Late-Holocene occupation and coastal economy in Blue Mud Bay, northeast Arnhem Land: Preliminary archaeological findings

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Abstract

Twelve months of archaeological excavation and survey were conducted on the Blane Peninsula in Blue Mud Bay over three field seasons between 2000 and 2002. During this time, 141 sites were recorded, and 16 sites were excavated. Though archaeological work in the region prior to this study has not been extensive, some general patterns have been identified that are similar to those reported by other researchers across the tropical North of Australia. These patterns include the type of sites present, the use of similar resources; the distribution of sites across similar landscapes, and the timing and extent of occupation through the late-Holocene. The preliminary analysis of the archaeological evidence demonstrates Aboriginal occupation and marine resource exploitation on the Blane Peninsula from 3000 years ago to the present day. This evidence includes relative continuity in the range of shellfish species gathered, in the site locations used during this time, and in the patterns of shellfish discarded in midden deposits.

Introduction: Aims of the archaeological research

This paper provides a preliminary account of archaeological investigations into the late Holocene pattern of coastal occupation in north east Arnhem Land in an area not previously studied archaeologically. The aim was to provide an overview of the spatial and temporal distribution of archaeological material within the landscape, with a view to investigating patterns of coastal settlement and subsistence during the mid to late-Holocene. No research oriented archaeological studies had previously been conducted either on the Blane Peninsula or in the larger Blue Mud Bay region. Archaeological investigations on the Blane Peninsula were undertaken to obtain a representative sample of the number and type of archaeological sites, and the spatial and chronological range for occupation in this area. Further aims were to gain an understanding of how patterns of settlement and coastal resource utilisation varied over time, particularly in relation to the patterns of climatic change and landscape alteration that occurred in Northern Australia during the Holocene, with particular reference to the last 5000 years.

The Blue Mud Bay project

The archaeological research presented here is one component of the larger, inter-disciplinary project entitled '*Indigenous Marine Tenure and Resource Use at Blue Mud Bay: Ethnographic and Archaeological Perspectives*'. The funding for this research project was provided by the Australian Research Council (ARC) Strategic Partnerships in Research and Training (SPIRT) program, with the Northern Land Council (NLC) as the industry partner. The overall aims of this project were to examine past and present systems of coastal and marine tenure among the Yolngu Aboriginal people of Blue Mud Bay in eastern Arnhem Land, relating specifically to resource exploitation, resource management and the historical development of the regional subsistence system over the last 6000 years. Other than the authors, personnel involved with this project from the Australian National University include Marcus Barber (ARC Doctoral Student, School of Archaeology and Anthropology), Professor Howard Morphy (Director, Centre for Cross Cultural research), Ms. Frances Morphy (Research Fellow, Centre for Aboriginal Economic and Policy Research) and Dr. Nicolas Peterson (Reader, School of Archaeology and Anthropology). Logistical support in the field was provided by the Northern Land Council, from both the Darwin (Head Office) and East Arnhem (Nhulunbuy) offices. Particular assistance was provided by Ms. Wendy Ash, Mr. Mick Reynolds, Mr. Ben Scambury and Mr. Jeff Stead, all of the Northern Land Council Anthropological division.

Indigenous consultation and negotiation

The project was conducted as a community archaeology project. Permission to live and work in the area around Yilpara was given by Djambawa Marawili, the Madarrpa clan leader, following the initial meeting with the Yilpara community, members of other, nearby communities such as Rurrangala and representatives of the Northern Land Council in 1999. The archaeological team lived in the Yilpara community for the duration of the fieldwork. A camp was established at Yilpara in 2000, and for the duration of the fieldwork period, immediately adjacent to the home of Mr. Nuwandjali Marawili and his family. Preliminary surveys were conducted in those areas specified by, and in conjunction with, Community members. The initial fieldwork strategy involved negotiation, consultation, and the familiarisation of the Yilpara community with the previously unknown method of archaeological research. Indigenous co-workers on the project included members of the Yilpara community, in particular Mr. Djambawa Marawili, Mr. Nuwandjali Marawili, their mother who recently passed away (2003), Mr. Waka Mununggurr, Mrs. Julia Marawili (Wirrpanda) and Mr. Craig Moore (a Rembarrnga man from Bulman).

