SETTLEMENT AND SUBSISTENCE ACTIVITIES ALONG TIN CAN BAY, SOUTHEAST QUEENSLAND

IAN MCNIVEN

Archaeology
La Trobe University

INTRODUCTION

Tin Can Bay flanks the northwestern boundary of the Cooloola region, coastal southeast Queensland. It is a rich estuarine environment emptying into the southern end of the Great Sandy Strait which separates Fraser Island from the mainland (Figure 1). In 1983, I undertook a survey along the eastern periphery of the bay as part of Stage 1 of the Cooloola Region Archaeological Project (McNiven 1984, 1985). The survey aimed to provide insights into the form, frequency and spatial arrangement of archaeological materials, and to integrate these results within an environmental framework. As part of Stage 2 research in the region, I re-analysed Stage 1 survey data and excavated two midden sites (McNiven 1990a). The work aimed at providing more detailed information about site location and content and a chronological perspective to the project. This paper presents preliminary results of this research, focusing upon the nature and development of associated estuarine settlement-subsistence activities. The broader spatial implications of this work have been integrated within a more encompassing regional model of settlement-subsistence behaviour (see McNiven 1990a, in press a).

ENVIRONMENTAL SETTING

The eastern periphery of Tin Can Bay stretches for some 60km northwards from Carland Creek to the western tip of Inskip Point (Figures 1 and 2). Its southern and northern halves are backed by the Coastal sand plain and Strand plain physiographic units respectively (Figure 1), while expansive tidal sand and mudflats flank the length of the bay (Thompson and Moore 1984). The immediate coastal fringe (<1km inland) of the bay is mostly less than 5m a.s.l. and consists of Pleistocene and Holocene aeolian sand deposits with podzol soils separated by low (<1m a.s.l.) drainage basins and channels exhibiting humus/peaty podzols. Freshwater is freely available along most lower lying areas, either from perennial waterways or from watertables less than 1.5m from the ground surface (Thompson and Moore 1984; see also Reeve, Fergus and Thompson 1985)

Vegetation along the coast generally reflects drainage status, and ranges from tall open forest on more elevated ground to swamps on lower elevation areas (Harrold et al. 1987; Sandercoe 1986; Thompson and Moore 1984). Four vegetation zones have been identified on more elevated areas. They include Forest red gum (Eucalyptus tereticornis) and coastal cypress (Callitris columellaris) forest complex, Casuarina (Casuarina littoralis) and mallee brush box (Lophostemon confertus) forest, Wallum banksia (Banksia aemula) woodland, and Scribbly gum (Eucalyptus signata) woodland. Vegetation on lower lying areas ranges from Heathland (Banksia spp.) to Paperbark (Melaleuca quinquenervia) swamp, Mixed paperbark woodland, and Paperbark and forest red gum woodland. Large mangrove (e.g. Bruguiera gymnorhiza) forests characterize the intertidal zone along most of the bay.

The potential terrestrial mammal resource base of the Coastal sand plain and Strand plain physiographic units is poor (Dwyer, Hockings and Willmer 1979; Dwyer, Kikkawa and Ingram 1979). Uncommon to rare species include northern brown bandicoots (Isoodon macrourus), ringtail possums (Pseudocheirus peregrinus), brushtail possums (Trichosurus caninus), grey kangaroos (Macropus giganteus), swamp wallabies (Wallabia bicolor) and dingoes (Canis familiaris dingo). The only relatively abundant mammals are murid rodents (Muridae), flying foxes (e.g. Pteropus scapulatus) and bats (Syconycteris australis). In marked contrast, the waters of Tin Can Bay are rich in a variety of fish species including bream (Acanthopagrus australis), whiting (Sillago spp.) and flathead (Platycephalus spp.). Similarly, extensive tidal sand and mudflats provide a rich suite of shellfish and crustaceans, including commercial oyster (Saccostrea commercialis), cockle (Anadara trapezia), club whelk (Pyrazus ebeninus) and mud crabs (Scylla serrata).

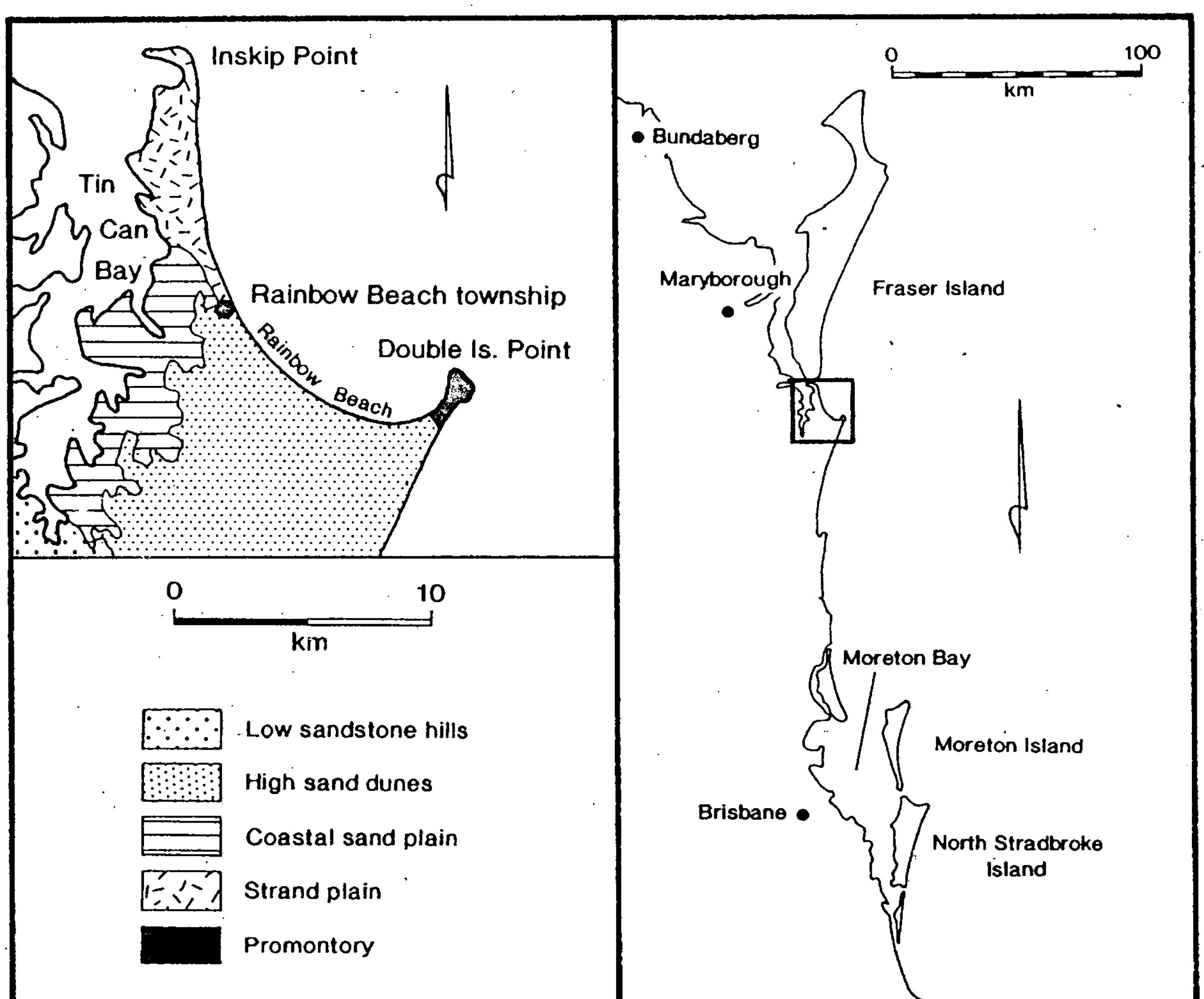

Figure 1. Map of the study area.

A variety of major plant foods have been identified along Tin Can Bay. More common species include bungwall fern (Blechnum indicum), cabbage-tree palm (Livistonia decipiens), bracken fern (Pteridium esculentum) and orange mangrove (Bruguiera gymnorhiza) (Gillieson and Hall 1982; Golson 1971; Harrold et al. 1978; Isaacs 1987; Kamminga 1981; Mathew 1910).

SITES

The eastern periphery of the bay was surveyed using a 45% random sample of 1km-long transects extending up to 50m inland from the high water mark (McNiven 1985:10,14). Employing a site discreteness measure of 10m between cultural remains, the 27 sampled transects resulted in the discovery of 71 sites represented by 54 (76%) shell middens, 16 (23%) stone artefact scatters and one (1%) isolated scarred tree (Figure 2). Most middens were observed within naturally eroded sections at the high water mark. These erosion sections generally ranged in height from 0.2m to 1.5m, and appeared to result from tidal action. Such action is slowly destroying in situ midden deposits, producing surface scatters of shells and stone artefacts on adjacent tidal flats. All stone artefact scatters were recorded on tidal flats adjacent to the high water mark.

