century (Guse 2006:116). Guse suggests that these activities would have contributed to mound

accumulation. Today, the earth mounds are culturally significant for traditional owners, both as burial sites and the location of an important Dreaming site (Guse 2006:114; Guse and Majar 2000:36). Guse (2006:116) suggests that internment of the dead within specific mounds may have strengthened a clan's claim to estate ownership.

Discussion

Definition, Location and Morphology

Earth mounds in northern Australia are usually situated at the junction of a number of resource zones, including coast, swamp, monsoon rainforest and woodland. They can be separated into two distinct types according to their location, composition and morphology. The first type is found in a coastal/estuarine location and is composed of soil, sand and/or marine and/or estuarine shell. These mounds contain little stone or bone. The second freshwater type is found inland in ill-drained areas associated with freshwater swamps and river floodplains, and is composed mainly of soil. Any shell remains in the latter are likely to be from freshwater species and there are usually greater numbers of stone artefacts present than in the coastal/estuarine mounds. Both types can be round or elongated in shape but descriptions suggest that the coastal type are more conical in cross-section. Available average dimensions demonstrate some ambiguous differences in size between the coastal/estuarine type and its freshwater counterpart that require further investigation (Table 1). Examples of the coastal/estuarine type exhibit smaller diameters and greater heights, consistent with a conical form. The freshwater type, in particular the Adelaide River mounds, exhibit lower and wider topography.

Origins

There has been much debate about the origins of both earth and shell mounds in northern Australia, in particular whether they are the result of human activities or the nesting behaviour of the orange-footed scrub fowl (*Megapodius reinwardt*) (Bailey 1991, 1994; Burns 1994; Cribb 1991; Mitchell 1993; Roberts 1994; Rowland 1994; Stone 1989, 1991, 1992, 1993; Veitch 1994; Williams 1994). This megapode resides exclusively in monsoon rainforest that occurs in pockets throughout the coastal plains of northern Australia. It constructs large mounds in which it incubates its eggs. Stone (1989:61, 1991, 1992, 1993) argues that all mounds, whether of earth or shell, are the result of megapode-nesting behaviour. He explains the presence of any associated cultural remains as the result of the megapode incorporating such material from the surrounding ground, or from serendipitous occupation by passing groups of hunter-gatherers which, he argues, would not have contributed significantly to mound formation.

In resolving the question of anthropogenic or natural origins of mounds, composition and internal structure are two factors that must be considered (Bailey 1991, 1994; Burns 1994; Cribb 1991; Mitchell 1993; Roberts 1994; Veitch 1994; Williams 1994). Constant reworking of active megapode mounds means that, in many instances, the stratigraphic context is likely to be featureless (Bowman *et al.* 1999). Researchers investigating both earth and shell mounds in northern Australia report that not only do the mounds under consideration contain distinct stratigraphic

features (Bailey 1977; Beaton 1985), they have also been built up deliberately by their human occupants through use as ovens (Meehan 1988:2; Peterson 1973:177). It is theoretically possible to determine origins by comparing soil samples from earth mounds, the surrounding ground, and active and abandoned scrub fowl mounds (Bailey 1994; Burns 1994; Mitchell 1993). Burns (1994) undertook such a study in Darwin Harbour that convincingly demonstrated distinct differences (in mollusc shell age, size and condition, number of species, range of habitats and proportion of shell to sediment) between humanly-constructed mounds and those of megapode origin.

Chronology

Radiocarbon dates indicate that the freshwater type of earth mound proliferated in the late Holocene, once freshwater conditions were established on the floodplains of the northern coastal plains (Brockwell 2001a:202, 2005:16) (Table 2). Although the regions under comparison share similar environmental histories, the timing of events differs from river to river. On the Adelaide River, the oldest date from a freshwater mound is c.2000 BP. On the Blyth River the earth mound Ji-bena, also freshwater, was dated to c.1500 BP. On the South Alligator and Reynolds Rivers, this type of earth mound is more recent in age, less than 600 years old (Guse and Majar 2000; Meehan *et al.* 1985:41) (Table 2).

Two of the coastal/estuarine type of earth mound on the Reynolds River returned dates of c.4300 and c.3500 BP. However, results from the Blyth River (Meehan 1991:205), Milingimbi (Roberts 1994:179) and Darwin Harbour (Bourke 2000:228) indicate that this type is 1500 years or younger in age in these areas (Table 2). More extensive dating is required to clarify the chronology of this site type.