Study area: Location and physical description

The study area is located approximately 200 km south of the mining town of Nhulunbuy and the former Mission settlement of Yirrkala (both on the Gove Peninsula), the Blane Peninsula being the central of three peninsulas on the northern coastal margin of Blue Mud Bay (see Fig. 1). The peninsula is situated within the Arnhem Land coastal plain. It is mainly flat, often undulating terrain (up to

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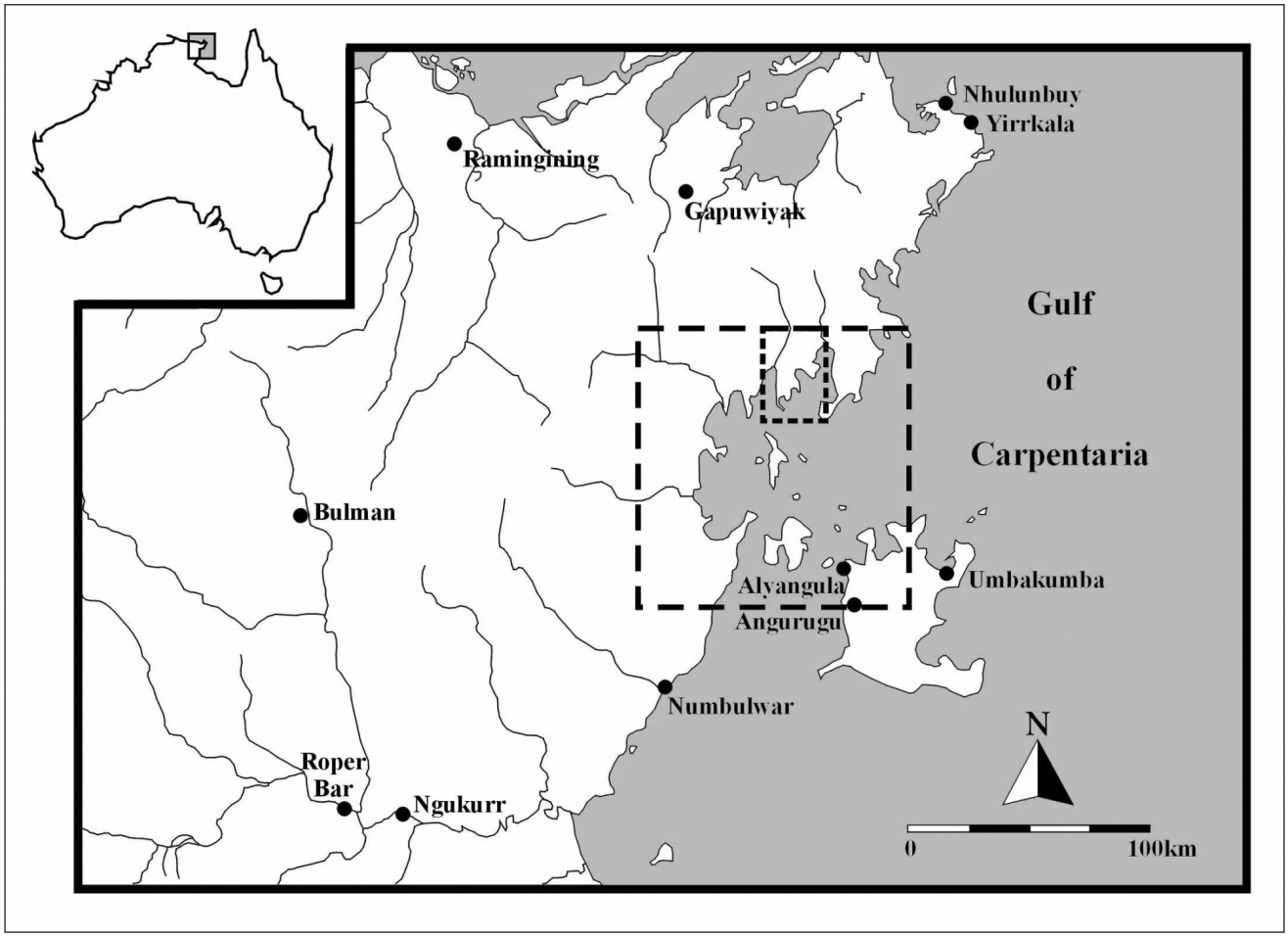

Figure 1 Location of Blue Mud Bay (large square) and the archaeological study area (small square) (redrawn from Haines et al. 1999:2).

approximately 200 m in elevation) with extensive coastal swamps and wetlands, extending up to ninety kilometres inland along the southern edge of Blue Mud Bay (Haines et al. 1999:1-2).