Middens were dominated by cockle, club whelk and oyster shells. Other faunal remains observed included a single mud crab claw at Site 57 (McNiven 1985:14) and single scallop (species?) shells at Sites 42 and 65. A range of stone artefact raw material was observed (silcrete, andesite, sandstone, quartzite, chert - McNiven 1984:137), while the only major formal artefacts identified were bevel-edged tools (cf. bevelled pounders - Gillieson and Hall 1982; Kamminga 1981; McNiven 1991a, in press b). Recent use-wear and residue analysis of similar tools suggests a function associated with plant food processing (Gillieson and Hall 1982; Hall, Higgins and Fullagar 1989; Higgins 1988; Kamminga 1981).

SITE DISTRIBUTION

Shell middens exhibit a clustered distribution along the bay (McNiven 1985:14). Following preliminary insights concerning the positive locational bias of middens to "open forest" vegetation (McNiven 1985:14-15), a more detailed locational analysis was undertaken using a more comprehensive vegetation map (Sandercoe 1986). Analysis was restricted to the 14 survey transects along the southern half (30km) of the coastline due to the spatial limits of Sandercoe's (1986) map and the availability of detailed site location data (i.e. Sites 45-86, n=43). Site 65 was deleted from the analysis due to its location on open tidal sandflats.

Middens were recorded within five of the eight vegetation types described for the bay (Table 1). The probability that this distribution is random is <0.05 (X^2=16.5, 7 d.f.). A comparison of the observed and expected number of middens within each vegetation type reveals that only three vegetation types exhibit more middens than expected. That is, a positive bias exists for the location of middens within Forest red gum and coastal cypress forest complex, Casuarina and mallee brush box forest and Scribbly gum woodland (Table 1). Each of these vegetation types exhibits 1.4, 1.6 and 2.0 times respectively the number of middens that would be expected if no biases in shell midden distribution existed along Tin Can Bay. Similarly, the density of middens within each of these vegetation types (1 midden/0.2km) is some 2.5-6.0 times that recorded for the other two vegetation types exhibiting middens (one midden/0.5-1.2km).

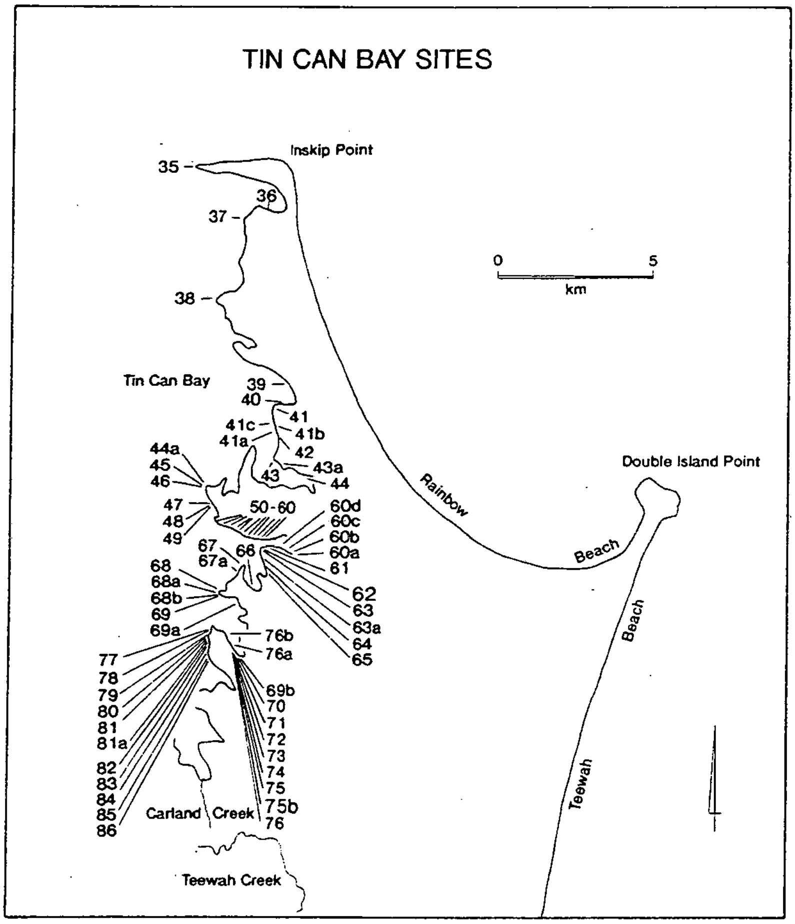

Figure 2. Location of sites along eastern periphery of Tin Can Bay.

The distribution of the 12 stone artefact scatters along the southern half of the bay differed to that observed for shell middens. Artefact scatters were found adjacent to six of the eight vegetation types surveyed, with no apparent locational bias towards any particular type (Table 2).

SITE SIZE

The length of stratified midden deposits along the coast ranged from less than a metre (e.g. Site 78) to 145m (Site 54), with a mean of nearly 26m (McNiven 1985:14). Unfortunately, limited visibility precluded accurate assessment of midden areas. The one exception was Site 42 which exhibited a surface scatter of shell over an area of approximately 115,000 m^2.

In contrast to the size of middens, most (n=14) stone artefact scatters were very small, consisting of three artefacts or less. The largest was Site 69b which measured over 10m x 50m in area and exhibited over 60 artefacts.

Table 1. Association of shell middens and vegetation types along Tin Can Bay.

Vegetation type	Coast length (km)	(%)	Middens (n)	(%)	Site density	O	E
FRGCCFC	4.4	31.4	19	44.2	1/0.2km	19	13.5
CMBBF	2.8	20.0	14	32.6	1/0.2km	14	8.6
WBW	0.2	1.4	0	0.0	-	0	0.6
SGW	0.5	3.6	3	7.0	1/0.2km	3	1.5
H	1.2	8.6	1	2.3	1/1.2km	1	3.7
PS	0.2	1.4	0	0.0	-	0	0.6
MPW	3.1	22.1	6	14.0	1/0.5km	6	9.5
PFRGW	1.6	11.4	0	0.0	-	0	4.9
Total:	14.0	100	43	100		43	43

FRGCCFC = Coastal red gum and coastal cypress forest complex
CMBBF = Casuarina and mallee brush box forest
WBW = Wallum banksia woodland
SGW = Scribbly gum woodland
H = Heathland
PS = Paperbark swamp
MPW = Mixed paperbark woodland
PFRGW = Paperbark and forest red gum woodland
O = observed
E = expected

Table 2. Association of stone artefact scatters and vegetation types along Tin Can Bay.

Vegetation type	Coast length (km)	(%)	Stone artefact scatters (n)	(%)	E
FRGCCFC	4.4	31.4	3	25.0	3.8
CMBBF	2.8	20.0	1	8.3	2.4
WBW	0.2	1.4	1	8.3	0.2
SGW	0.5	3.6	0	0.0	0.4
H	1.2	8.6	1	8.3	1.0
PS	0.2	1.4	0	0.0	0.2
MPW	3.1	22.1	4	33.3	2.7
PFRGW	1.6	11.4	2	16.7	1.4
Total:	14.0	100	12	100	12

FRGCCFC = Coastal red gum and coastal cypress forest complex
CMBBF = Casuarina and mallee brush box forest
WBW = Wallum banksia woodland
SGW = Scribbly gum woodland
H = Heathland
PS = Paperbark swamp
MPW = Mixed paperbark woodland
PFRGW = Paperbark and forest red gum woodland

EXCAVATIONS

Two sites were excavated from the southern half of Tin Can Bay to provide further insights into the range and chronology of cultural remains from the Coastal sand plain physiographic unit. This selection strategy allowed integration of results with existing archaeological data, the bulk of which was available from the southern half the bay and adjacent northern sections of the Coastal sand plain and High sand dunes physiographic units (McNiven 1985). The sites are Tin Can Bay Site 75b and Cameron Point Site 62 (Figure 2).

TIN CAN BAY SITE 75B

The site

Tin Can Bay Site 75b is part of a complex of middens along a small baylet adjacent to expansive tidal mudflats. It is intermittently exposed for some 10m along a c. 1m-high erosion face extending northwest of a cluster of large cypress trees. Surrounding vegetation is Casuarina and mallee brush box forest. A small freshwater spring is located immediately southeast of the site (Figure 3).

Excavation and stratigraphy

Two contiguous 50cm x 50cm Squares (SQs A and B) forming a rectangular-shaped test pit were excavated in a relatively dense concentration of shell to obtain an adequate sample of cultural remains for analysis (Figure 3). Each square was control excavated using one or multiple 'bucket' Excavation Units (XU) (see Johnson 1979) subsequent to wet sieving through 3mm mesh. Larger stone artefacts were plotted in three dimensions and sediment samples were taken for XUs from SQA. The pit was excavated to a maximum depth of 92cm (SQA) and 42 XUs totalling 630.3kg of deposit were removed.