Function

Based on both ethnographic observation and archaeological evidence, earth mounds are interpreted variously as being seasonal base camps (Baker 1981; Brockwell 2001a, 2005; Burns 1999; Cribb 1986; Guse 2006; Meehan 1988, 1991; Peterson 1973; Schrire 1968), 'dinnertime camps' (Roberts 1991, 1994), ovens (Bourke 2000; Guse 2006; Meehan 1988, 1991; Peterson 1973), bases for shelters (Guse 2006; Peterson 1973) and burial sites (Guse 2006). These functions often overlap. Cribb (1996; Cribb *et al.* 1988) speculates that earth mounds also functioned as sites for 'domiculture', similar to the 'gardens' suggested by Balme and Beck (1996) for earth mounds located in the Macquarie Marshes on the Lachlan River in New South Wales. The presence of economically useful trees out of environmental context on the Blyth, Adelaide and Reynolds River mounds (Guse 2006; Jones 1975; Smith 1981) suggests that this may also be the case for the northern earth mounds. Overall, however, the evidence suggests that mounds under consideration were multifunctional, rather than dedicated to any single use.

Economic Role

Earth mounds in northern Australia are always associated with other site types and are regarded universally as being part of a wider settlement system, usually as camps that take advantage of seasonal resources while avoiding flooding and damp ground. Wet season occupation is suggested, based on considerations

of mound location, elevation, and proximity of wet season resources (Baker 1981; Brockwell 1989; Burns 1999; Cribb 1986; Schrire 1968). On the basis of both ethnographic observation and archaeological evidence, however, late wet and early dry season occupation are also suggested (Brockwell 2001a; Meehan 1988, 1991; Peterson 1973).

Mobility is a difficult issue to determine without detailed intensive investigations, such as excavation, to obtain data that may indicate whether earth mound sites are the remains of base camps, overnight camps, or sites for temporary subsistence, processing and consumption activities (Cribb 1986:148). However, archaeological evidence from my own research on the Adelaide River and ethnographic evidence from the Arafura Swamp suggest that they represent base camps occupied early in the dry season. As such, they formed part of a more extensive seasonal round that included other parts of the floodplains, and creeks and lagoons in the open woodland behind the floodplains, and perhaps even the coast in the wet season (Brockwell 2001a:202; Peterson 1973).

While not specifically addressing the role of mounds in the regional economy of western Arnhem Land, Jones (1985:292-293) and Meehan *et al.* (1985:152) argue that the general increase in the number of sites established along the South Alligator River post-1000 BP represents an expansion of occupation and use of the landscape in the late Holocene. Jones (1985:293) envisages a regional increase in population and a restructuring of the economy to take advantage of resources from the newly formed freshwater swamps. However he cautions against explanations such as 'intensification' and says that environmental evidence, such as the seasonal abundance of resources on the adjacent floodplains, should also be considered (Jones 1985:294). Hiscock (1999:100) argues that the evidence points not so much to an increase in population in the Alligator Rivers region, as a reorganisation of population distribution and resource use following the marine transgression.

Social Significance: Mounds as Cultural Markers

Archaeological and ethnographic evidence has pointed to the possible role that mounds may have played as cultural markers. In the Murray Valley in southern Australia, Pardoe (1988) argues that cemeteries acted as symbols to signify ownership in areas containing valuable resources. Bonhomme (1990:82-84) suggests that this notion could apply equally well to mounds. Mounds in northern Australia, both earth and shell, are often regarded by Aboriginal people as pre-dating human occupation of the landscape and they therefore hold cultural significance in relation to Dreamtime mythology and as burial sites (Cribb 1986; Guse 2006; Guse and Majar 2000; Meehan 1988; Peterson 1973; Roberts 1991). This makes them important markers in the contemporary cultural landscape. As earth mounds tend to be located at the juncture of a number of resource zones, they may also have acted as territorial markers demonstrating ownership of those resources in the past.

Conclusion

This review has provided an overview of research into earth mounds in northern Australia. It examined themes that provide useful information on the function, economic role and social significance of this site type in past Aboriginal settlement

systems, including those of morphology, location, origins and chronology.

Two types of earth mounds occur in northern Australia; coastal/estuarine and freshwater. The coastal/estuarine type typically contains some shell and little else, while the freshwater type often contains little shell, but more stone. Both types are usually located at the junction of a number of resource zones, close to freshwater. They appear to be anthropogenic in origin, although there are arguments that some were originally abandoned scrub fowl mounds, subsequently used by humans. Several excavations, however, have revealed cultural contents and stratigraphic features and integrity, which suggest that these particular mounds, at least, were built up through repeated human occupation and/or use as earth ovens.

Current dates indicate that the earth mounds under review were established and proliferated post-2000 BP, although some of the coastal/estuarine examples are older. Their establishment has been linked to 'intensification' in the late Holocene, but may be rather the function of expanded occupation of the coastal lowlands related to the establishment of new resource zones on the floodplains. They appear to have been multifunctional, acting as breezy well-drained seasonal camp sites, bases for shelters, earth ovens and burials. Their seasonality of occupation is debatable, but there are both archaeological and ethnographic arguments for wet season and/or early dry season occupation. Although there is no direct archaeological evidence, the ethnography suggests that both earth and shell mounds, particularly the more spectacular examples, feature in the mythological landscape and, in the past, may have acted as markers of territorial boundaries.

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