The geological history of the area consists of the deposition of thin terrestrial and shallow marine sediments across Blue Mud Bay, largely in response to the high stand of sea-level and the beginning of the deep weathering processes in operation from the early Holocene to the present (Bureau of Meteorology 1998:1; Haines et al. 1999:91). Therefore, the dominant land surfaces in the study area are quite shallow, as they have only been accumulating in their current configuration since the period of Holocene sea-level rise stabilisation at 6,000 BP (Grindrod et al. 1999:465; Haines et al. 1999:77; Woodroffe et al. 1998). Depositional landscapes of widely spread, fine estuarine and riverine alluvial deposits with some beach ridge development are prominent features of littoral soil zones within the study area (Haines et al. 1999:77; Specht 1958:353-356). Active sediment deposits forming on intertidal flats and in tidal channels cover extensive areas near the coast and in tidal reaches of major rivers. These are largely unvegetated, apart from stands of mangroves, and consist of unconsolidated grey clay, silt and sand, and are often highly saline soils (salt flats) (Haines et al. 1999:77; Specht 1958:350). These salt flat areas are rimmed by slightly elevated grassy black soil and grey clay plains, which are interpreted as old coastal deposits stranded by the slow regression of the coastline (Haines et al. 1999:77; Specht 1958:349; Walker and Butler 1983:83-85).

Following the marine transgression, many of the shallow bays in Northern Australia were gradually infilled to form freshwater wetlands and salt or mudflat areas (Chappell 1982:71). Although no geomorphological studies have been conducted in the study area, a large amount of research has been carried out in the Alligator Rivers region of Western Arnhem Land (Woodroffe and Mulrennan 1993). The model of estuarine evolution during the Holocene for the Alligator Rivers region suggests that the process of sedimentation continued after the stabilisation of sea-level leading to a transition from mangrove to freshwater environments (Clark and Guppy 1988:679-681). The model of estuarine evolution and Holocene deposition demonstrated for the Alligator Rivers region is said to apply broadly to other river systems across Northern Australia (Woodroffe 1995:80). Therefore, it can confidently be assumed that the post-glacial processes associated with the marine transgression and sedimentary infill has similarly formed the wetland and salt flat areas of the study area.

Previous archaeological research

The studies that fall within the area of north east Arnhem Land and which provide the most direct contexts for comparison with the current study are those conducted by Warner (1969) and more recently by Roberts (1991, 1994) at Milingimbi, the archaeological research carried

out by McCarthy and Setzler (1960) as part of the American Australian Expedition to Arnhem Land, the excavation at the Borngolo Shelter, Caledon Bay by Carmel Schrire (White 1968, 1969, 1970; Schrire 1972), the Groote Eylandt archaeological project conducted by Anne Clarke (1994) and the Cape Arnhem midden excavated by the then Department of Lands, Planning and Environment and Dhimurru Land Management (Bourke 2001).

Other studies conducted across tropical Northern Australia also provide a broad chronological and interpretive framework for understanding late-Holocene archaeology in this region. This includes studies conducted at princess Charlotte Bay (Beaton 1985) and Weipa (Wright 1971; Bailey 1977, 1994) in North Queensland, Bayley Point (Robins et al. 1998) in the southern Gulf of Carpentaria, Chambers Bay (Baker 1981) and the Cobourg Peninsula (Mitchell 1993, 1994), the Alligator Rivers region (Mowat 1995), and in Darwin Harbour and surrounding region (Bourke 2000, 2002; Burns 1994, 1999; Hiscock 1997; Hiscock and Hughes 2001). Meehan's (1982, 1983, 1988a, 1988b, 1991) ethno-archaeological research with the An-barra people in the Blyth River region has been highly influential in the interpretation of coastal occupation and resource use for the last twenty years, primarily relating to the role of shellfish in the overall diet.