Two major Stratigraphic Units (SU) were identified (Figure 4). SU1a and SU1b consist of relatively loose sediment grading from dark gray (10YR-4/1) sand with a pH of 4.5 to light brownish gray (10YR-6/2) sand with a pH of 7.5 with depth. They extend from the surface down to a maximum depth of c. 23cm (SQA). SU1b (midden zone) exhibits a major concentration of shell and yielded the bulk of cultural remains recovered from the pit. SU2 extends from c. 9cm below the surface for some 70-80cm to the base of the pit. It mostly consists of loose, light gray (10YR-7/1) sand grading to white (10YR-8/1) and very light gray (10YR-7/2) sand towards the base of the pit. Acidity (pH) values range from 6.5 to 8.0. The upper section of this unit exhibits a low number of shell fragments and stone artefacts around a series of large tree roots.

Dating

A 56.0g sample of oyster and club whelk shell fragments was submitted for radiocarbon age determination to Beta Analytic Inc. through the NWG Macintosh Centre for Quaternary Dating, The University of Sydney. The sample was obtained from SQA:XU7 to date the base of the midden. The resulting age in radiocarbon years is 700q70 bp (Beta-19421), producing a calibrated and marine reservoir (450 year - Gillespie and Temple 1977) corrected age of modern (Table 3). Thus, the midden probably dates to the 19th century.

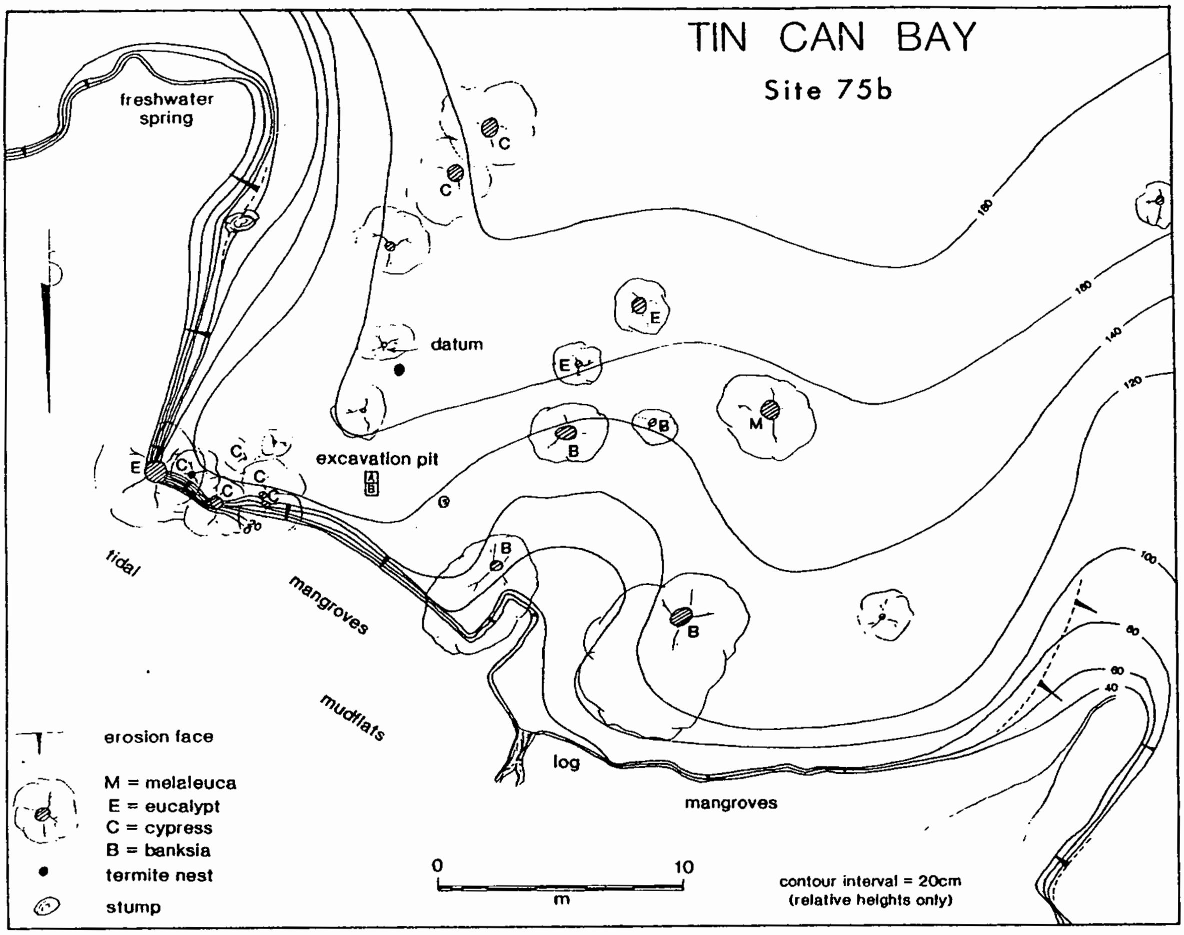

Figure 3. Site plan of Tin Can Bay Site 75b.

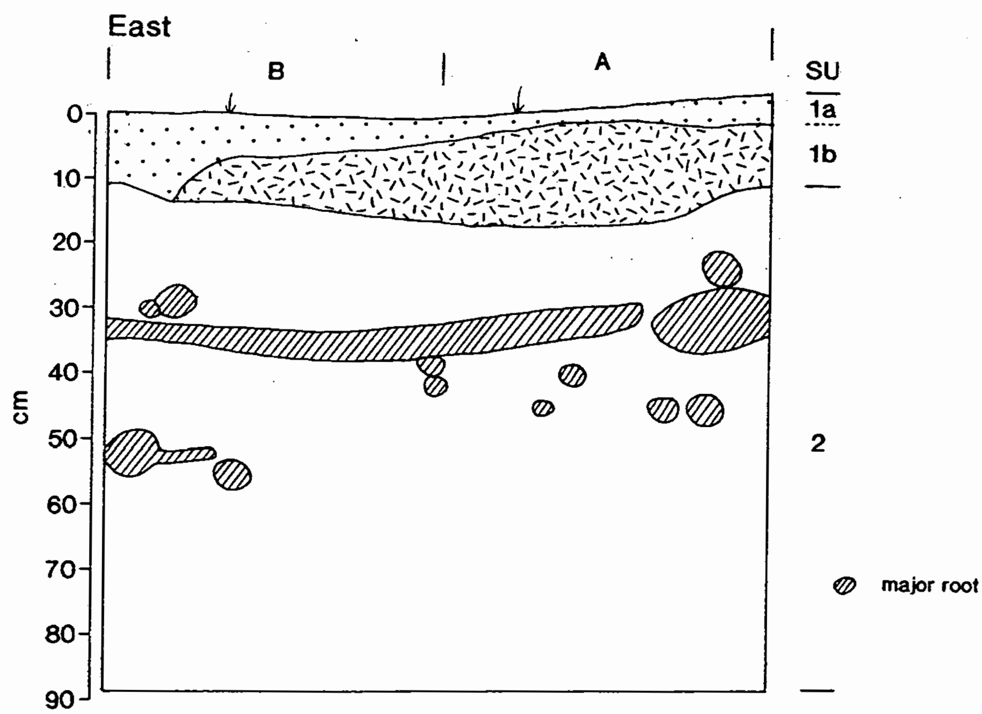

Figure 4. Stratigraphic section for Tin Can Bay Site 75b.

Table 3. Radiocarbon age determinations for Tin Can Bay sites.

Lab. No.	Site No.	SQ-XU	Depth (cm)	C-14 age (yrs bp)	Cal. age (yrs BP)	Cal. age (2 sigmas)
Beta-19421	75b	A-7	18-21	700q70	modern^	modern
Beta-34400	62	B-6	14-17	190q50	199*	416-0
Beta-34401	62	B-10	27-30	950q60	807#	970-730

KEY:
^ = marine reservoir corrected (Gillespie and Temple 1977)
* = one of seven calibrated dates (282, 199, 192, 173, 154, 3, 0)
# = one of three calibrated dates (917, 807, 803)
NB. Calibrations made using CALIB (Rev. 2.0) computer program (Stuiver and Reimer 1986). Calibrated dates chosen represent those closest to the midpoint of the 2 sigma calibrated age range.

Cultural remains

Cultural materials included shellfish remains, vertebrate remains and stone artefacts. The bulk of faunal remains were restricted to the upper 25cm of the deposit, while stone artefacts were found throughout most of the sequence (Figure 5, see Appendix). Due to time restrictions, only shellfish remains recovered from SQA were analysed in full.