The regional archaeological context provides the current project with a chronological and cultural framework for interpretation. These studies provide an understanding of the range, location and types of site likely to be encountered in the study area. The main site types include shell mounds, shell middens, earth mounds, quarries and artefact scatters, located at the junction of the hinterland and mangroves on low hill slopes, laterite platforms and salt flats (Bourke 2000:73; Bourke 2002:37; Burns 1999:59, 62-64). Radiocarbon dates suggest that shell mounds are likely to fall within a period around 2500 to 500 years ago. Shell middens, particularly on the open coast or in rock shelters, could be much older, up to 7000 years old. The studies described above, however, emphasise that most of the archaeological evidence in areas where there are few contexts for protected, deeply stratified deposits within caves or rock shelters relates to the last 5000 years. The principal conclusion from these studies that is of relevance to this project is that Aboriginal people occupying Northern coastal areas in the late-Holocene practised a generalised and flexible subsistence economy, utilising resources on the coastal margins, plains and hinterland, particularly in the last 3000-2500 years.

Fieldwork methodology

Archaeological fieldwork was undertaken in the study area during 2000 (June to November), 2001 (July to October) and 2002 (July to October). Total time spent in the field amounts to approximately twelve months over this three-year period. In keeping with the community-based nature of the research, a purposeful sampling strategy was deemed most appropriate for investigating the unknown abundance, characteristics and visibility of the archaeological record (Clarke 1994; Clarke 2002; Mitchell 1994:174; Redman 1987:251; Rhoads 1980:147; Schiffer et al. 1978:5-7). All fieldwork was carried out during the June to November period of the dry-season to ensure good vehicular accessibility and reasonable surface visibility. Initial surveys were conducted on the margins of the peninsula through the direction of community members, with subsequent surveys extending coverage on the coastal and wetland margins. Transects were walked across approximately 17 km of coastline and 13 km along the edges of the freshwater wetlands of the Durabudboi River. In addition, bush tracks and roads were utilised across the peninsula to systematically survey the inland areas, with a further 46 km of transects being surveyed in this way. The tracks were used as survey transects as they enabled an example of all environmental zones within the study area to be inspected and, although variable, afforded higher visibility than heavily vegetated areas. Where possible, surveys were also conducted in recently burnt areas. As a result, 78% of the survey sample contained an adequate visibility of 40% or higher.

For the purposes of the survey, sites were defined by distinguishing between relatively dense, discrete concentrations of archaeological material and the sparsely distributed surrounding materials (Binford 1982:5; Plog et al. 1978:389). However, it was decided that the artefact should form the basis for the minimum recording unit (Dunnel and Dancey 1983:272; Foley 1981; Holdaway et al. 1998; Thomas 1975); therefore all archaeological material discovered in the course of the survey was recorded and plotted distributionally (an approach referred to in the archaeological literature as an off-site or non-site methodology).

The site recording process included taking maximum and minimum dimensions of the site, noting the surrounding environmental features and landform associations, and characterising the types of cultural material present. An approximate percentage of ground surface visibility for the immediate area and the types of disturbance processes in operation were also noted (Sullivan 1989:51). All of the mound sites were mapped and cross-section measurements taken at the minimum (width) and maximum (length) axes. As the dominant archaeological material within the study area was shell, Number of Identifiable Specimens (NISP) counts and species presence/absence were sampled in 50 cm^2 units at regular 10 m intervals across each site, in conjunction with noting levels of fragmentation and burning. This allows for some comparison of the variation in shellfish exploitation by people across time and space within the landscape. Following the field survey, sixteen sites were selected for excavation, including ten shell middens and five shell mounds. The sites selected for excavation were determined by location, environmental context, site morphology and possible chronological variation. Broadly, the methods were adapted from Johnson (1980) to suit the specific type of site being excavated. Shell middens were excavated in either 0.5 m^2 or 1 m^2 test-pits and smaller test pits were used where several areas within the one site (or complex) were excavated for comparative purposes. Mound sites were excavated in 1 m x 0.5 m or 1 m^2 test pits. These squares were further divided into smaller 0.5 m^2 sample quadrats for laboratory sub-sampling (Ambrose 1967; Barz 1977; Casteel 1970; Claassen 1991; O'Neil 1993).