Shellfish

A total minimum number of 909 shellfish (based on MNI/XU) weighing 6656.1g was recovered from SQA. Species included commercial oyster (<u>Saccostrea commercialis</u>), club whelk (<u>Pyrazus ebeninus</u>), toothed oyster (<u>Ephippium ephippium</u>), sand snail (<u>Polinices sordidus</u>), mud whelk (<u>Velacumantus australis</u>), nerite (<u>Nerita lineata</u>), cockle (<u>Anadara trapezia</u>), limpet (<u>Patelloida mimula</u>), periwinkle (<u>Bembicium nanum</u>), pipi (<u>Donax deltoides</u>), hairy mussel (<u>Trichomya hirsuta</u>), murex (<u>Bedeva paivae</u>, <u>Cronia contracta</u>) and Mactridae (Table 4). Commercial oyster is the most numerous shellfish type recovered, followed by club whelk, toothed oyster and sand snail. Of lesser importance is mud whelk, nerite and cockle, followed by a minor representation of limpet, periwinkle, pipi, hairy mussel, murex and Mactridae. As commercial oyster, club whelk, toothed oyster and sand snail represent the larger shellfish recovered, it is clear that they constituted the bulk of shellfish meat consumed at the site.

All shellfish could have been procured from the inter-tidal zone adjacent to the site. The only exception is the four pipi shells recovered from XUs 3 and 4. These shells could have been obtained from either Rainbow Beach or Teewah Beach located at distances of 9km and 13km respectively.

A number of changes occur in the vertical distribution of shellfish taxa (Table 4). For example, while commercial oyster and club whelk occur throughout most of the midden, there exists a spatial disjunction between toothed oyster (XUs 1-4) and sand snails (XUs 4-7) (see below).

Table 4. MNI for shellfish identified from SQA, Tin Can Bay Site 75b.

XU (no.)	1 MNI	2 MNI	3 MNI	4 MNI	5 MNI	6 MNI	7 MNI	8 MNI	9 MNI	10 MNI	11 MNI	12 MNI	13 MNI	14 MNI
1	3	0	0	0	0	0	0	0	0	0	0	0	4	0
2	21	2	1	0	0	0	0	0	0	0	0	0	41	0
3	38	2	1	1	1	2	1	0	0	0	0	0	90	16
4	5	0	2	0	3	6	2	5	1	0	3	0	249	40
5	0	0	2	0	0	6	1	8	1	1	27	2	168	35
6	0	0	0	0	0	0	1	0	0	0	5	12	38	29
7	0	0	0	0	0	0	1	0	0	0	1	0	11	12
8	0	0	0	0	0	0	0	0	0	0	0	0	3	1
9	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12	0	0	0	0	0	0	0	0	0	0	0	0	0	1
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	1
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total:	67	4	6	1	4	14	6	13	2	1	36	14	604	137

KEY
1 = toothed oyster (*Ephippium ephippium*)
2 = hairy mussel (*Trichomya hirsuta*)
3 = periwinkle (*Bembicium nanum*)
4 = Mactridae
5 = pipi (*Donax deltoides*)
6 = mud whelk (*Velacumantus australis*)
7 = limpet (*Patelloida mimula*)
8 = cockle (*Anadara trapezia*)
9 = murex (*Bedeva paivae*)
10 = murex (*Cronia contracta*)
11 = sand snail (*Polinices sordidus*)
12 = nerite (*Nerita lineata*)
13 = commercial oyster (*Saccostrea commercialis*)
14 = club whelk (*Pyrazus ebeninus*)

Vertebrates

Vertebrate remains consisted of only two fragments of unburnt bone weighing 0.01g in SQB:XU1. However, these may not have been discarded by Aboriginal people. For example, as bone fragments were observed in recent dingo scats near the site, it is possible that the excavated bone represents weathered dingo fecal material. Future taphonomic research may resolve this issue (see McNiven 1990b).

Stone artefacts

A total of 170 stone artefacts weighing 151.12g was recovered from the pit. These are represented by 22 flakes (complete and broken) (12.9%), 148 manuports (87.1%) and at least seven raw material types (Table 5). While the dominant raw material was quartz (78.8%), most of this stone was in the form of small pebble/fragment manuports (n=133). At present, it remains unknown why these items were discarded at the site. It is possible, however, that they were brought inadvertently to the site attached to some other resource (e.g. soil surrounding plant foods, Su Davies, Department of Anthropology and Sociology, The University of Queensland, pers. comm. 1989).

One manuport appears to have been intentionally transported to the site. It weighs 131.2g and consists of a tabular fragment of ferruginous sandstone (oxide). This item could have been obtained from a number of creeks along the western side of the sandmass or from either Teewah Beach or Rainbow Beach where layers of identical material form within Pleistocene dunes (Thompson and Moore 1984). It exhibits neither flaking nor use-wear, and at present, its function(s) remain unknown.

The majority of flakes were manufactured from either andesite (n=7) or silcrete (n=12). All of the andesite flakes and seven of the silcrete flakes were recovered from the midden (XUs 1-9) while the remaining five silcrete flakes were found beneath (XUs 10-21).

The only evidence for tool use at the site was four flakes exhibiting use-wear along the platform recovered from the midden (XUs 1-9). They range in size from 0.05g to 3.17g and are made from andesite (n=1) and silcrete (n=3). One of the flakes is a bevel flake deriving from the working edge of a bevel-edged tool (see McNiven 1991a, in press b). The remaining three flakes exhibit a section of a heavily use-worn ('rounded') working edge of an 'east coast chopping tool' (Kamminga 1978:270-277). These artefacts provide strong evidence for plant food processing at the site.

Table 5. Stone artefact raw materials for SQs A and B, Tin Can Bay Site 75b.

Raw material	n	%	wt. (g)	%
Quartz	134	78.8	5.64	3.7
Silcrete	13	7.6	5.58	3.7
Sandstone	11	6.5	1.37	0.9
Andesite	7	4.1	6.41	4.2
Oxide	3	1.8	132.01	87.4
Basalt	1	0.6	0.05	0.1
Unknown	1	0.6	0.06	0.1
Total:	170	100	151.12	100

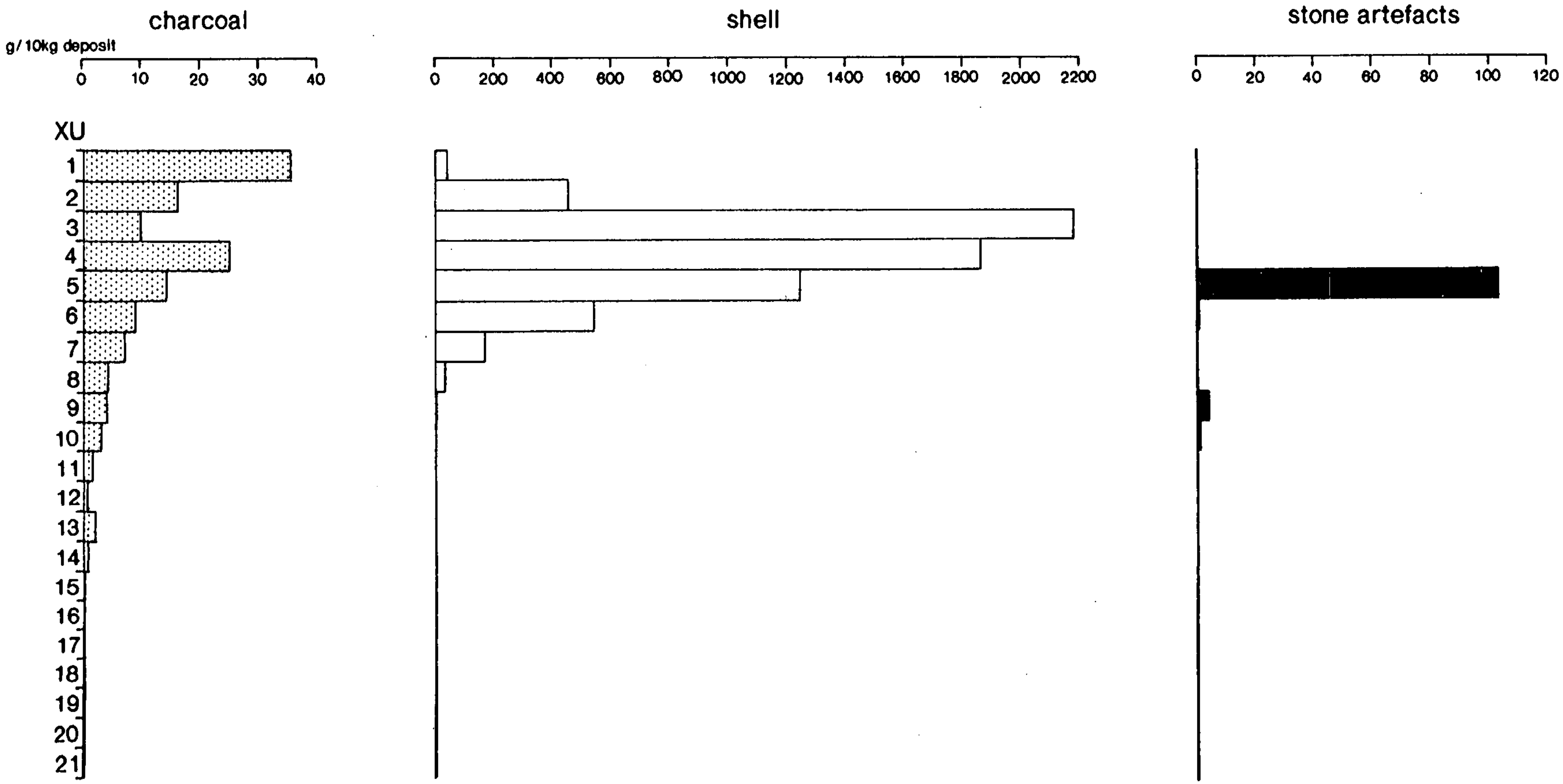

Figure 5. Vertical distribution of excavated finds from Square A, Tin Can Bay Site 75b.