Results of fieldwork

Site distribution

A total of 141 archaeological sites were recorded during the course of the survey (Fig. 2). Very little archaeological material was recorded across the interior of the peninsula

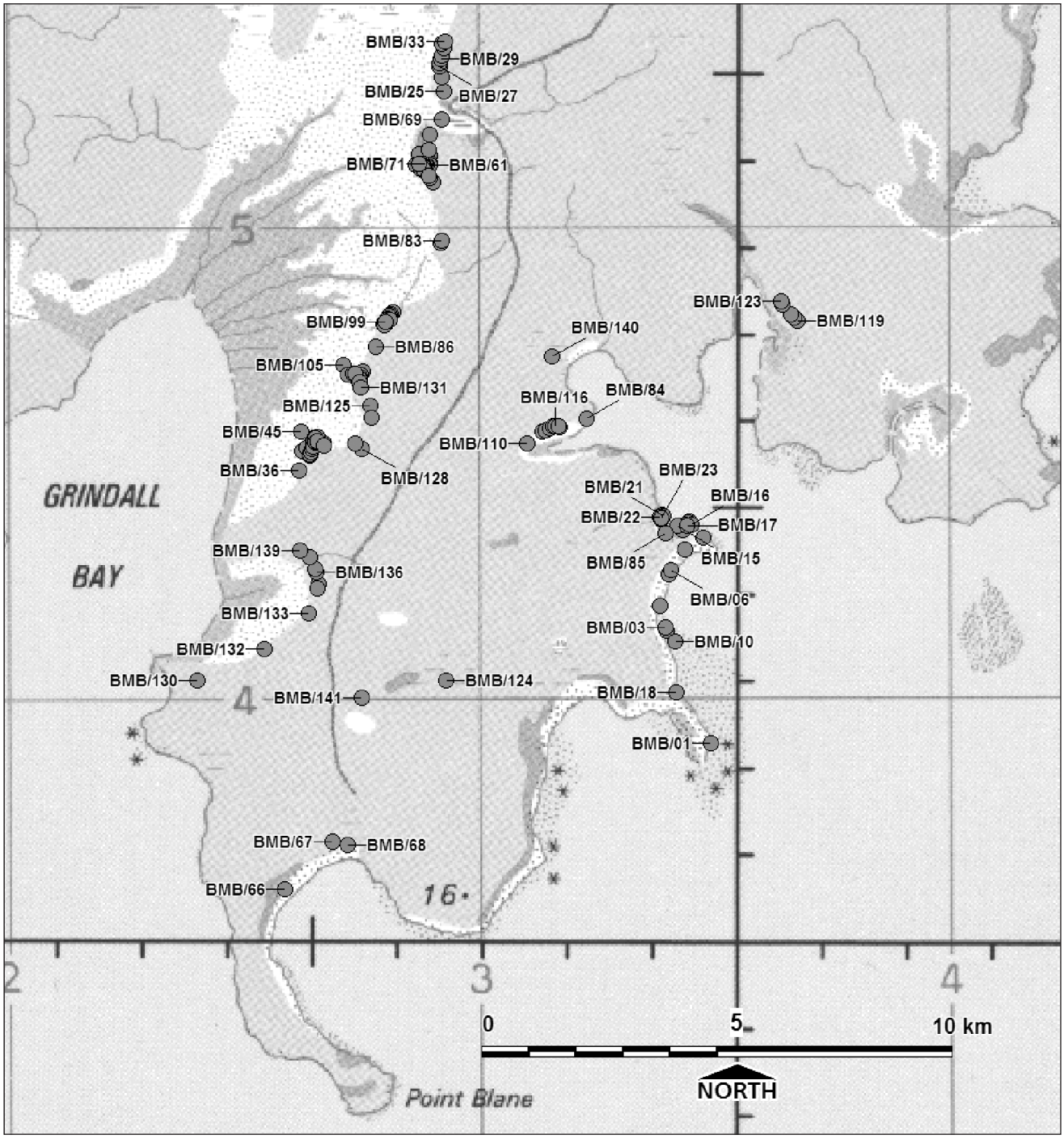

Figure 2 Distribution of sites in the study area (Geoscience Australia 1:250 000 Blue Mud Bay base map).

Site Type	Total		Coast		Wetlands	
	No.	%	No.	%	No.	%
Artefact Scatter	6	4.3	3	7.5	3	3.0
Isolated Artefacts	14	9.9	1	2.5	13	12.9
Macassan Site	1	0.7	1	2.5	0	0.0
Shell Midden	56	39.7	31	77.5	25	24.8
Shell Midden/ Artefact Scatter	3	2.1	2	5.0	1	1.0
Shell Mound	60	42.6	1	2.5	59	58.4
Well	1	0.7	1	2.5	0	0.0
Total	141	100	40	100	101	100

Table 1 Number and percentage of site types within the study area.

apart from small, localised artefact scatters or isolated stone artefacts. The types of sites recorded are evidence of a pattern of landscape utilisation predominantly orientated towards the use of coastal resources. The relative distribution of the site types recorded across the study area and by broad coastal/wetlands landscape division are presented in Table 1.

This pattern is similar to that found within the Darwin Harbour area (Bourke 2000:77; Burns 1994), where the dominant coastal site type is shell middens and mounds, followed by smaller numbers of surface stone artefact scatters or isolated occurrences of artefacts. Of the sites recorded in the study area 84% contain deposits of marine shell, compared with artefact scatters and isolated artefacts,

comprising only 14% of the archaeological material recorded. Of the 141 sites recorded, 40 are situated on the present day coastline (28%), and 101 on the edges of freshwater wetlands, a prograded area of former coastline, or significant seasonal swamps (72%). Clearly, shell deposits are the dominant archaeological site type, regardless of location.

Variation does exist, however, particularly with regard to the distribution of shell mounds and middens. When the middens and mounds are combined, they make up 80% of the coastal sites and 83% of the wetlands sites. With site type differentiation, however, mound sites dominate the wetlands at 58%, yet only make up 3% of the sites located on the modern coastline, with the lower lying shell middens at 25% and 78% respectively. This variation has implications relating to the density of a given resource within different localities, the intensity of resource use and the pattern of refuse discard. The histories of landscape evolution within these areas are quite different; therefore they will be taken as distinct environmental units for comparison.

Site morphology: Midden size and content

Size and content are used here to determine the extent of site variation between the coastal and wetlands landscape units and the most commonly occurring site types.

Area (m^2) was used as the measure of site size as it ensures the inclusion of all sites regardless of height or stratification. Descriptive statistics for site area are presented in Table 2. This data has been organised to compare area for those sites located on the present day coastline and those situated on the wetland margins. Table 2 shows that site area is appreciably larger in coastal areas than on the wetlands and swamps. It is difficult to determine whether this pattern is a reflection of site differences, or a post-depositional factor resulting from increased disturbance around the open coastline. Lower levels of disturbance, increased archaeological visibility and the more contained nature of the shell mounds may have helped to define site boundaries on the wetlands, whereas higher disturbance levels and lower archaeological visibility against a shelly-sand background on the coast may have created a site pattern with indistinct boundaries and greater post-depositional spread of material. The difference in site area between the coast and wetlands areas may be explained partially in terms of site formation factors (e.g. cyclonic activity or animal disturbance), and partially in terms of behavioural factors which have resulted in people piling shell into mounds.

248 stone artefacts were recorded during the course of the survey. The assemblage is dominated by unretouched flakes, manufactured from locally available quartzite. Analysis of this material is underway and the results will be presented in a forthcoming paper. The discussion of site content therefore primarily focuses on shell mounds and midden sites.