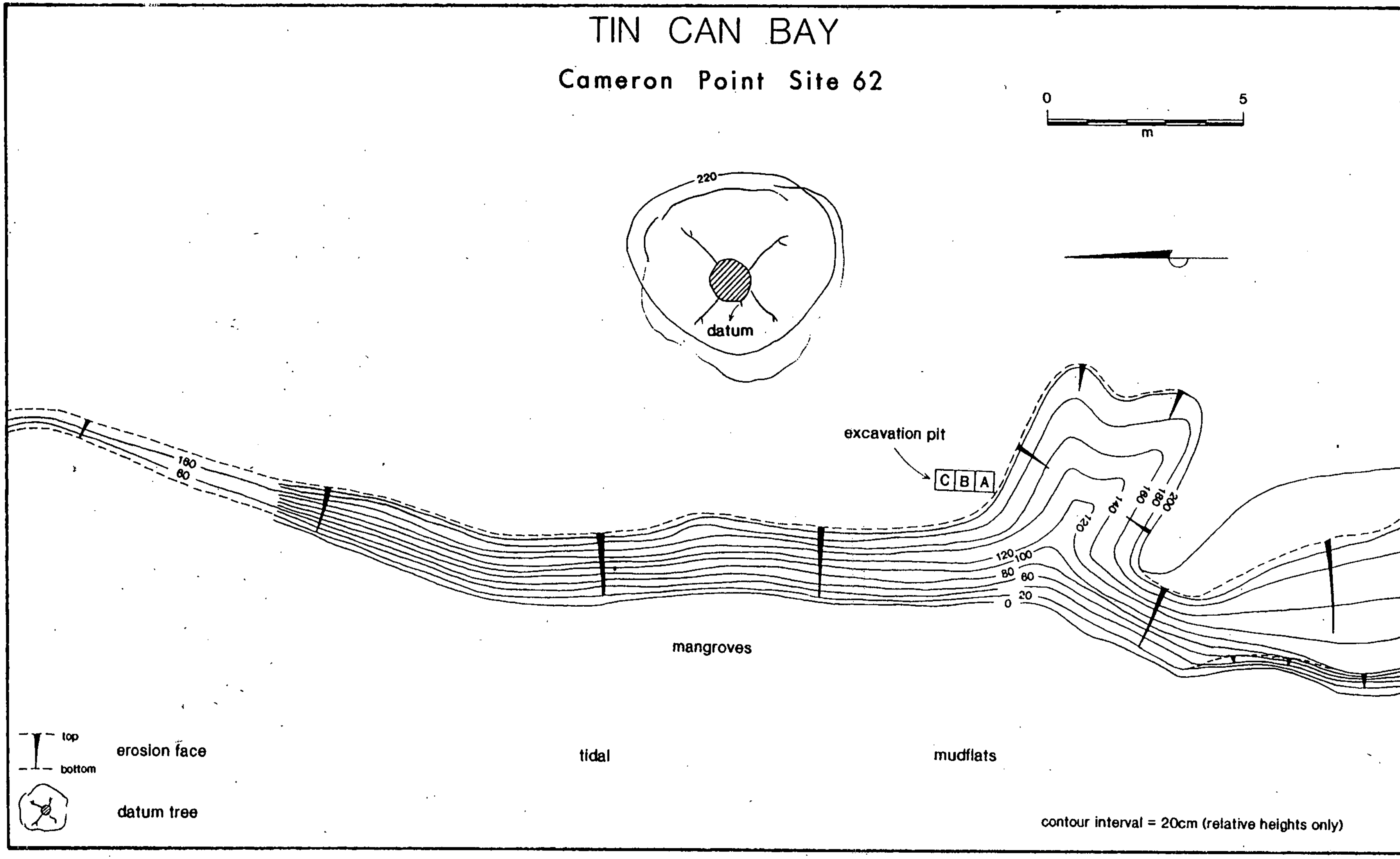

Figure 6. Site plan of Cameron Point Site 62.

CAMERON POINT SITE 62

Cameron Point Site 62 is a large shell midden exposed for approximately 40m along a 2m-high erosion face (Figure 6). At the foot of this erosion face is a lag deposit of stone artefacts and midden debris. Natural erosion sections indicate that the site is at least 5m wide. Surrounding vegetation comprises Forest red gum and coastal cypress forest complex.

Three contiguous 50cm x 50cm Squares (SQs A, B and C), forming a rectangular-shaped pit, were placed adjacent to a relatively thick exposure of shell to obtain an adequate sample of cultural remains for analysis (Figure 6). Excavation procedures were similar to those from Site 75b. The pit was excavated to a maximum depth of 52cm (SQs B and C) and 39 XUs totalling 371.7kg of deposit were removed. All excavated materials were dry-sieved through 3mm mesh.

Two major stratigraphic units were identified (Figure 7). SU1 extends from the surface down to a maximum depth of 22cm (SQA). It consists of loose, very dark gray (10YR-3/1) sand with pH values ranging from 4.0 to 5.5. The bulk of shell was restricted to this unit. SU2 is located beneath SU1 and grades from gray (10YR-5/1) sand with a pH of 6.0 to light gray (10YR-6/1) sand with a pH of 4.0 with depth. It extends from 13cm below the surface for some 29-37cm to the base of the pit and exhibits a number of large tree roots. Most stone artefacts were restricted to this unit.

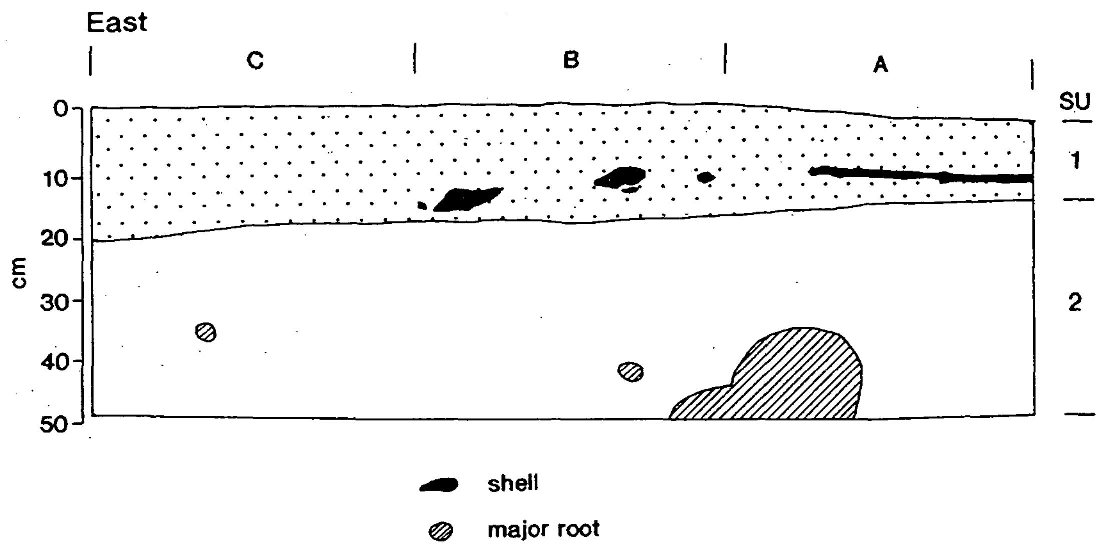

Figure 7. Stratigraphic section for Cameron Point Site 62.