A total of 32 shellfish species were recorded on the surface of the shell midden and mound sites within the study area. Field observations indicated that some species may be more heavily concentrated on the exposed coastal margins, such as *Anadara antiquata* (Cockle), *Gafrarium tumidum* (Venus Shell), *Marcia hiantina*, *Polymesoda erosa* (Mud Mussel), *Septifer bilocularis*, *Isognomon isognomon* (Tree Oyster), *Ostrea* species and *Terebralia palustris* (Mud Whelk). Other species such as *Anadara granosa* (Roughbacked Cockle), *Mactra abbreviata* (Trough Clam), *Placuna placenta* (Window Pane Oyster) and *Telescopium telescopium* (Long Bum), by contrast, are concentrated within the former protected bay of the wetlands area.

NISP counts were used to measure relative abundance of shellfish species. The number of shellfish taxa per site (NTAXA) and NISP counts were used together to measure site variability. Descriptive statistics for the number of taxa (NTAXA) and density of material (NISP/0.5 m^2) are presented in Table 3. The coastal sites show a mean NTAXA of 7.06, compared with a mean of 4.92 for the wetlands sites, suggesting that there was a broader range of shellfish species exploited on the coast compared with the wetlands area. This pattern could be due to a greater range of shellfish species being available on the coast as opposed to the wetlands area, rather than behavioural differences in the choice of resources exploited.

The mean site density values refer to the number of shell pieces, both whole and fragmented. Site density shows an inverse of the NTAXA pattern, with a very low density of material in the coastal sites, at a mean of 147/0.5 m^2, compared with 644/0.5 m^2 for the wetlands sites (Table 3). Given that shell mounds dominate the wetlands and

Area (m^2)	Mean	Median	S.D.	Min	Max	Range	Number
All Sites	644.95	175.5	2006.34	0.25	16000	15999.75	141
Coast	1252.65	101.11	3302.44	0.5	16000	15999.5	40
Wetlands	404.28	201	1084.42	0.25	10620	10619.75	101

Table 2 Descriptive statistics for site area by landscape unit.

NTAXA	Mean	Median	S.D.	Min	Max	Range	Number
All Sites	5.55	5	3.26	1	23	22	110
Coast	7.06	6	4.65	1	23	22	27
Wetlands	4.92	5	2.2	1	11	10	83
NISP/0.5m^2							
All Sites	521.67	328	543.12	9	3580	3571	110
Coast	147.19	92	120.43	9	468	459	27
Wetlands	643.49	496	571.23	11	3580	3569	83

Table 3 Descriptive statistics for the number of taxa per site and NISP/0.5m^2 per site.

Location	Lab Code	CRA (BP)	Calibrated Date (Cal bp)	One Sigma Range (Cal bp)	Two Sigma Range (Cal bp)
Coast	ANU-11911	122.3 ± 1.0	Modern	N/A	N/A
	ANU-11503	3200 ± 70	2965	3074 - 2872	3194 – 2785
Wetlands	ANU-11495	2660 ± 60	2326	2354 - 2292	2471 - 2172
	ANU-11717	990 ± 60	550	624 - 517	653 - 487

Table 4 Comparison of date ranges for sites occurring in coastal and wetland locations within the study area

swamps, this density pattern is not surprising, as the mounds are comprised of very densely packed, fragmentary shell, usually built up to a height of 30 cm or more. Unlike mounds, however, surface deposits of shell are likely to be more affected by processes of post-depositional disturbance, creating a larger site area and lower artefactual density with the spread of material. Moreover, *Anadara granosa* which dominates the mound sites is a robust shell which is much more resistant to fragmentation and disturbance compared with *Marcia hiantina*, which dominates the midden scatters on the exposed coastline.

Chronology

Dating and analysis are still in progress, however results to date indicate a long sequence of occupation and coastal resource utilisation within the study area, ranging from approximately 3000 years BP to the present. The maximum and minimum conventional radiocarbon ages, the calibrated ages and the one and two sigma date ranges for these sites according to their broad environmental context are listed in Table 4.

At Blue Mud Bay, use of the open coastal areas spans the entire 3000 year period, whereas sites on the wetlands spans only the last 1800 years. Occupation of the wetlands appears to begin some 600 years after the open coast at 2326 BP, and fades out around 550 BP. As seen in the analysis of site distribution and morphology, the difference between these two broad landscape areas is likely a reflection of differential resource availability, which is undoubtedly linked to processes of environmental alteration. Following from the generally accepted pattern of estuarine infill and coastal progradation, this pattern is to be expected. That is, people followed the movement of the marine resource base with the changing environment (Chappell 1982:71; Woodroffe et al. 1998).