Dating

Two samples of charcoal were submitted to Beta Analytic Inc. for radiocarbon age determination. One (11.0g) was obtained from the base of SU1 (SQB:XU6) in order to date the base of the midden (Figure 8) and gave the resultant age of 190q50 bp (Beta-34400). The calibrated age is 199 BP (Table 3). The other sample (12.0g) was obtained from SQB:XU10 in SU2 to establish the antiquity of cultural discard (stone artefacts) at the site. Its age in radiocarbon years is 950q60 bp (Beta-34401), yielding a calibrated age of 807 BP.

Cultural remains

Cultural materials included shellfish remains, vertebrate remains and stone artefacts. The bulk of faunal remains was restricted to the upper 17cm of the sequence, while all stone artefacts were found below this level and almost to the base of the pit (Figure 8, see also Appendix). Due to time restrictions, only faunal remains from SQB were analysed in detail. Cultural remains from SQA were not analysed in full due to potential disturbance from massive root intrusion.

Shellfish

A total minimum number of 332 shellfish (based on MNI/XU) weighing 2854.5g was recorded from SQB. Species included commercial oyster (Saccostrea commercialis), cockle (Anadara trapezia), club whelk (Pyrazus ebeninus), mud whelk (Cerithidea largillierti), nerite (Nerita lineata) and hairy mussel (Trichomya hirsuta) (Table 6). As seen at Site 75b, commercial oyster is the most numerous shellfish type recovered, followed by smaller quantities of club whelk and cockle, and minor amounts of hairy mussel, mud whelk and nerite. No major vertical (chronological) changes exist in the relative proportion of shellfish types (Table 6).

All shellfish could have been procured from the inter-tidal zone adjacent to the site. While no pipi shell was excavated, a single valve was observed on the erosion face towards the southern end of the site. I suggest this shell was collected from Rainbow Beach (6km away) due to its proximity, although Teewah Beach (13km away) should not be ruled out as a source.

Table 6. MNI for shellfish identified from SQB, Cameron Point Site 62.

XU (no.)	Commercial oyster MNI	Cockle MNI	Club whelk MNI	Mud whelk MNI	Hairy mussel MNI	Nerite MNI
1	1	0	4	0	0	0
2	2	0	0	0	0	0
3	8	1	2	0	0	0
4	151	4	18	0	0	0
5	89	10	9	1	3	1
6	20	2	3	0	0	0
7	2	0	1	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
Total:	273	17	37	1	3	1

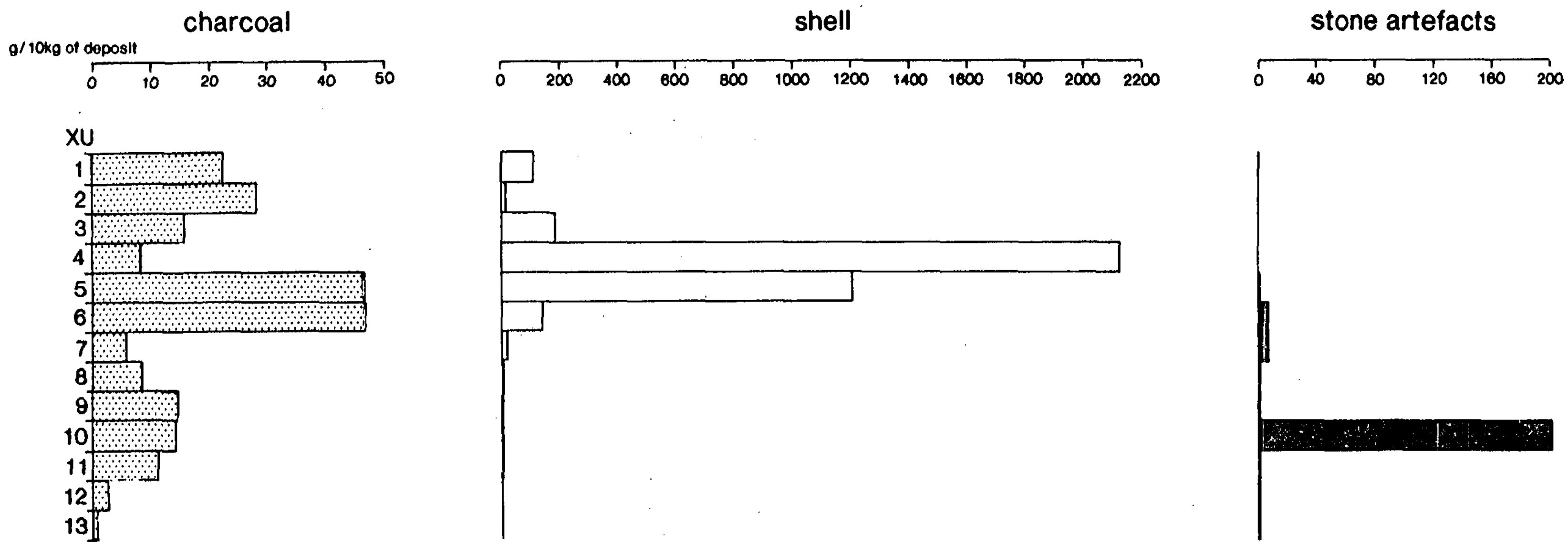

Figure 8. Vertical distribution of excavated finds from SQB, Cameron Point Site.

Vertebrates

Only 0.15g of bone was recovered from SQB (XUs 2, 4 and 5). The only identifiable piece was an unburnt otolith (0.10g) in XU2 which is from a small summer whiting (Sillago ciliata). This fish abounds in the shallow tidal waters adjacent to the site today. Unfortunately, the role that Aboriginal people played in the discard of the otolith is problematic. As noted at Site 75b, dingo faeces exhibiting fish bones have been observed on the ground adjacent to the site. Thus, it is quite possible that the otolith is the result of non-human agency.

Four fragments of bone weighing 0.77g were recovered from SQA:XU5. One of these (0.32g) derives from the limb of a macropod, while another (0.26g), possibly from a mammal, exhibits burning and some calcining. As with the whiting otolith, however, both these bones could have been transported to the site as a result of dingo activity. Once again, future taphonomic research may solve this important question (see McNiven 1990b:72).

Stone artefacts

A total of 101 stone artefacts weighing 249.36g was recovered from SQs B and C. These are represented by 11 flakes (complete and broken) (10.9%), one flaked piece (1.0%), one core (1.0%), 88 manuports (87.1%) and at least eight raw material types (Table 7). As seen at Site 75b, most artefacts are small quartz pebble/fragment manuports (n=59, 58.4%) probably introduced inadvertently to the site attached to some other resource (e.g. soil surrounding plant foods etc.). A similar origin may also account for the remaining manuports.

Flaked stone artefacts (flakes, flaked pieces and a core) were manufactured from silcrete (n=4), andesite (n=2), chert (n=2) and unknown (n=3). No formal implement types were recovered.

To gain further insight into the nature of stone artefact types discarded at the site, a large private collection of 224 stone artefacts recovered from the inter-tidal zone adjacent to Sites 62 and 63 was examined (McNiven 1984:145). All artefacts appear to have eroded out from stratified deposits on the adjacent embankment and probably date to the last c. 800 years. A total of 12 bevel-edged tools, 10 bevel flakes, a backed flake and a tula adze was identified (Figure 9). While the identification of bevelled artefacts is consistent with other finds from along Tin Can Bay, both the backed flake and tula adze remain unique finds. The bevelled artefacts provide strong evidence for plant food processing at the site.

Table 7. Stone artefact raw materials for SQs B & C, Cameron Point Site 62.

Raw material	n	%	wt. (g)	%
Quartz	59	58.4	23.77	9.5
Sandstone	12	11.9	3.30	1.3
Oxide	8	7.9	3.77	1.5
Silcrete	4	4.0	4.70	1.9
Andesite	3	3.0	210.05	84.2
Chert	2	2.0	0.38	0.2
Quartzite	1	1.0	1.44	0.6
Unknown	12	11.9	1.95	0.8
Total:	101	100	249.36	100