The sites on the open coastline show relatively continual occupation with a high species diversity for the last 3000 years. In contrast, the *Anadara granosa* dominated shell midden and mound sites correspond with a very defined period of time, when processes of sedimentation within the former bay created an optimal habitat for this species (see Bourke 2003:43). Around 500 BP, the more open shorelines of the prograding bay possibly shifted to a mangrove dominated shoreline, an environmental change noted within Darwin Harbour that has been linked to a cessation of mound building and a decrease in *Anadara granosa* dominated sites (Hiscock 1997:447).

The Blue Mud Bay chronology fits neatly into the previously established pattern of coastal occupation for Northern Australia, showing continual occupation for the last 3000 years. Although there is variation between the wetlands and the open coast, clearly this relates to the processes of landscape alteration and the distribution and availability of resources.

Past occupation and economic systems

In discussing the changes in the pattern of resource exploitation in this area during the mid to late-Holocene, it should be noted that due to preservation conditions and differential preservation of remains, it is not possible in this case to use archaeology to evaluate all of the dietary components of a past economy (see examples by Luebbers 1978, Meehan 1972 and Shawcross 1967). This is because the shellfish component has excellent preservation, while other important contributions to the economy, such as marine and terrestrial faunal remains and botanical matter may be under-represented or absent due to poor preservation in tropical conditions (see White 1968:8-9). This differential preservation is reflected in the minimal range of site types recorded in the study in comparison with other regions, for example Darwin Harbour (Bourke 2000). Shell middens and mounds, by far the dominant site type in the area, are essentially dumps or refuse sites, as opposed to occupation sites. Therefore, it is highly unlikely that the patterns of settlement and subsistence discussed here are a true reflection of the overall economy or range of activities in this area. The pattern of resource use on the Blane Peninsula revealed by this study must consequently be viewed as a component, or subset, of the overall diet.

Very little bone has been noted within the excavated sites on the Blane Peninsula, and where it does occur; it is representative only of fish. The importance of larger marine or terrestrial animals to the diet can therefore not be assessed, although it is reasonable to assume that larger terrestrial and marine animals were only a minor element of the food consumed at these particular sites. Though it could be expected that more robust elements, such as teeth, that take some time to decay, might be present within these sites, the absence of such remains in the more modern levels of occupation supports the conclusion that these animals were of minor importance.

What may be stated is that this research provides evidence of a coastally dominated economic system. In comparing sites located on the Durabudboi Wetlands with the exposed coastline, it can be seen that regardless of variations that exist across the study area, there is little economic differentiation between the wetlands and the open coast sites. The variations that do exist are in line with the patterns of environmental changes that occurred throughout the late-Holocene across Northern Australia. This reinforces the interpretation that the exploitation strategy of marine resources within Blue Mud Bay was deliberate and systematic, and in keeping with other areas within Northern Australia. The marine focus in the archaeological record strongly suggests that the coastal zones have been the primary resource base for the occupants of Blue Mud Bay throughout the Holocene.

Conclusion

The pattern of Indigenous coastal settlement and

subsistence in Blue Mud Bay during the late-Holocene, identified through archaeological survey, excavation and preliminary analysis. General resource exploitation patterns have been identified in this study that are similar to those reported by other researchers across the tropical North of Australia (e.g. Bailey 1977, 1994; Beaton 1985; Bourke 2000; Meehan 1977, 1982; Mitchell 1993, 1994; Mowat 1995; Roberts 1991, 1994). These patterns include the dominance of middens and mounds, the use of similar resources (such as comparable shellfish species), the distribution of sites across similar landscapes and the timing and extent of occupation through the late-Holocene period. The archaeological evidence presented from the Blane Peninsula in Blue Mud Bay is suggestive of a predominantly coastally oriented economy. For at least the last 3000 years the economic strategy of people inhabiting this area has been focussed for the most part on resources found within the marine zone, complemented by less intensive, seasonal use of the freshwater wetlands and open woodland closer to the coast.

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