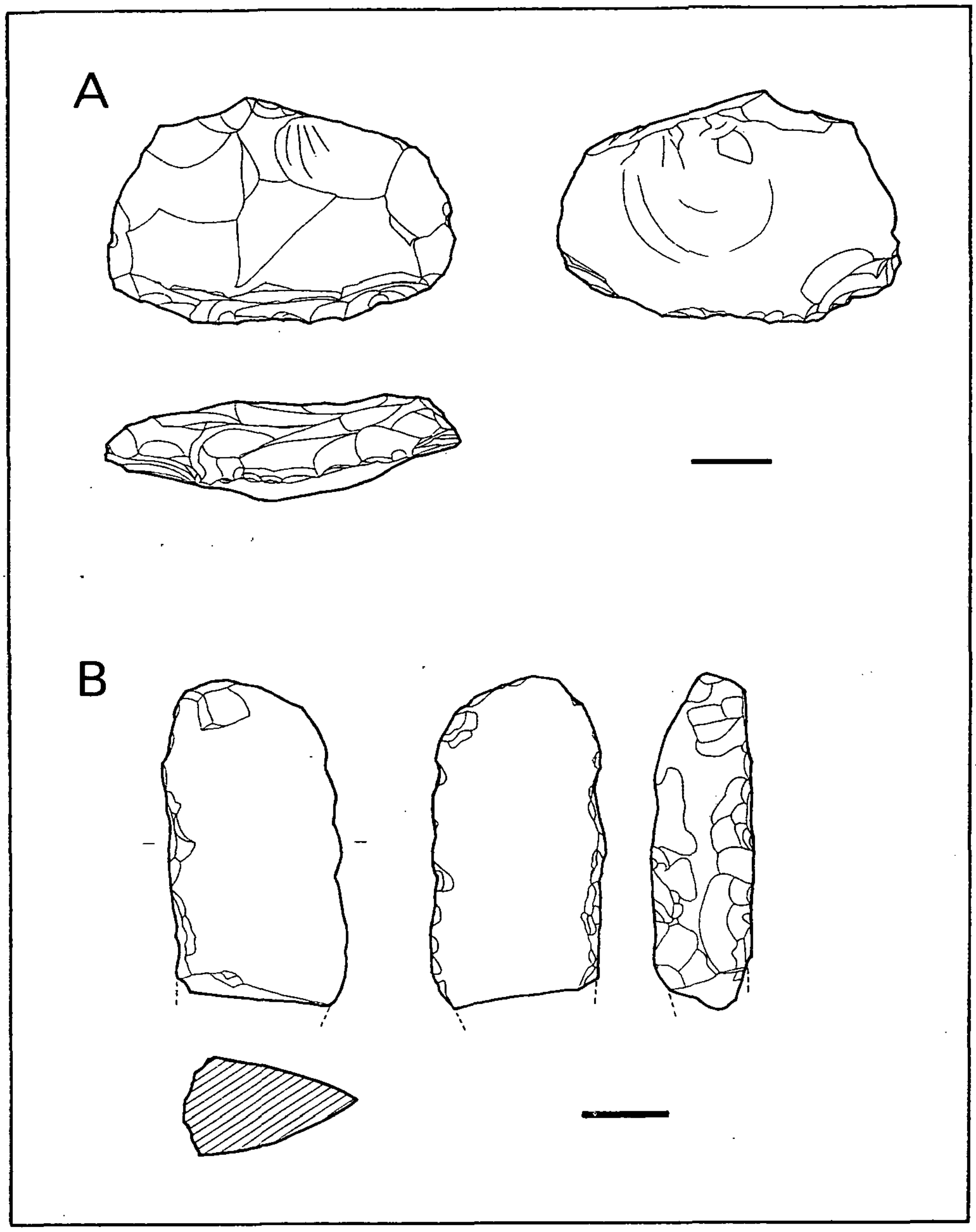

Figure 9. Selected stone implements from Cameron Point Sites 62-63. A:Tula adze (IF3), B:Backed flake (IF4). Scale bar = 1cm.

DISCUSSION

Site distribution

It is doubtful that the bias of middens to Forest red gum and coastal cypress forest complex, Casuarina and mallee brush box forest and Scribbly gum woodland is related to adjacent spatial variations in shellfish productivity, as shellfish habitats (tidal sand and mudflats) occur along the entire length of the coast. Alternatively, I suggest considerations of camp comfort were important determinants of midden location. For example, in contrast to other vegetation types along the bay (e.g. Paperbark swamp and Heathland), the three preferred vegetation types provide a cool shady retreat with abundant shelter construction materials on more elevated and dry sand (cf. Stockton 1974).

Subsistence activities

Faunal remains identified from excavation and survey work along Tin Can Bay include molluscs (oyster, whelk, cockle, scallop, sand snail, nerite, hairy mussel, limpet, murex and pipi), crustaceans (mud crab), fish (summer whiting) and mammal (macropod?). As the only evidence for mud crab consists of a single claw fragment (Site 57) and major taphonomic problems surround the source of vertebrate remains recovered from Sites 62 and 75b, it is clear that faunal remains are dominated by shellfish.

The large range of shellfish taxa recovered from middens clearly documents the existence of a relatively broad shellfish foraging strategy, with a focus upon the collection of oysters. In addition, short-term variations in the ratio of shellfish taxa at Site 75b appear to reflect a degree of procurement flexibility, possibly in response to local variations in resource availability (cf. Meehan 1982).

It is doubtful that poor preservation is the cause of the dearth of vertebrate remains within middens. For example, pH values for Site 75b midden ranged from 4.5-7.5, while at Site 62 they ranged only from 4.0-5.5. Ironically, the bulk of bone excavated from these sites came from Site 62 which exhibited a more acidic and hence a poorer preservational matrix for bone. If quantities of vertebrate remains were being discarded along with shellfish remains at both sites, then more evidence should be forthcoming. The most plausible explanation for the paucity of vertebrate remains at these sites is that such remains were simply never associated with midden deposits.

The lack of conclusive evidence for the procurement of terrestrial animals is not altogether surprising given their low abundance in the region. In contrast, the lack of fish remains is not consistent with the huge potential fish resource base of the adjacent bay and numerous accounts documenting fishing by Aboriginal people at Cooloola (McNiven 1991b, in press c). Therefore, I argue that in the recent prehistoric past, fishing was a more significant activity along Tin Can Bay than is documented in the archaeological record and that the discard of fish remains was probably spatially and/or temporally separated from the discard of shellfish remains.

While it is possible that other midden sites along Tin Can Bay functioned as fishing bases, no evidence of fish remains was ever observed in midden sections along the coast. Nevertheless, future excavation of a larger sample of sites is required before more conclusive statements can be made concerning vertebrate faunal procurement and consumption along Tin Can Bay. Such studies should also investigate in detail the potential taphonomic effects of dingo faecal contamination of sites through an examination of recent scat material. Similarly, use-wear and residue analysis of stone artefacts may also provide insights into the possible consumption of fish and other vertebrates (cf. Flenniken 1981; Fullagar 1986).

It is probable that subsistence activities represented by pre-midden sections of Sites 62 and 75b were similarly marine oriented given the poor state of alternative terrestrial vertebrate resources. I suggest, however, that fish contributed relatively more to the diet compared to shellfish due to the lack of shellfish remains. This absence of older shell midden deposits is clearly not a function of differential preservation, as vertical changes in shell densities tend to track vertical changes in charcoal densities. Similarly, few vertical differences were observed in shell preservation and pH values were generally higher for lower non-midden sections of each sequence (cf. Teewah Beach Site 26 - McNiven 1991b:18).

Chronological changes in land-use

The earliest date obtained for Tin Can Bay was c. 800 BP at Cameron Point Site 62. Given that other recorded midden sites along Tin Can Bay have comparable stratigraphic contexts, I argue that they also date to the recent prehistoric past (<1000 BP). As a result, the bulk of archaeological remains can be associated with Recent Phase (c. 900-100 BP) developments identified for other parts of Cooloola (McNiven 1991b). This Recent Phase is associated with an increase in human activity which resulted in, amongst other things, increased relative use of local resources (e.g. shellfish and stone). In this regard, Tin Can Bay midden sites may tentatively be seen to represent a major areal expansion of Recent Phase activities into the estuarine environments of Cooloola.

At present, reasons for the sudden increase in shellfishing activities c. 100-200 years ago remain unknown. Following the general model of increasing human activity for the onset of Recent Phase developments, I suggest that recent changes in shellfishing activity along Tin Can Bay reflect a secondary augmentation of human activity. While the reasons behind such changes were probably variable and complex, it is quite possible that they were partly a response to 19th century European invasion of surrounding Aboriginal lands. For example, from the 1840's through to the 1860's, Europeans were engaged in a major campaign of land acquisition for pastorial (sheep and cattle) and timber enterprises along the Mary River, located immediately inland from Cooloola. As Pedley (1979:19) states, the "squatter and timbermen were in a constant state of war with the legions of nomadic Aborigines" (see also Evans and Walker 1977). In contrast, most areas of Cooloola were not subjected to the same sort of direct action owing to poor grazing potential. Thus, it can be predicted that low-impact coastal areas such as Tin Can Bay may have served as refuges for remnant 'inland' Aboriginal people trying to escape slaughter (see Heap 1966:10). Such a hypothesis is consistent with strong social ties that existed between Cooloola and adjacent Mary River Aboriginal groups (McNiven in press c).

CONCLUSION

This paper has demonstrated that the archaeological record of eastern Tin Can Bay is highly structured in terms of its spatial and chronological dimensions. While a number of insights were made in this regard, it is clear that further work is required to document the parameters of this record. Substantive issues identified in the paper which need to be addressed include the taphonomy of vertebrate remains and the origin and function of certain artefact types (e.g. manuports, bevel-edged tools). Similarly, further research is also needed to investigate the antiquity of human use of the bay. In this connection, the antiquity of stone artefact scatter sites needs to be better understood before more meaningful statements can be made concerning changes in land-use patterns. All of these issues will be incorporated into the next stage of research at Tin Can Bay, including an areal expansion of survey and excavation activities along the western periphery of the bay.

APPENDIX

Tin Can Bay Site 75b SQA - XU data recordings

XU (no.)	Mean XU depth* (cm)	XU wt. (kg)	Charcoal wt. (g)	Shell wt. (g)	Stone artefacts wt. (g)	pH
1	2	5.5	19.34	21.4	0.05	4.5
2	5	7.7	12.52	344.9	0.20	-
3	8	11.1	11.00	1679.9	0.33	5.0
4	12	12.7	31.11	2361.5	0.10	-
5	16	12.7	17.90	1568.5	131.36	7.0
6	18	9.1	8.17	491.6	0.89	-
7	21	8.9	6.61	151.0	0.09	7.5
8	23	8.6	3.77	28.9	0.14	-
9	28	10.5	4.25	3.9	4.05	7.0
10	31	9.6	3.40	1.2	1.10	-
11	34	9.0	1.59	0.4	0.34	8.0
12	37	10.5	1.20	0.3	0.07	-
13	40	9.9	2.15	0.6	0.19	7.5
14	42	7.9	0.79	0.1	0.08	-
15	47	16.7	0.50	0.8	0.19	7.0
16	52	19.2	0.29	0.1	0.19	-
17	58	20.6	0.39	0.8	0.19	7.5
18	62	18.6	0.14	0.1	0.05	-
19	71	32.2	0.03	0.1	0.33	7.0
20	81	37.5	0.06	0.0	0.41	-
21	92	41.2	0.08	0.1	0.68	6.5

* = mean depth below ground surface

Cameron Point Site 62 SQB - XU data recordings

XU (no.)	Mean XU depth* (cm)	XU wt. (kg)	Charcoal wt. (g)	Shell wt. (g)	Bone wt. (g)	Stone artefacts wt. (g)	pH
1	3	4.5	10.02	47.1	0.00	0.00	5.0
2	5	5.5	15.40	4.0	0.10	0.00	-
3	9	6.1	9.64	111.5	0.00	0.00	4.0
4	12	8.0	6.41	1689.6	0.01	0.00	-
5	14	7.3	33.79	884.6	0.04	0.24	5.5
6	17	7.6	35.21	109.1	0.00	6.84	-
7	21	9.0	4.98	6.8	0.00	8.32	6.0
8	24	9.5	7.65	1.3	0.00	1.05	-
9	27	10.1	14.68	0.1	0.00	0.20	5.0
10	30	10.5	15.42	0.3	0.00	213.06	-
11	35	11.3	12.78	0.1	0.00	2.29	5.0
12	43	20.7	5.80	0.0	0.00	0.29	-
13	50	17.7	1.24	0.0	0.00	0.71	4.0

* = mean depth below ground surface

REFERENCES CITED

Dwyer, P.D., M. Hockings and J. Willmer 1979 Mammals of Cooloola and Beerwah. **Proceedings of the Royal Society of Queensland** 90:65-84.

Dwyer, P.D., J. Kikkawa and G.J. Ingram 1979 Habitat relations of vertebrates in subtropical heathlands of coastal southeastern Queensland. In R.L. Specht (ed.) **Ecosystems of the world 9A. Heathlands and related scrublands. Descriptive studies.** Pp. 281-99. Amsterdam: Elsevier Scientific Publishing Co.

Evans, R. and J. Walker 1977 'These strangers, where are they going?' Aboriginal-European relations in the Fraser Island and Wide Bay region 1770-1905. **University of Queensland, Anthropology Museum, Occasional Papers in Anthropology** 8:39-105.

Flenniken, J.J. 1981 Replicative systems analysis: a model applied to the vien quartz artefacts from the Hoko River site. **Washington State University, Laboratory of Anthropology, Report of Investigations** No. 59.

Fullagar, R. 1986 Use-wear and residue on stone tools: functional analysis and its application to two southeastern Australian archaeological assemblages. Unpublished PhD thesis, La Trobe University.

Gillieson, D.S. and J. Hall 1982 Bevelling bungwall bashers: a use-wear study from southeast Queensland. **Australian Archaeology** 14:43-61.

Golson, J. 1971 Australian Aboriginal food plants: some ecological and culture-historical implications. In D.J. Mulvaney and J. Golson (eds.) **Aboriginal man and environment in Australia.** Pp. 196-238. Canberra: Australian National University Press.

Gillespie, R. and R.B. Temple 1977 Radiocarbon dating shell middens. **Archaeology and Physical Anthropology in Oceania** 12(1):26-37.

Hall, J., S. Higgins and R. Fullagar 1989 Plant residues on stone tools. In W. Beck, A. Clarke and L. Head (eds.) **Plants and Australian archaeology.** Pp. 136-60. Tempus Volume 1. Anthropology Museum, University of Queensland.

Harrold, A.G., W.J.F. McDonald, M.S. Hopkins, J. Walker, C.S. Sandercoe and C.H. Thompson 1987 Studies in landscape dynamics in the Cooloola-Noosa River area, Queensland 5. Vascular plants. **CSIRO Division of Soils, Divisional Report** No. 89.

Heap, E.G. 1966 In the wake of the raftsmen. **Queensland Heritage** 1(5):9-20.

Higgins, S. 1988 Starch grain differentiation of archaeological residues: a feasibility study. Unpublished B.A. (Hons) thesis, University of Queensland.

Isaacs, J. 1987 **Bushfood: Aboriginal food and herbal medicine.** Sydney: Weldons.

Johnson, I. 1979 The getting of data. Unpublished PhD thesis, Australian National University.

Kamminga, J. 1978 Journey into the microcosms: a functional analysis of prehistoric Australian stone tools. Unpublished PhD thesis, University of Sydney.

Kamminga, J. 1981 The bevelled pounder: an Aboriginal stone tool type from southeast Queensland. **Proceedings of the Royal Society of Queensland** 92:31-5.

McNiven, I. 1984 Initiating archaeological research in the Cooloola region, southeast Queensland. Unpublished B.A. (Hons) thesis, University of Queensland.

McNiven, I. 1985 An archaeological survey of the Cooloola region, S.E. Queensland. **Queensland Archaeological Research** 2:4-37.

McNiven, I. 1990a Prehistoric Aboriginal settlement and subsistence in the Cooloola region, coastal southeast Queensland. Unpublished PhD thesis, The University of Queensland.

McNiven, I. 1990b Blowout taphonomy: non-cultural associations between faunal and stone artefact assemblages along the Cooloola coast, southeast Queensland. **Australian Archaeology** 31:67-74.

McNiven, I. 1991a The resharpening of bevel-edged tools from coastal southeast Queensland. **Memoirs of the Queensland Museum** 30(3):493-504.

McNiven, I. 1991b Teewah Beach: new evidence for Holocene coastal occupation in coastal southeast Queensland. **Australian Archaeology** 33:14-27.

McNiven, I. in press a Shell middens and mobility: the use of off-site faunal remains. **Journal of Field Archaeology.**

McNiven, I. in press b Bevel-edged tools from coastal southeast Queensland. **Antiquity.**

McNiven, I. in press c Ethnohistorical reconstructions of Aboriginal lifeways along the Cooloola coast, southeast Queensland. **Proceedings of the Royal Society of Queensland.**

Mathew, J. 1910 **Two representative tribes of Queensland.** London: T. Fisher Unwin.

Meehan, B. 1982 **Shellbed to shell midden.** Canberra: Australian Institute of Aboriginal Studies.

Pedley, I. 1979 **Winds of change.** Gympie: Widgee Shire Council.

Reeve, R., I.F. Fergus and C.H. Thompson 1985 Studies in landscape dynamics in the Cooloola-Noosa River area, Queensland 4. Hydrology and water chemistry. **CSIRO Division of Soils, Divisional Report** No. 77.

Sandercoe, C. 1986 Womalah State Forest and part of the Cooloola National Park Map (1:25,000) Edition 1. Department of Forestry, Brisbane.

Stockton, J. 1974 Report of an archaeological survey in the vicinity of Bribie Island, south-east Queensland. Unpublished B.A. (Hons) thesis, University of Queensland.

Stuiver, M. and P.J. Reimer 1986 A computer program for radiocarbon age calibration. **Radiocarbon** 28:1022-30.

Thompson, C.H. and A.W. Moore 1984 Studies in landscape dynamics in the Cooloola-Noosa River area, Queensland 1. Introduction, general description and research approach. **CSIRO Division of Soils, Divisional Report** No. 73.

* * * *